

CookBook OEA and EA-IRMS

6th Edition
Your Samples, Our Experience

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Dear User

The document that you are reading now is a compilation of more than 50 years' experience in Organic Elemental Analysis and Elemental Analysis Isotope Ratio Mass Spectrometry. Quite a significant compilation!

When we started to gather our Elemental Analyzer results, this was only a summary of our lab experience.

Over the last 50 years, however, analysis coming from our worldwide users, the numerous tests done to certify analytical limits, participation in the International Round Robin Test and the analysis undertaken to ensure that the Thermo Scientific™ Elemental Analyzer complies with Official Methods, have greatly expanded our experience. It has also expanded the methods and analytical data available.

In this 6th edition of the OEA and EA-IRMS CookBook, for the first time, we have included analytical methods and data obtained directly by our worldwide users. This demonstrates the significant expansion of the application capacity of our Elemental Analyzer and the methods used across the world. In addition, we have significantly expanded our chapter on EA-IRMS analysis, documenting the methods and data behind Isotope Fingerprint analysis.

We have collected more than 8000 analysis from over 100 different matrices.

Each analysis presented in your CookBook contains important information on data quality, methods and consumables required to replicate the analysis in your laboratory. This includes details on Reactor and GC Column Temperature, Carrier gas and Oxygen Flow rates and dosages, analysis time, reactor packings, reference materials and strategies and method optimization tips. In addition to the concentration value indicated for each sample, expressed in % or in ppm, or the delta value for stable isotope analysis, expressed in per mille, the number of the analysis for evaluating the average data are indicated.

In spite of the huge amount of data, we have strived to simplify the Cookbook to make it easier to navigate through and simpler to understand the information within.

In the final part of the OEA and EA-IRMS CookBook, we have prepared a (partial) bibliography dedicated to our methods and a list of most common Official Methods dedicated to various application areas, including Food, Animal Feed, Petroleum products, Lubricants, Soil and Geological Materials.

Finally, our OEA and EA-IRMS CookBook is a constantly growing document and we are fully committed to extend its range of applications to offer you a complete vision of the Thermo Scientific™ FlashSmart™ and Thermo Scientific™ EA IsoLink™ IRMS System possibilities and a complete and accurate guide following our *Your Samples, Our Experience* philosophy.

To receive further information, send us your valuable suggestions or have your data and methods featured in the next edition of the CookBook, please feel free to contact us at oeacookbook@thermofisher.com

Thermo Fisher Scientific



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Technical Note 42254

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Technical Note 42254

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CHNS determination of complex chemical structure compounds.
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Analytical Report 42315**Oxygen determination of complex chemical structure compounds.**
Analytical Report 42316

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Application Note 42152**Petrochemical Compounds Characterization using the Thermo Scientific Flash 2000 Elemental Analyzer.**
Application Note 42169**Organic Elemental Analysis for Carbon Characterization by the Thermo Scientific Flash 2000 Elemental Analyzer.**
Application Note 42182**Characterization of Lubricants and Oils by the Thermo Scientific FlashSmart Elemental Analyzer.**
Application Note 42216**CHNS/O Determination in Coals.**
Application Note 42218**CHNS/O determination in Carbon.**
Application Note 42182

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Application note 42222

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Poster Note 42239

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Application Note 42240

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Analytical Report 42323

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Application Note 42192

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Application Note 42306

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EA-IRMS: Literature

The literature section for EA-IRMS is not designed to be exhaustive, but to give the reader an overview of some papers and textbooks that demonstrate the applications. The interested reader will find, within those cited articles, further references and reading opportunities, which we encourage reading of.

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Your samples, our experience

The CookBook is constantly growing, sharing expertise to the global user base of the Flash Elemental Analyzer series.

We really love hearing from you, and would be happy to receive any feedback on our CookBook and suggestions for future editions.

Also, this is an open invitation for you to join in, and have your methods, data and laboratory in the next edition. It would be our pleasure to share your experience around the world and help improve Elemental Analysis for generations to come!

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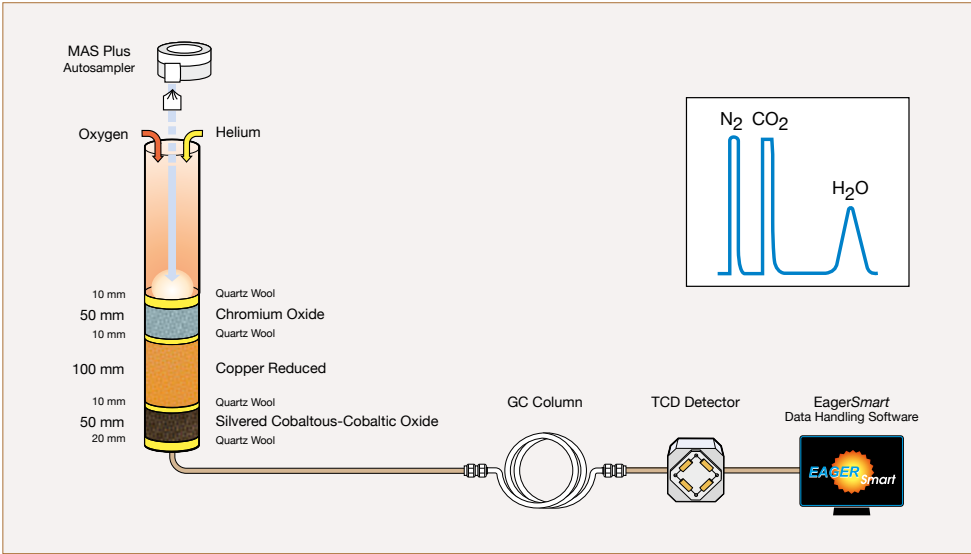
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ANALYTICAL CONFIGURATIONS - CHN DETERMINATION



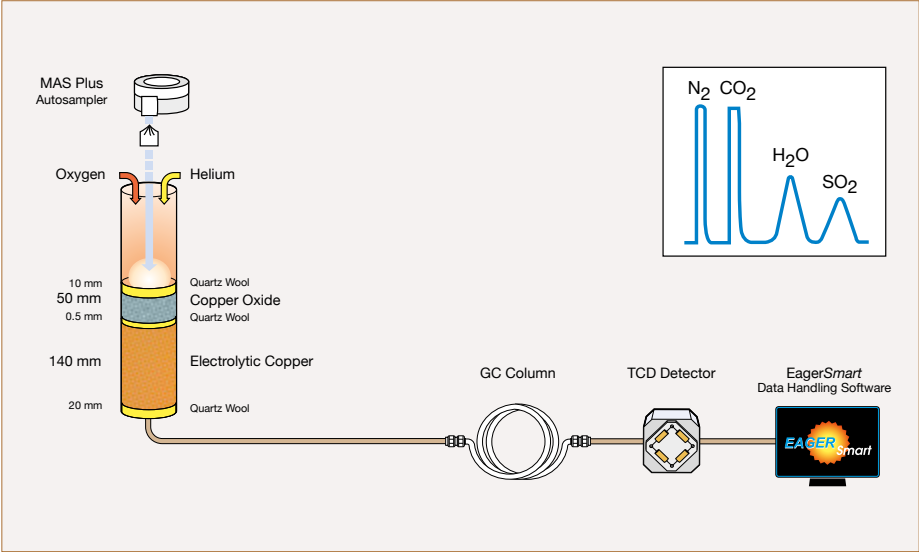
Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	250
Temperature (°C)	Left	950
	Right	0
	Oven	75
Cycle (Run Time)	480 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Chromium oxide (25 g)	338 22900
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 35312
Quartz wool (5 g)	338 22200
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Multiseparation column (PTFE, 2 m, 6x5 mm)	260 08220

Note
If the instrument configuration is CHN/O, set both Helium and Oxygen pressure to 250 kPa.



ANALYTICAL CONFIGURATIONS - CHNS DETERMINATION



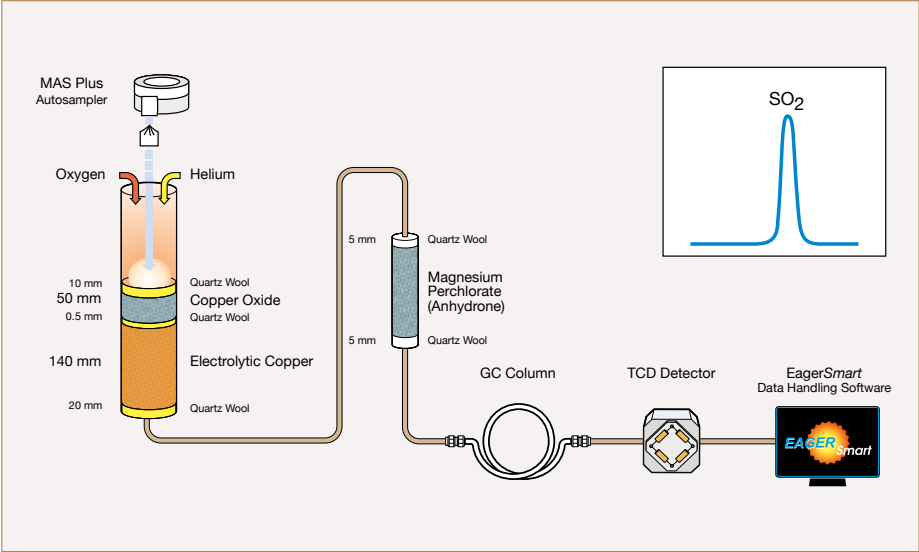
Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	250
Temperature (°C)	Left	950
	Right	0
	Oven	65
Cycle (Run Time)	600 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Electrolytic copper (70 g)	338 35313
Vanadium pentoxide (1 g)	338 37510
Quartz wool (5 g)	338 22200
Pre-packed quartz reactor for CHNS/NCS	468 02015
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	25204510
Packed column CHNS/NCS (PTFE; 2 m; 6 x 5 mm)	260 08215

Note
If the instrument configuration is CHNS/O set both Helium and Oxygen pressure to 250 kPa.



ANALYTICAL CONFIGURATIONS - SULFUR DETERMINATION

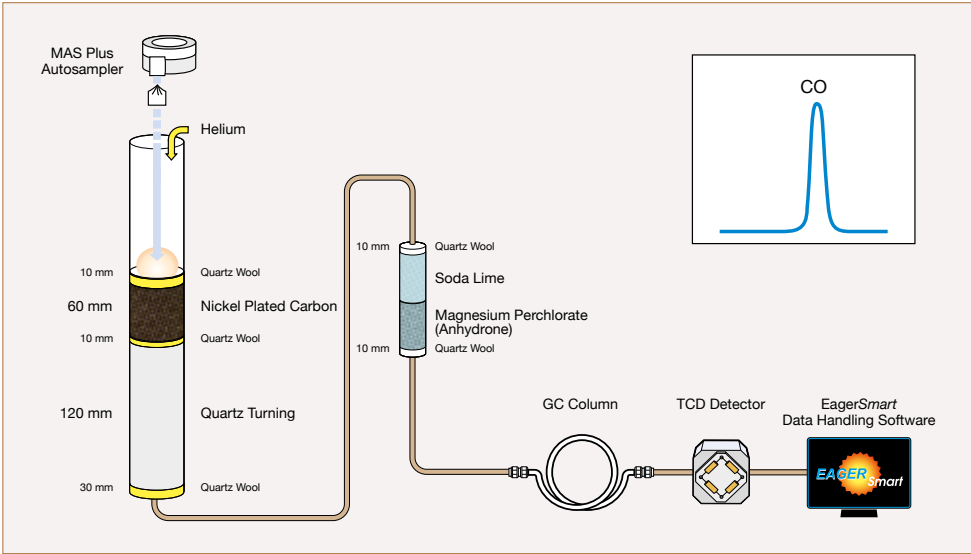


Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	250
Temperature (°C)	Left	950
	Right	0
	Oven	65
Cycle (Run Time)	300 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Electrolytic copper (70 g)	338 35313
Vanadium pentoxide (1 g)	338 37510
Magnesium perchlorate (Anhydrous) 100 g	338 21900
Quartz wool (5 g)	338 22200
Pre-packed quartz reactor for CHNS/NCS	468 02015
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Adsorption trap (small)	281 13104
Sulfur separation column (PTFE, 0.8 m, 6x5 mm)	260 07800



ANALYTICAL CONFIGURATIONS - OXYGEN DETERMINATION

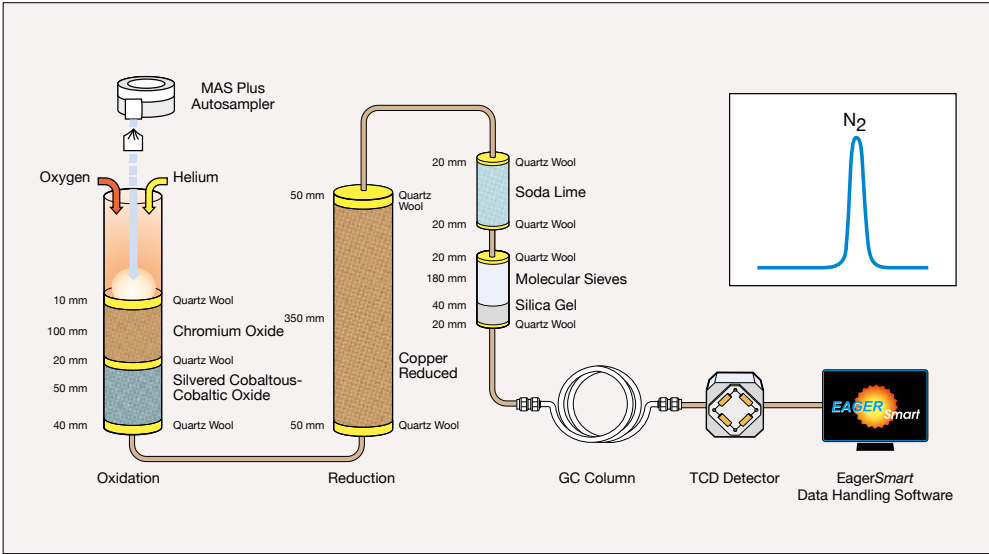


Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	0
Flow (ml/min)	He measurement	100
	He reference	100
	Oxygen	0
Temperature (°C)	Furnace	1060
	Oven	65
Cycle (Run Time)	400 sec	
Oxygen Injection Time	0 sec	
Sample Delay Time	0 sec	

List of consumables	p/n
Nickel plated carbon (5 g)	338 23800
Quartz turnings (50 g)	338 22300
Quartz wool (5 g)	338 22200
Soda lime (100 g)	338 35235
Magnesium perchlorate (Anhydron) 100 g	338 21900
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Adsorption trap (small)	281 13104
Oxygen column (SS, 1 m, 6x5 mm)	260 07900



ANALYTICAL CONFIGURATIONS - N DETERMINATION

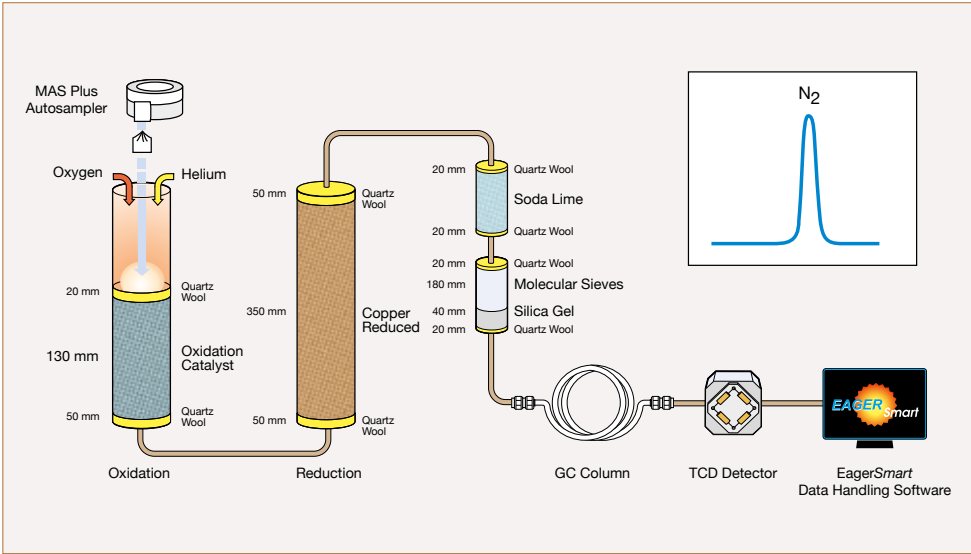


Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	250
Temperature (°C)	Left	950
	Right	840
	Oven	50
Cycle (Run Time)	300 sec	
Oxygen Injection Time	10 sec	
Sample Delay Time	10 sec	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Silvered cobaltous -cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 35312
Soda lime (100 g)	338 35235
Silicagel plus indicator (100 g)	338 40035
Quartz wool (5g)	338 22200
Molecular sieve 3A(100g)	338 01801
Chromosorb WAW (25 g)	338 37530
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Adsorption trap (large)	281 13064
Nitrogen separation column (PTFE, 0.5 m, 8x6 mm)	260 07820



ANALYTICAL CONFIGURATIONS - N LUBRICANT DETERMINATION

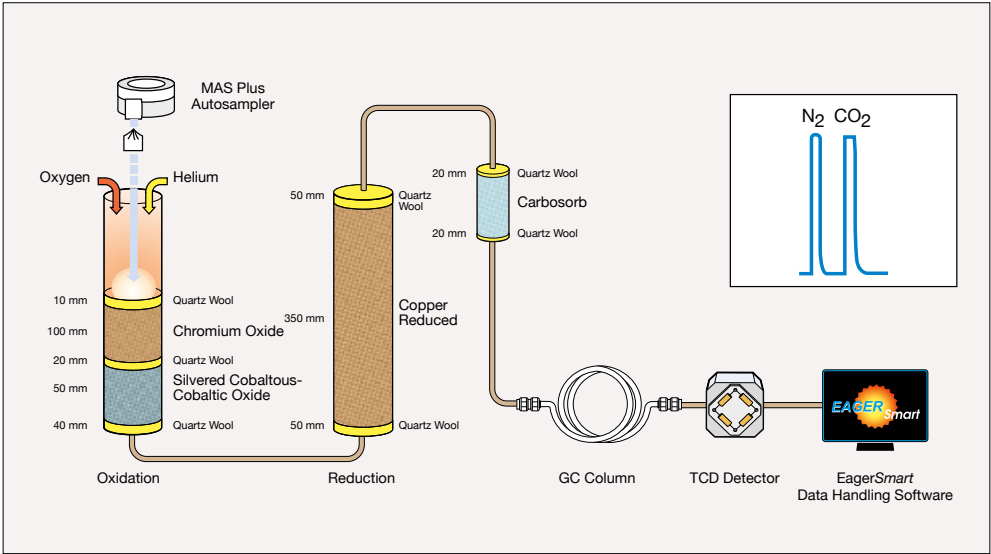


Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	300
Temperature (°C)	Left	950
	Right	840
	Oven	50
Cycle (Run Time)	400 sec	
Oxygen Injection Time	8 sec	
Sample Delay Time	10 sec	

List of consumables	p/n
Oxidation catalyst (40 g)	338 40000
High quality copper (50 g)	338 35312
Quartz wool (5 g)	338 22200
Soda lime (100 g)	338 35235
Molecular sieve (100 g)	338 01801
Silicagel plus indicator (100 g)	338 40035
Prepacked HPAR reactor	468 02008
HPAR crucible	252 05011
Empty HPAR reactor	468 20075
Adsorption trap (large)	281 13064
Nitrogen separation column (PTFE; 1m; 8x6 mm)	260 70004



ANALYTICAL CONFIGURATIONS - NC DETERMINATION

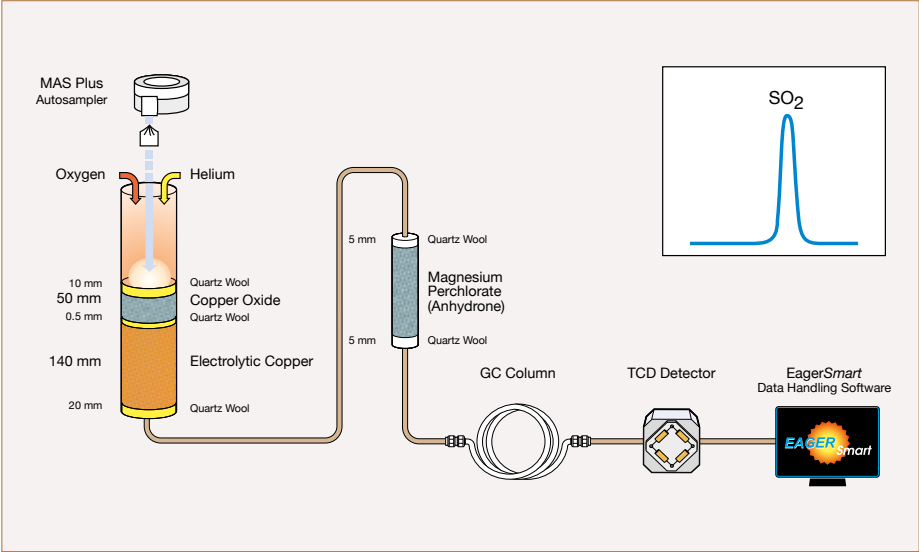


Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	250
Temperature (Å°C)	Left	950
	Right	840
	Oven	50
Cycle (Run Time)	300 sec	
Oxygen Injection Time	10 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 35312
Magnesium perchlorate (Anhydrone) 100 g	338 21900
Quartz wool (5 g)	338 22200
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Adsorption trap (small)	281 13104
Multiseparation column (SS, 2 m, 6x5 mm)	260 07920



ANALYTICAL CONFIGURATIONS - NCS DETERMINATION



Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	250
Temperature (°C)	Left	950
	Right	0
	Oven	65
Cycle (Run Time)	600 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Electrolytic copper (70 g)	338 35313
Magnesium perchlorate (Anhydrous) 100 g	338 21900
Vanadium pentoxide (1 g)	338 37510
Quartz wool (5 g)	338 22200
Pre-packed quartz reactor 18 mm OD	468 02015
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Adsorption trap (small)	281 13104
CHNS/NCS separation column (PTFE, 2 m, 6x5 mm)	260 08215

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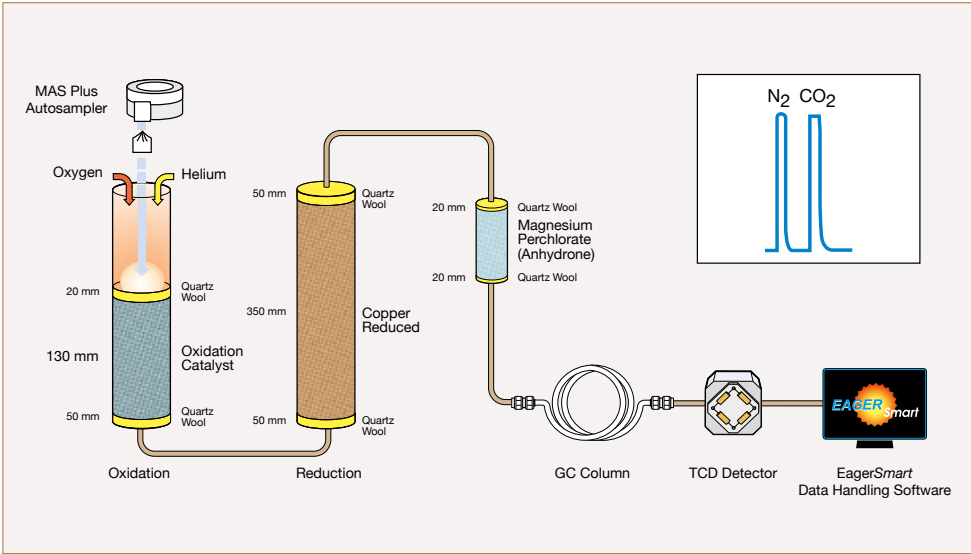
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ANALYTICAL CONFIGURATIONS - NC SOILS DETERMINATION

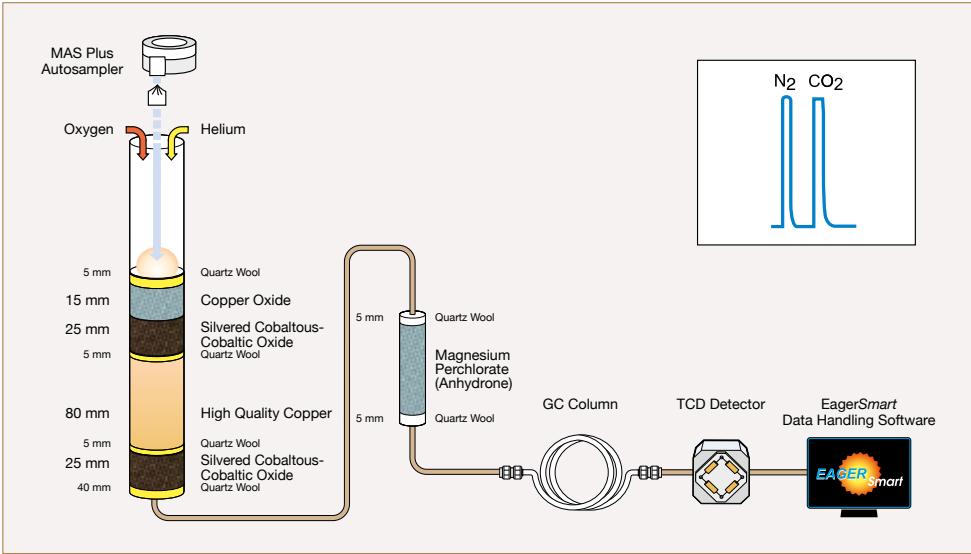


Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	250
Temperature (°C)	Left	950
	Right	840
	Oven	50
Cycle (Run Time)	300 sec	
Oxygen Injection Time	10 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Oxidation catalyst (40 g)	338 40000
High quality copper (50 g)	338 35312
Magnesium perchlorate (Anhydrous) 100 g	338 21900
Quartz wool	338 22200
Prepacked HPAR reactor	468 02008
HPAR crucible	252 05011
Empty quartz reactor (set of 2)	468 20070
Adsorption trap (small)	281 13104
Multiseparation column (SS, 2 m, 6x5 mm)	260 07920



ANALYTICAL CONFIGURATIONS - NC SOILS DETERMINATION by SINGLE COMBUSTION/REDUCTION REACTOR



Analytical conditions			
Method	A	B - "Fast"	C
Sample weight	50 - 70 mg soils, 250 - 300 mg sand, 5 - 7 mg plants	50 - 70 mg soils, 250 - 300 mg sand, 5 - 7 mg plants	About 20 mg of vegetals
Furnace Temperature	950°C	950°C	950°C
Oven Temperature	50°C	65°C	50°C
Helium Carrier Flow	200 ml/min	200 ml/min	170 ml/min
Helium Reference Flow	40 ml/min	40 ml/min	40 ml/min
Oxygen Flow	160 ml/min	160 ml/min	300 ml/min
Analysis Time	330 sec	270 sec	420 sec
Oxygen Injection Time	12 sec	12 sec	9 sec
Sample Delay Time	20 sec	20 sec	17 sec

List of consumables	p/n
Cooper oxide (50 g)	338 21710
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 25312
Quartz wool (5g)	338 22200
Empy HAPAR Reactor; 25 mm OD	468 20075
HPAR crucible	252 05011
Magnesium perchlorate (Anhydrous) 100 g	338 21900
Adsorption trap (small)	281 13104
Multiseparation column (SS, 3 m, 6x5 mm)	260 07931

Note
The parameters depends of the sample nature, sample weight and the method used (A, B or C)



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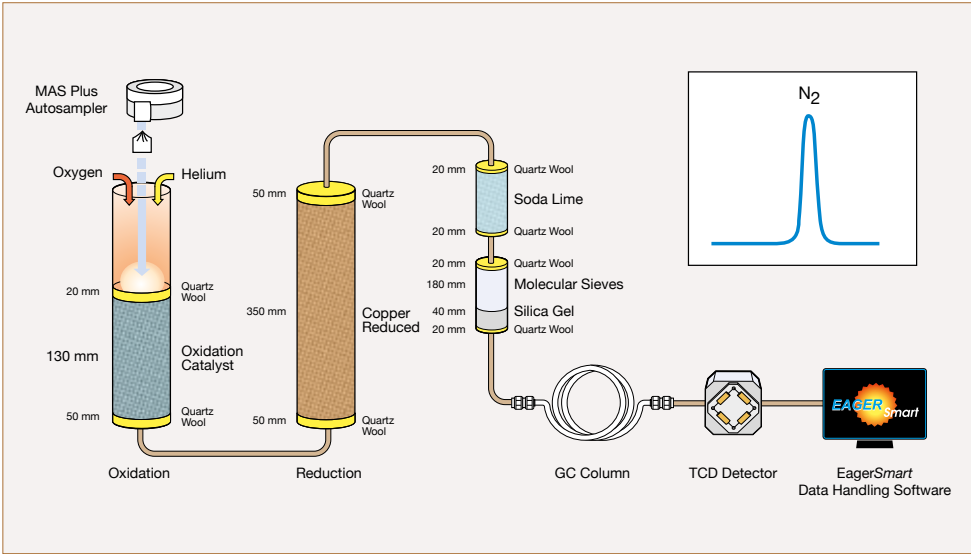
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ANALYTICAL CONFIGURATIONS - N PROTEIN DETERMINATION



Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	300
Temperature (°C)	Left	950
	Right	840
	Oven	50
Cycle (Run Time)	300 sec	
Sample Delay Time	10 sec	

List of consumables	p/n
Oxidation catalyst (40 g)	338 40000
High quality Copper (50 g)	338 35312
Silica gel with indicator (100 g)	338 40035
Quartz wool	338 22200
Molecular sieve 3A(100 g)	338 01801
Chromosorb WAW (25 g)	338 37530
Soda lime (200 g)	338 35230
Prepacked HPAR reactor	468 02008
HPAR crucible	252 05011
Empty HPAR reactor, 25 mm OD	468 20075
Adsorption trap (large)	281 13064
Nitrogen separation column (PTFE, 0.5 m, 8x6 mm)	260 07820



PERFORMANCE TEST - ANALYTICAL VALIDATION TESTS

Sequence of analysis

Configuration	Run 1	Run 2	Run 3 to 5 (Standards)	Weight (mg)	Run 6 to 8 (Unknown)	Weight (mg)
CHN	Blank	Bypass	3 Acetanilide	2-3	3 CEDFNI	2-3
CHNS	Blank	Bypass	3 Methionine	2-3	3 Sulfanilamide	2-3
S	Blank	Bypass	3 Methionine	2-3	3 Sulfanilamide	2-3
O	Blank	Bypass	3 CEDFNI	2-3	3 Acetanilide	2-3
N	Blank	Bypass	3 Acetanilide	4-5	3 CEDFNI	4-5
N- Lubricant	Blank	Bypass	3 Atropine	3-5	3 Lubricant	8-10
NC	Blank	Bypass	3 Acetanilide	4-5	3 CEDFNI	4-5
NCS	Blank	Bypass	3 Methionine	2-3	3 Sulfanilamide	2-3
NC-Filters	Blank	Bypass	3 Aspartic acid	4-5	3 Soil	50-100
NC-Sediments	Blank	Bypass	3 Aspartic acid	4-5	3 Soil	50-100
NC-Soils	Blank	Bypass	3 Aspartic acid	4-5	3 Soil	50-100

Theoretical Values, Range of concentration accepted

Sample	Theoretical % (range accepted)				
	N%	C%	H%	S%	O%
Acetanilide	10.36	-	-	-	11.84
	(10.26-10.46)				(11.74-11.94)
Aspartic Acid	10.52	-	-	-	-
	(10.42-10.62)				
CEDFNI	20.14	51.79	5.07	-	-
	(19.94-20.34)	(51.49-52.09)	(5.00-5.14)		
Soil	0.193	2.003	-	0.033	-
	(0.17-0.23)	(1.931-2.075)		(0.031-0.035)	
Sulfanilamide	16.27	41.84	4.68	18.62	-
	(16.07-16.47)	(41.54-42.04)	(4.62-4.74)	(18.42-18.82)	
Lubricant	0.579				
	(0.559-0.599)				



PERFORMANCE TEST - REPRODUCIBILITY AND ACCURACY OF CHN ANALYSIS (A)

Sequence of analysis

Sample	Weight (mg)	N%	C%	H%
Tryptophane	2.932	13.6211	64.7168	5.9485
Imidazole	2.646	41.3494	52.9347	5.9389
Isatin	2.598	9.4496	65.4830	3.4388
Alanine	2.982	15.7465	40.6144	7.9743
Nicotinamide	2.856	22.8973	59.1437	4.9662
Cyclohexanone	2.645	12.4311	63.8859	9.8627
Acetanilide	2.706	10.3436	71.1922	6.7390
CEDFNI*	2.722	20.1050	51.8560	5.1093
Urea	2.328	46.4307	19.9941	6.7451
Atropine	2.024	4.8406	70.8229	8.0590
Tryptophane	2.412	13.5574	64.9026	5.9537
Imidazole	2.251	41.3269	53.2495	5.9616
Isatin	2.652	9.4560	65.5894	3.4449
Alanine	2.603	15.6128	40.5736	7.9633
Nicotinamide	2.257	22.7772	59.2099	4.9618

Sample	Weight (mg)	N%	C%	H%
Cyclohexanone	2.432	12.3488	64.0010	9.8994
Acetanilide	2.735	10.3443	71.3059	6.7606
CEDFNI*	2.744	20.1032	51.8092	5.1075
Urea	2.641	46.6539	20.0452	6.7588
Atropine	2.972	4.8314	70.7553	8.0705
Tryptophane	2.441	13.5326	64.7746	5.9363
Imidazole	2.609	41.3771	53.0959	5.9421
Isatin	2.509	9.3441	65.5231	3.4309
Alanine	2.909	15.6056	40.5705	7.9882
Nicotinamide	2.097	22.7759	59.4544	4.9784
Cyclohexanone	2.643	12.3941	63.8854	9.8762
Acetanilide	2.996	10.3476	71.2120	6.7594
CEDFNI	2.939	20.0540	51.6717	5.0975
Urea	2.907	46.8338	20.0991	6.7744

*CEDFNI: Cyclohexanone-2,4-dinitrophenylhydrazone

Note
Calibration has been performed with acetanilide, CEDFNI, urea and atropine (linear regression method).

Comment
This test points out the complete absence of any memory effect and the stability of the system.



PERFORMANCE TEST - REPRODUCIBILITY AND ACCURACY OF CHN ANALYSIS (A)

Sequence of analysis

Sample	Average experimental value						Theoretical value		
	N%	RSD%	C%	RSD%	H%	RSD%	N%	C%	H%
Tryptophane	13.57	0.33	64.80	0.15	5.95	0.15	13.72	64.70	5.92
Imidazole	41.35	0.06	53.09	0.29	5.95	0.21	41.15	52.93	5.92
Isatin	9.42	0.67	65.53	0.08	3.44	0.20	9.52	65.30	3.43
Alanine	15.65	0.51	40.59	0.06	7.97	0.15	15.72	40.44	7.92
Nicotinamide	22.82	0.30	59.27	0.28	4.97	0.17	22.94	59.01	4.90
Cyclohexanone	12.39	0.33	63.92	0.10	9.88	0.19	12.38	63.68	9.80
Acetanilide	10.34	0.02	71.24	0.08	6.75	0.18	10.36	71.09	6.71
CEDFNI	20.09	0.14	51.78	0.18	5.10	0.12	20.14	51.79	5.07
Urea	46.64	0.43	20.05	0.26	6.76	0.22	46.65	20.00	6.71
Atropine	4.84	0.13	70.78	0.07	8.06	0.12	4.84	70.56	8.01

Comment

This test points out the complete absence of any memory effect and the stability of the system.



PERFORMANCE TEST - REPRODUCIBILITY AND ACCURACY OF CHN ANALYSIS (B)

Sequence of analysis

Sample	Experimental data						Theoretical value		
	N%	RSD%	C%	RSD%	H%	RSD%	N%	C%	H%
CEDFNI*	20.01		52.01		5.08				
	19.97	0.16	51.83	0.20	5.06	0.27	20.14	51.79	5.07
	20.03		51.84		5.09				
Atropine	4.81		70.84		8.05				
	4.81	0.30	70.59	0.17	8.03	0.15	4.84	70.56	8.01
	4.83		70.71		8.05				

*CEDFNI: Cyclohexanone-2,4-dinitrophenylhydrazone

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
Standard weight: 2-3 mg

Note

These standards have been determined as unknowns, using as standard acetanilide (K factor method).



PERFORMANCE TEST - REPRODUCIBILITY AND ACCURACY OF CHNS ANALYSIS

Sequence of analysis

N%	C%	H%	S%
9.355	40.399	7.437	21.237
9.391	40.154	7.381	21.261
9.383	40.185	7.404	21.318
9.402	40.300	7.451	21.485
9.373	40.292	7.434	21.269
9.394	40.164	7.440	21.471
9.365	40.112	7.442	21.306
9.376	40.204	7.424	21.559
9.435	40.294	7.426	21.477
9.429	40.498	7.462	21.388
9.402	40.232	7.453	21.407
9.387	40.134	7.418	21.365
9.414	40.061	7.393	21.348
9.439	40.096	7.419	21.400
9.439	40.368	7.470	21.556

N%	C%	H%	S%
9.440	40.255	7.450	21.421
9.427	40.221	7.442	21.349
9.420	40.233	7.426	21.534
9.427	40.182	7.428	21.253
9.391	40.156	7.403	21.229
9.439	40.266	7.420	21.265
9.499	40.424	7.464	21.288
9.376	40.071	7.414	21.422
9.498	40.429	7.449	21.365
9.422	40.098	7.402	21.267
9.429	40.178	7.393	21.411
9.488	40.407	7.444	21.518
9.475	40.196	7.432	21.217
9.497	40.356	7.468	21.492
9.484	40.393	7.457	21.589

Element	Theoretical value %	Average experimental value	RSD%
Nitrogen	9.39	9.42	0.44
Carbon	40.25	40.24	0.29
Hydrogen	7.43	7.40	0.32
Sulfur	21.49	21.38	0.52

Note
These 30 analyses of dl-methionine have been performed using cystine (n=2), sulfanilamide (n=2) and BBOT (n=2) for linear regression method. The statistical results are reported above. Analyses performed with the addition of 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

Comment
The test points out the accuracy of the data and the stability of the system.



PERFORMANCE TEST - REPRODUCIBILITY, ACCURACY AND STABILITY OF NC ANALYSIS

Sequence of analysis

Day	Instrument condition	Sample Name	Type	Weight (mg)	N%	C%
1	Ready	Atropine	Standard	2.7300	4.8400	70.5600
1	Ready	Acetanilide	Standard	2.2470	10.3600	71.0900
1	Ready	CEDFNI	Standard	2.2060	20.1400	51.7900
1	Ready/Stand-By	Nicotinamide	Unknown	2.3620	22.9509	59.2978
2	Ready/Stand-By	Atropine	Unknown	2.8920	4.9139	70.5443
2	Ready	Acetanilide	Unknown	2.9940	10.4079	70.9194
2	Ready	CEDFNI	Unknown	2.4460	20.1864	51.7683
2	Ready	Nicotinamide	Unknown	2.2200	22.9021	59.1178
2	Ready	Atropine	Unknown	2.6910	4.8379	70.5490
2	Ready	Acetanilide	Unknown	2.7970	10.4163	71.2176
2	Ready	CEDFNI	Unknown	2.5600	20.2318	51.7279
2	Ready/Stand-By	Nicotinamide	Unknown	2.2880	22.8953	59.0913

Day	Instrument condition	Sample Name	Type	Weight (mg)	N%	C%
2	Ready/Stand-By	Atropine	Unknown	2.5650	4.8638	70.1995
2	Ready	Acetanilide	Unknown	2.8870	10.3681	70.9169
2	Ready	CEDFNI	Unknown	2.3280	20.0396	51.6128
2	Ready	Nicotinamide	Unknown	2.6150	22.8748	58.9390
2	Ready	Atropine	Unknown	2.5290	4.8437	70.6310
2	Ready	Acetanilide	Unknown	2.5570	10.3134	70.9665
2	Ready	CEDFNI	Unknown	2.5710	20.3617	52.2192
2	Ready/Stand-By	Nicotinamide	Unknown	2.3790	22.9305	59.2349
2	Ready	Atropine	Unknown	2.7360	4.8462	70.3659
2	Ready	Acetanilide	Unknown	2.6690	10.3407	71.0270
2	Ready	CEDFNI	Unknown	2.0880	20.1703	51.9163
2	Ready	Nicotinamide	Unknown	2.5250	22.8363	59.0574

CEDFNI: Cyclohexanone-2,4-dinitrophenylhydrazone
Ready: The instrument is ready for analysis
Ready / Stand-By: At the end of the analysis the instrument goes to St-By condition
Stand-By / Ready: The analysis starts when the instrument reaches Ready condition

Note
The calibration has been performed using linear regression method.

Summary results

Sample	Average experimental value				Theoretical value	
	N%	RSD%	C%	RSD%	N%	C%
Atropine	4.8611	0.6389	70.4579	0.2468	4.84	70.56
Acetanilide	10.3693	0.4216	71.0095	0.1755	10.36	71.09
CEDFNI	20.1980	0.5749	51.8489	0.4508	20.14	51.79
Nicotinamide	22.8983	0.1771	59.1230	0.2170	22.94	59.01

Comment
The test points out the accuracy of the data and the stability of the system.



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PERFORMANCE TEST - SULFUR TEST

Sulfur determination of NIST Standard Reference Materials					
Montana Soil SRM 2211		Tomato leaves SRM 1573a		Peach leaves SRM 1547	
Weight (mg)	S%	Weight (mg)	S%	Weight (mg)	S%
12.136	0.0469	4.325	0.9779	4.546	0.1929
15.267	0.0433	4.982	0.9899	4.728	0.1907
10.824	0.0443	4.877	0.9642	4.091	0.1898
14.981	0.0427	4.367	0.9848	4.998	0.1913
15.139	0.0442	4.903	0.9983	4.482	0.1874
14.776	0.0422	4.255	0.9816	4.538	0.1973
13.645	0.0428	4.609	0.9938	4.906	0.1881
14.873	0.0440	4.025	0.9970	4.779	0.1908
11.229	0.0429	4.786	0.9776	4.965	0.1916
14.549	0.0458	4.865	0.9805	4.183	0.1980
Average	0.0439	Average	0.9845	Average	0.1918
RSD%	3.3753	RSD%	1.0648	RSD%	1.8188
NIST value	0.042±0.001	NIST value	0.96	NIST value	0.20

Note
1) Calibration was performed with 2-3 mg BBOT (K factor method).
2) Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
3) Sulfur NIST value is certified only for Montana soil. For tomato and peach leaves, the sulfur value is provided for information only. These are not certified.



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PERFORMANCE TEST - ACCURACY AND PRECISION OF CHNS DETERMINATION IN HALOGENATED SUBSTANCES

Sulfur determination of NIST Standard Reference Materials												
Sample	N%	RSD%	T.V.	C%	RSD%	T.V.	H%	RSD%	T.V.	S%	RSD%	T.V.
Trifluoroacetanilide	7.33	0.34	7.40	50.7	0.12	50.8	3.21	0.95	3.19			
BCR 71	10.70	0.63	10.80	40.2	0.33	40.4	2.29	0.55	2.37	8.39	0.50	8.30
BCR 72	9.59	0.46	9.65	36.1	0.35	36.1	2.06	0.49	2.10	7.50	0.62	7.35

Trifluoroacetanilide (STD): 30.16 F%
BCR 71: N-(4-bromophenyl)-N'-(2-chloro-4-nitrophenyl) thiourea (STD) 20.68 B%; 9.18 Cl%
BCR 72: N-(2-chloro-4-nitrophenyl)-N'-(4-iodophenyl) thiourea (STD) 8.12 Cl%; 29.28 I%
T.V.: Theoretical Value

Sample information
 Standard: BBOT 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2-3 mg
 Sample weight: 2-3 mg

Note

Each Trifluoroacetanilide value is the average of 7 runs. Each BCR 71- BCR 72 value is the average of 6 runs.

Comment

Among the halogens only fluorine has an influence on CHN determinations, as it causes splitting of the hydrogen peak.

For this reason silver capsules are used, so that silver traps fluorine producing AgF that remains in the ash on top of the combustion reactor. Following these precautions the determination of carbon, hydrogen, nitrogen and sulfur results in an excellent accuracy and precision.

The other halogen atoms (Cl, Br, I) do not influence CHNS determinations at all, neither in terms of accuracy nor precision. No specific precautions need to be taken.



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- Water

Carbon Soot

CHNS/O determination

CARBON SOOT

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.331	0.79	93.89	0.06	0.539	0.49	1.08	0.93	1.57	0.37
0.336		93.87		0.543		1.07		1.58	
0.335		93.78		0.538		1.09		1.57	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 1.5 - 2.0 mg

Sample information for Oxygen determination

Standard: BBOT* 7.43 O%

Standard weight: 1.0 - 2.0 mg

Sample weight: 1.0 - 2.0 mg

Note

For CHNS, samples were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Composts

CHNS/O determination

COMPOSTS

Sample	N%	C%	H%	S%	O%
A	1.500	40.874	5.683	0.510	34.482
	1.568	40.882	5.702	0.507	34.098
	1.552	40.770	5.664	0.471	34.083
B	1.864	40.037	5.224	0.590	31.157
	1.879	39.604	5.158	0.567	31.395
	1.823	39.938	5.193	0.592	31.504
C	2.196	39.724	5.137	0.560	31.425
	2.201	39.674	5.177	0.564	31.820
	2.176	39.680	5.109	0.597	31.112
D	2.296	41.400	5.620	0.660	32.798
	2.243	41.783	5.532	0.665	32.425
	2.297	41.399	5.611	0.688	32.352
E	2.237	41.858	5.553	0.710	31.673
	2.205	41.802	5.518	0.705	31.387
	2.283	41.607	5.478	0.714	31.475

Sample information

Standard for CHNS determination:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard for O determination:	Benzoic acid	26.20 O%
Standard weight:	BBOT*	2.0 - 3.0 mg
	Benzoic acid	3.0 - 4.0 mg
Sample weight:	CHNS	3.0 - 4.0 mg
	Oxygen	2.0 - 3.0 mg

Note

Samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510) (CHNS analysis).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Composts

CHNS/O and Heat Value data

COMPOSTS

Sample	N%	C%	H%	S%	O%	G.H.V.	N.H.V.
1	13.0884	36.7927	5.1549	1.9008	30.8515	3525	3559
	13.2374	36.9949	5.2545	1.9000	30.8594	3524	3559
	12.8570	36.7172	5.1442	1.9242			
Av. %	13.0609	36.8349	5.1845	1.9083	30.8554	3525	3559
RSD %	1.4676	0.3898	1.1733	0.7204	0.0181	0.0068	0.0074

G.H.V. (Gross Heat Value) and N.H.V. (Net Heat Value) determined by the Thermo Scientific EagerSmart Data Handling Software

Sample information

Standard for CHNS determination:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard for O determination:	Benzoic acid	26.20 O%
Standard weight:	BBOT*	2.0 - 3.0 mg
	Benzoic acid	3.0 - 4.0 mg
Sample weight:	CHNS	3.0 - 4.0 mg
	Oxygen	2.0 - 3.0 mg

Note

Samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

It is possible to determine the G.H.V. and N.H.V. values using a special algorithm incorporated into the Thermo Scientific EagerSmart Data Handling Software.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Composts

Total Nitrogen (TN), Total Carbon (TC) and Total Organic Carbon (TOC)

COMPOSTS

Sample	N%	TC%	TOC%
1	0.26	11.02	3.02
	0.25	11.19	3.06
2	0.80	10.55	2.08
	0.80	10.42	2.02
3	1.12	19.17	4.26
	1.11	19.16	4.23

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Soil Reference Material	0.196 N%, 1.998 C%
Standard weight:	Aspartic acid	4.0 - 5.0 mg
	Soil Reference Material	50 - 100 mg
Sample weight:		4.0 - 6.0 mg

Note

TOC % values are determined by *FlashSmart™* EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

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Composts

Sulfur determination

COMPOSTS

Sample	A1	B2	C3	C1/8	D4	E5	E1/9	F6
S%	0.2294	0.3131	0.2653	0.1968	0.3065	0.2609	0.2346	0.3278
	0.2175	0.3127	0.2648	0.2071	0.3256	0.2517	0.2184	0.3247

Sample	G7	G1/10	H11	I12	L13	M14	N15	O16
S%	0.2167	0.2179	0.3266	0.3785	0.4128	0.4466	0.4553	0.4243
	0.2222	0.2026	0.3213	0.3500	0.3956	0.4273	0.4579	0.3917

Sample information

Standard: Tomato leaves (NIST SRM No. 1573) 0.96 S%
 Standard weight: 2.0 mg
 Sample weight: 3.0 - 4.0 mg

Note

The samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Composts

NCS determination

COMPOSTS

Sample	DAY 1					
	N%	RSD%	C%	RSD%	S%	RSD%
Powder Compost	1.6066		16.7111		2.9204	
	1.6219	0.6720	16.7906	0.3985	2.8966	0.4253
	1.6010		16.8440		2.9027	
Liquid Compost	0.1482		2.3492		0.0493	
	0.1399	3.0651	2.3490	0.2063	0.0506	1.3352
	0.1468		2.3575		0.0497	

Sample	DAY 2					
	N%	RSD%	C%	RSD%	S%	RSD%
Powder Compost	1.6357		16.9382		2.9150	
	1.6527	1.3068	16.6923	0.7370	2.8953	0.4238
	1.6103		16.8430		2.9180	
Liquid Compost	0.1434		2.3616		0.0495	
	0.1455	0.8219	2.3321	1.2095	0.0501	0.6139
	0.1435		2.3892		0.0497	

Sample information

Standard: BBOT* 6.51 N%, 72.56 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

Standard and powder compost were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Liquid compost samples was weighed in double tin container (p/n 240 064 00). Samples were analyzed in two days to evaluate the reproducibility.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Composts

Nitrogen determination

COMPOSTS

Sample	N%	RSD%
Powder Compost	1.650	1.354
	1.641	
	1.608	
Liquid Compost	0.130	0.884
	0.130	
	0.132	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 70 mg	
Sample weight:	200 - 250 mg powder compost	
	180 - 200 mg liquid compost	

Note

FlashSmart N/Protein configuration was used for these analysis, select Category B (OxyTune®) for powder compost, Category C (OxyTune®) for liquid compost.
The liquid compost was adsorbed on 40 - 50 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530).

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Composts

NC determination

COMPOSTS

N%	RSD%	C%	RSD%
1.6128		21.4860	
1.5957	0.53	21.6802	0.46
1.6032		21.6098	

Sample information

Standard:	Aspartic acid	10.52 N% , 36.09 C%
Standard weight:	18 - 19 mg	
Sample weight:	20 - 25 mg	

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen injection Time to 10 sec.
The 3 m GC column (p/n 260 07931) installed into the oven at 50 °C was used.



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Composts

NCS determination

COMPOSTS

N%	RSD%	C%	RSD%	S%	RSD%
1.5813		21.5041		0.6550	
1.6078	0.85	21.5579	0.96	0.6619	0.6495
1.5904		21.8888		0.6541	

Sample information for NCS determination

Standard: BBOT* 6.51 N%, 72.56 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 4.0 - 5.0 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Composts

TOC determination

COMPOSTS

TOC%	RSD%
18.1585	
18.3274	0.47
18.2173	

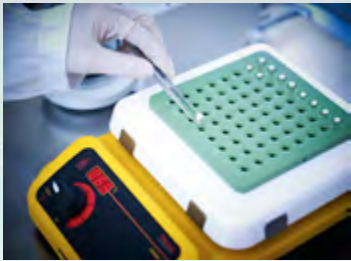
Sample information

Standard:	Aspartic acid	36.04 C%
Standard weight:	3.0 - 4.0 mg	
Sample weight for		
TOC determination:	5.0 - 7.0 mg	

Note

TOC determination was performed with the dedicated kit (p/n 190 04145).
TOC % values are determined by *FlashSmart* EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

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Composts

NC and TOC determination

COMPOSTS

Sample	N%	RSD%	C%	RSD%	TOC%	RSD%
A	1.437		16.384		14.199	
	1.421	0.57	16.535	0.46	14.184	0.16
	1.426		16.475		14.228	
B	3.743		32.482		28.120	
	3.754	0.25	32.576	0.26	28.126	0.16
	3.735		32.653		28.047	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%

Standard weight: 18 - 19 mg for NC
3.0 - 4.0 mg for TOC

Sample weight: 18 - 20 mg for NC
5.0 - 10 mg for TOC determination

Note

Set Oxygen Injection Time at 10 seconds. A 3 m GC column (P/N 260 07931) installed into the oven at 40 °C was used. TOC determination was performed with the dedicated kit (p/n 190 04145). TOC % values are determined by *FlashSmart* EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)



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Composts

CHNS/O determination

COMPOSTS (1/2)

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	1.74	0.33	21.56	0.32	2.57	0.39	0.149	1.69	15.08	0.08
	1.74		21.63		2.58		0.147		15.10	
	1.75		21.49		2.59		0.152		15.10	
2	2.57	0.00	26.58	0.16	2.93	0.34	0.137	1.80	21.19	0.31
	2.57		26.60		2.94		0.142		21.06	
	2.57		26.66		2.95		0.140		21.12	
3	2.14	0.47	22.17	0.38	2.65	0.38	1.47	0.68	23.08	0.09
	2.15		22.24		2.67		1.46		23.12	
	2.13		22.13		2.66		1.45		23.10	
4	2.17	0.54	24.52	0.21	2.64	0.38	0.881	0.75	24.53	0.18
	2.15		24.42		2.65		0.890		24.46	
	2.15		24.45		2.63		0.877		24.54	

Heat Values and CO ₂ Emission Trade calculation						
Sample	G.H.V. (Kcal/Kg)	RSD%	N.H.V. (Kcal/Kg)	RSD%	CO ₂ E.T.	RSD%
1	2548.7	0.02	2397.9	0.02	97.2	0.02
	2547.7		2396.9		97.2	
	2548.0		2397.2		97.2	
2	2285.6	0.13	2134.8	0.13	109.1	0.13
	2291.4		2140.5		108.8	
	2288.6		2137.8		109.0	
3	1778.3	0.06	1641.8	0.06	118.3	0.06
	1776.3		1639.8		118.4	
	1777.3		1640.8		118.3	
4	1881.1	0.10	1745.6	0.11	122.7	0.11
	1884.2		1748.7		122.5	
	1880.9		1745.4		122.7	



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Composts

CHNS/O determination

COMPOSTS (2/2)

Total Organic Carbon (TOC) determination					
Sample	TOC%	RSD%	Sample	TOC%	RSD%
1	19.93	0.28	3	19.74	0.18
	20.04			19.76	
	20.01			19.69	
2	22.30	0.09	4	20.26	0.32
	22.26			20.13	
	22.29			20.19	

Sample information for CHNS determination

Standard for CHNS: BBOT* 9.39 N%, 40.25 C%, 7.43 H%, 21.49 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 3.0 - 4.0 mg

Sample information for Oxygen determination

Standard for Oxygen: Atropine 16.59 O%
 Benzoic acid 26.20 O%
 Standard weight: 0.4 - 0.6 mg
 Sample weight: 0.5 - 0.6 mg

Sample information for TOC determination

Standard for CHNS BBOT* 40.25 C%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 4.0 - 6.0 mg

Note

Standard and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

For the CHNS analysis increase the Oxygen Flow to 280 - 300 ml/min and the Oxygen Injection Time to 7 - 8 seconds. The G.H.V. and N.H.V. and the CO_2 emission trade values are calculated automatically by the Thermo Scientific EagerSmart Data Handling Software. These calculations give a quantitative value of the energetic quality of the analyzed sample. The G.H. V./N.H.V. can also be determined directly using a calorimeter Mahler bomb (ASTM 271 Oxygen combustion method).

Total Organic Carbon (TOC) were determined by FlashSmart EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. For this application we suggest to use the kit for Total Organic Carbon (TOC) in solid samples (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Contaminants (PCBs)

CH determination and G.H.V./N.H.V.

CONTAMINANTS (PCBs)

Sample	C%	H%	G.H.V.	N.H.V.
PCB 1	49.568	1.942	3900	3796
	49.715	1.883	3891	3790
PCB 2	56.621	2.580	4667	4529
	56.530	2.609	4668	4528
TSE-T	53.940	4.246	5697	5470
	54.148	4.250	5715	5488
TSE-C	44.072	1.465	4053	3975
	43.985	1.470	4048	3969

G.H.V (Gross Heat Value) and N.H.V (Net Heat Value) determined by the Thermo Scientific EagerSmart Data Handling Software.

Sample information

Standard: BBOT* 72.53 C%, 6.09 H%
 Standard weight: 2.0 - 2.5 mg
 Sample weight: 2.0 - 3.0 mg

Comment

It is possible to determine the G.H.V. and N.H.V. values using a special algorithm incorporated into the Thermo Scientific *EagerSmart* Data Handling Software.

These calculations give a quantitative value of the energetic quality of these *alternative* fuels.

The G.H.V./N.H.V. can be also determined directly using a calorimeter Mahler bomb (ASTM 271 oxygen combustion method).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Dried Sewage Sludge

Nitrogen determination

DRIED SEWAGE SLUDGE

Sample	N%	RSD%
1	4.2446	0.3076
	4.2261	
	4.2195	
2	2.3298	1.1928
	2.3740	
	2.3223	
3	4.1399	0.1822
	4.1345	
	4.1494	

Sample information

Standard:	Atropine	4.84 N%
Standard weight:	10 - 15 mg	
Sample weight:	20 - 30 mg	

Note

Set the following analytical conditions: Oxygen Flow to 300 ml/min and Oxygen Injection Time to 10 seconds, Sample Delay 8 seconds.



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Dried Sewage Sludge

NC determination

DRIED SEWAGE SLUDGE

N%	RSD%	C%	RSD%
2.3845		25.1622	
2.3124	1.9064	25.1272	0.3911
2.3953		25.3127	

Sample information

Standard:	Acetanilide	10.36 N%, 71.09 C%
Standard weight:	4.0 - 5.0 mg	
Sample weight:	5.0 - 6.0 mg	

Note

Set the following analytical conditions: Oxygen Flow to 300 ml/min and Oxygen Injection Time to 10 seconds, Sample Delay 8 seconds.



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Dried Sewage Sludge

NC determination

DRIED SLUDGE

Sample	N%	RSD%	C%	RSD%
1	11.4685		58.1045	
	11.4251	0.1899	58.1795	0.0676
	11.4490		58.1216	
2	3.4922		31.0669	
	3.5042	0.2699	30.9367	0.2669
	3.4856		31.0905	
3	4.0535		31.1468	
	4.1031	0.6622	31.3385	0.3621
	4.0970		31.1390	
4	4.6149		36.7606	
	4.6261	0.2460	36.8688	0.1470
	4.6034		36.8157	
5	0.0278		1.4619	
	0.0275	0.5528	1.3931	2.8307
	0.0276		1.3919	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%

Standard weight: 4.0 - 5.0 mg

Sample weight: 4.0 - 5.0 mg (for samples 1, 2, 3 and 4)
100 - 110 mg (for sample 5)

Note

Set Oxygen Flow 300 ml/min, Oxygen Injection Time 10 seconds.



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Fly Ash

Carbon determination

FLY ASH

C%	RSD%
3.5104	0.5738
3.5479	
3.5428	
3.5105	
3.5506	

Sample information

Standard:	Aspartic acid	36.09 C%
Standard weight:	4.0 - 5.0 mg	
Sample weight:	90 - 100 mg	



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Freeze-Dried Microalgae

CHNS/O determination

FREEZE-DRIED MICROALGAE

	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	6.2828		45.4178		6.6669		0.2806		29.3882	
	6.2830		45.3069		6.6595		0.2829		29.4303	
	6.2988	0.8935	45.2882	0.1146	6.5827	0.5547	0.2904	1.5276	29.4260	0.0788
	6.2925		45.3246		6.6184		0.2894			
	6.2701		45.3671		6.6000		0.2830			
2	9.6655		48.2842		6.6924		0.5592		28.5385	
	9.6353		48.2423		6.7354		0.5489		28.7312	
	9.6214	0.1677	48.2090	0.1162	6.6955	0.4528	0.5510	0.8935	28.3192	0.7226
	9.6407		48.1372		6.7508		0.5588			
	9.6348		48.2533		6.7568		0.5587			

Sample information

Standard for CHNS determination:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard for O determination:	Benzoic acid	26.20 O%
Standard weight:	CHNS	2.0 - 3.0 mg
	Oxygen	1.0 - 2.0 mg
Sample weight:	CHNS	3.0 - 4.0 mg
	Oxygen	1.0 - 2.0 mg

Note

For CHNS, standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Samples were dried at 110°C for 2 hours.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Particulate Mater

CHN determination

PARTICULATE MATTER (FILTERS) (1/4)

Sample information

The filters (48 mm diameter) were dry at 60°C overnight. The filters were cut in 12 parts, every filter data will be the addition of the 12 runs.

Determination of the Area of 1 µg of each element through the analysis of Acetanilide:

- Analysis of the blank (only tin container) in duplicate (in general N blank is not significative) and calculation of the average of the area obtained (Table 1)
- Analysis of acetanilide in triplicate (Table 2)
- Values of Area / µg for each element (Table 3)

Table 1

Blank analysis	Area (mVolt/sec)			Average Area (mVolt/sec)		
	N	C	H	Av. N	Av. C	Av. H
tin container	0	7618	5032	0	7581	5173
tin container	0	7544	5315			

Table 2

Weight (mg)	Amount			Area (mVolt/sec)			Corrected Area by Blank (mVolt/sec)		
	ug N	ug C	ug H	N	C	H	N	C	H
2.111	218.70	1500.71	141.65	439940	7345728	2257076	439940	7338147	2251903
2.118	219.42	1505.69	142.12	441130	7353533	2270688	441130	7345942	2265515
2.113	218.91	1502.13	141.78	439099	7326713	2267107	439099	7319132	2261934

Table 3

Area / ug		
N	C	H
2011.61	4889.78	15897.66
2010.44	4878.79	15940.86
2005.84	4872.5	15953.83

Average Area /ug		
Average N	Average C	Average H
2009.3	4880.36	15930.78



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Particulate Mater

CHN determination

PARTICULATE MATTER (FILTERS) (2/4)

Analysis of the filters Tricho 10 ml and Tricho 20 ml:

- Analysis of the blank (tin container + filter) (Table 4), calculation of the total area of each element
- Analysis of the samples, calculation of the total area of each element, correction of the area by the blank, calculation of the μg for each element (Table 5 and 6)

Table 4 - Blank filter

Part of the filter(mVolt/sec)	Area (mVolt/sec)		
N	N	C	H
Blank filter	0	46745	264357
Blank filter	0	30701	238820
Blank filter	0	35891	263505
Blank filter	0	42386	246641
Blank filter	0	32563	237994
Blank filter	0	34431	257342
Blank filter	0	34207	211649
Blank filter	0	31632	254639
Blank filter	0	34635	197724
Blank filter	0	26540	192874
Blank filter	0	32637	250637
Blank filter	0	37604	209081
Total Area (mVolt/sec)	0	419972	2825263



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Particulate Mater

CHN determination

PARTICULATE MATTER (FILTERS) (3/4)

Table 5 - Filter Tricho 10 ml

Part of the filter		Area (mVolt/sec)		
		N	C	H
Tricho 10 ml		19410	249331	988225
Tricho 10 ml		16235	206227	689254
Tricho 10 ml		20084	253372	973526
Tricho 10 ml		16494	213454	726722
Tricho 10 ml		14546	184021	696355
Tricho 10 ml		15333	196022	654084
Tricho 10 ml		11923	158287	507108
Tricho 10 ml		25473	317026	1078875
Tricho 10 ml		14719	184936	695623
Tricho 10 ml		32461	413096	1292190
Tricho 10 ml		13944	179624	556938
Tricho 10 ml		12491	165308	613956
	Total Area (mVolt/sec)	213113	2720704	9472856
	Total Area corrected by blank	213113	2300732	6647593
	ug of element	106.06	471.43	417.28

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Particulate Mater

CHN determination

PARTICULATE MATTER (FILTERS) (4/4)

Table 6 - Filter Tricho 20 ml

Part of the filter		Area (mVolt/sec)		
		N	C	H
Tricho 20 ml		35773	411787	724877
Tricho 20 ml		28626	1016717	1247060
Tricho 20 ml		29980	339232	1170446
Tricho 20 ml		25414	299424	781247
Tricho 20 ml		18386	214038	495672
Tricho 20 ml		23230	270344	789962
Tricho 20 ml		41124	492692	1086428
Tricho 20 ml		33242	412550	781661
Tricho 20 ml		30226	388105	617209
Tricho 20 ml		20431	245968	459284
Tricho 20 ml		27235	332057	976343
Tricho 20 ml		26652	315855	891907
	Total Area (mVolt/sec)	340319	4738769	10022096
	Total Area corrected by blank	340319	4318797	7196833
	ug of element	169.37	884.93	451.76

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Particulate Mater in Air

NC determination

PARTICULATE MATTER IN AIR (FILTERS)

Sample	N%	RSD%	C%	RSD%
1	0.0590		0.1704	
	0.0567	3.6138	0.1773	2.2007
	0.0549		0.1768	
2	0.5985		1.9992	
	0.5909	0.6644	2.0095	1.4277
	0.5966		1.9560	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Standard weight: 4.0 - 5.0 mg
Sample weight: 30 - 50 mg

Note

Sample 1 was collected during the summer while sample 2 was collected during the winter. The filters containing the sample were cut into pieces. For a correct determination it is important to evaluate the blank level by analyzing a clean filter, the resulting blank value is then automatically subtracted in subsequent analyses by the software.



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Particulate Mater in Air

NC determination

PARTICULATE MATTER IN AIR (FILTERS) (1/2)

Sample weighing technique:

- 1) Empty quartz filter blank: it was cut in four parts, one quarter was used for CHNS analysis and another quarter was used for oxygen determination.
- 2) Half quarter filter sample containing the particulate matter: it was cut in two parts, one quarter was used for CHNS analysis and another quarter was used for oxygen determination. Each quarter was cut in six parts.

Calculation and Results of CHNS determination

1) Determination of the Area of 1 µg of each element through the analysis of BBOT:

- a) Analysis of the blank (tin container plus 10 mg vanadium pentoxide) in triplicate and calculation of the average of the area (mVolt/s) obtained.

Run	Area Nitrogen	Area Carbon	Area Hydrogen	Area Sulfur
1	292	11126	10681	0
2	246	9290	10618	0
3	400	14668	12732	0
Average	312	11694	11343	0

- b) Analysis of four BBOT* standard: correction of the areas obtained by the blank, calculation of the µg of each element, calculation of the Area/ug for each element, determination of the average of the Area/ug

Sample Name	Weight (mg)	Area Nitrogen	Area Carbon	Area Hydrogen	Area Sulphur	Area corrected by blank			
						Nitrogen	Carbon	Hydrogen	Sulphur
BBOT	2.047	265249	7854000	1969709	330294	264937	7842306	1958366	330294
BBOT	2.028	262673	7792763	1959297	330133	262361	7781069	1947954	330133
BBOT	2.013	260261	7727094	1942365	328990	259949	7715400	1931022	328990
BBOT	2.063	265783	7911067	1990407	337394	265471	7899373	1979064	337394

Sample Name	Weight (mg)	Amount N (ug)	Amount C (ug)	Amount H (ug)	Amount S (ug)	N Area/ug	C Area/ug	H Area/ug	S Area/ug
BBOT	2.047	133.26	1484.69	124.66	152.30	1988	5282	15709	2169
BBOT	2.028	132.02	1470.91	123.51	150.88	1987	5290	15772	2188
BBOT	2.013	131.05	1460.03	122.59	149.77	1984	5284	15752	2197
BBOT	2.063	134.3	1496.29	125.64	153.49	1977	5279	15752	2198
Average						1984	5282	15746	2188

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Particulate Mater in Air

NC determination

PARTICULATE MATTER IN AIR (FILTERS) (2/2)

- 2) **Analysis of the blank of the filter**
- a) Every sixth part of the fourth filter was weighed in a tin container with about 10 mg of vanadium pentoxide.
 - b) Determination of the total areas obtained for one quarter of filter.

Run No.	Area Nitrogen	Area Carbon	Area Hydrogen	Area Sulphur
1	576	20435	21584	0
2	688	20313	21426	0
3	714	23609	22993	0
4	701	21411	21542	0
5	584	21158	20306	0
6	947	29500	27247	0
Total Area	4210	136426	135098	0

- 3) **Analysis of CHNS in the filter KPS13022122PPQV**
- a) Every sixth part of the fourth air filter was weighed in a tin container with about 10 mg of vanadium pentoxide.
 - b) Determination of the total areas obtained for one quarter of filter.
 - c) Correction of the areas by the total blank areas
 - d) Calculation of the µg obtained of each element.

Element	Nitrogen	Carbon	Hydrogen	Sulphur	Nitrogen	Carbon	Hydrogen	Sulphur
	Sample 1				Sample 2			
Area (mVolt/sec)	9807	69390	53094	5008	2302	43826	54279	1621
	7108	57024	39986	3665	3168	47154	55935	1798
	9051	60126	51709	4662	2012	32166	42618	1223
	4367	34768	27680	2366	2103	33362	47891	1791
	6541	46656	35027	3661	2371	35189	52594	1403
	5537	45894	33087	2869	1919	30929	43926	1382
Total Area	42411	313858	240583	22231	13875	222626	297243	9218
Area corrected by blank	38201	177432	105485	39454	9665	86200	162145	9218
Total Amount (ug) in 1 quarter of filter	19.25	33.59	6.7	10.16	4.87	16.32	10.3	4.21



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Particulate Mater in Air

NC determination

PARTICULATE MATTER IN AIR (FILTERS) (1/2)

Calculation and results of Oxygen determination

1) Determination of the Area of 1 µg through the analysis of BBOT standard

- a) Analysis of the blank performed with an empty silver container: determination of the average of the areas (mVolt/s) obtained.

Run No.	Area	Average Area
1	4201	4247
2	4173	
3	4368	

- b) Analysis of four BBOT* standard: correction of the areas obtained by the blank, calculation of the µg of each element, calculation of the Area/ug for each element, determination of the average of the Area/ug

Sample Name	Weight (mg)	Area Oxygen	Area corrected by blank	Amount Oxygen (ug)	Area/ug Oxygen	Average Area/ug O
BBOT	2.047	265249	7854000	1969709	330294	330294
BBOT	2.028	262673	7792763	1959297	330133	330133
BBOT	2.013	260261	7727094	1942365	328990	328990
BBOT	2.063	265783	7911067	1990407	337394	337394

2) Analysis of the blank of filter

- a) Every sixth part of the fourth filter was weighed in a silver container with about 10 mg of vanadium pentoxide.
- b) Determination of the total areas (mVolt/s) obtained for one quarter of filter.

Run No.	Area Oxygen
1	26164
2	27400
3	27106
4	26577
5	28794
6	27072
Total Area	163113



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Particulate Mater in Air

NC determination

PARTICULATE MATTER IN AIR (FILTERS) (2/2)

- 3) **Analysis of Oxygen in the filter KPS13022122PPQV**
- a) Every sixth part of the fourth air filter was weighed in a silver container
 - b) Determination of the total areas obtained for one quarter of filter.
 - c) Correction of the areas by the total blank areas
 - d) Calculation of the µg Oxygen obtained.

Sample	Element	Oxygen
1	Area	58540
		57630
		83729
		78739
		76927
		72932
	Total Area	349768
	Area corrected by blank	186655
	Total Amount (ug) in 1 quarter of filter	44.70
2	Area	56627
		39115
		46198
		46412
		45989
		35073
	Total Area	269414
	Area corrected by blank	106301
	Total Amount (ug) in 1 quarter of filter	25.46

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Particulate Mater in Water

NC determination

PARTICULATE MATTER IN WATER (FILTERS) (1/2)

Table 1

Weight (mg)	N amount (µg)	C amount (µg)	N Area	C Area	C Blank corr. area	N Area/µg N	C Area/µg C
1.384	66.98	976.55	110903	4897750	4889399	1656	5007
1.305	63.16	920.81	104818	4632224	4623873	1660	5021

Table 2

No.Run	N Area	C Area	Average C Area
1	--	17016	
2	--	13349	14938
3	--	14449	

Table 3

Sample	No.filter	N Area	C Area	C. A. corrected	µg N	µg C
1	1	541	41475	26537	0.33	5.29
	2	585	37275	22337	0.35	4.45
	3	618	41079	26141	0.37	5.21
2	1	3857	78837	63899	2.33	12.74
	2	3878	78166	63228	2.34	12.61
	3	3820	77138	62200	2.30	12.40
3	1	10367	41666	26728	6.25	5.33
	2	10990	46245	31307	6.63	6.24
	3	10274	43952	29014	6.20	5.78

Calculation and results

- Determination of the area of 1 µg Nitrogen and the area of 1 µg Carbon through the analysis of Atropine:
 - Analysis of the blank (only tin container) in triplicate (in general N blank is not significant)
 - Analysis of Atropine in duplicate (Table 1)
 - Values of N Area / µg N and C Area / µg C to use for sample calculation (Table 1)
- Analysis of filters containing the sample:
 - Analysis of the blank (tin container + filter) in triplicate (Table 2)
 - Analysis of sample (Table 3)
 - Calculation of µg N and µg C (Table 3)



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Particulate Matter in Water

NC determination

PARTICULATE MATTER IN WATER (FILTERS) (2/2)

Analytical conditions

NC Soils configuration, setting Oxygen Injection Time 8 sec.

Sample information

Standard:	Atropine	4.84 N%, 70.56 C%
Sample weight:	1.0 - 1.5 mg	

Comment

Particulate matter in water is normally analyzed after filtration on glass filters (typically 24 mm diameter). The dried filter is analyzed.

Weighing the sample is not required as it is the total content of the elements which is being determined.



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Sewage Sludges

N Org determination

SEWAGE SLUDGES

Sample	N%		
A	0.17	0.17	0.17
B	0.19	0.19	0.20
C	0.21	0.21	0.21

Sample information

Standard: Atropine 4.84 N%

Standard weight: 5.0 - 10 mg

Sample weight: 50 - 60 mg

Note

Samples have been adsorbed on Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) using a microsyringe.
Tin containers (p/n 240 06400) have been used.



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Sewage Sludges

NC and TOC (Total Organic Carbon) determination

SEWAGE SLUDGES

Sample	N%	RSD%	C%	RSD%	TOC%	RSD%
1	6.044		36.532		34.271	
	6.052	0.5182	36.372	0.315	33.922	0.5252
	6.102		36.595		34.167	
2	0.670		4.476		4.166	
	0.666	0.5244	4.476	0.6084	4.136	0.3638
	0.673		4.429		4.148	

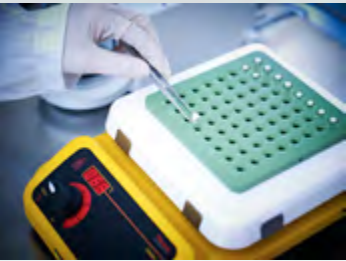
Sample information

Standard: Aspartic acid 10.52 N%, 36.04 C%
Standard weight: 4.0 - 5.0 mg
Sample weight for NC determination: 4.0 - 5.0 mg (sample 1),
40 - 50 mg (sample 2)
Sample weight for TOC determination: 3.0 - 4.0 mg (sample 1),
15 - 20 mg (sample 2)

Note

TOC determination was performed with the dedicated kit (p/n 190 04120).
TOC % values are determined by FlashSmart™ EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

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Sewage Sludges

Nitrogen determination

SEWAGE SLUDGES

Sample	N%	RSD%
1	0.770	0.2709
	0.766	
	0.769	
2	1.074	0.4955
	1.064	
	1.066	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.04 C%
Standard weight:	50 - 60 mg	
Sample weight:	240 - 260 mg (sample 1)	
	150 - 170 mg (sample 2)	



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Sludges

CHNS/O determination

SLUDGES

	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	3.8788		26.6298		4.5335		1.0472		22.9644	
	3.8220	0.8034	26.4631	0.3459	4.5342	0.1665	1.0459	0.9757	23.0424	0.2383
	3.8294		26.6135		4.5208		1.0643		22.9368	
2	0.7037		59.4515		4.8871		0.2942		25.7291	
	0.7005	0.2279	59.6610	0.3034	4.8825	0.0881	0.2927	0.6545	25.8408	0.7589
	0.7021		59.3018		4.8911		0.2904		25.4616	
3	1.2841		32.5504		2.5863		0.8617		8.8929	
	1.2834	0.7526	32.2068	0.7381	2.6431	1.1315	0.8575	1.0178	8.9031	0.2327
	1.2671		32.6681		2.6294		0.8744		8.9328	

Sample information

Standard for CHNS determination:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard for O determination:	Benzoic acid	26.20 O%
Sample weight:	CHNS	2.0 - 3.0 mg
	Oxygen	1.0 - 2.0 mg
Sample weight:	CHNS	3.0 - 4.0 mg
	Oxygen	1.0 - 2.0 mg

Note

For CHNS, standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Waste Materials

CHN/O determination

DUST FROM WASTE MATERIALS (1/3)

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	0.883	1.40	32.00	0.45	4.20	1.15	0.354	2.45	24.17	0.53
	0.878		31.76		4.12		0.366		23.94	
	0.897		31.76		4.11		0.374		23.99	
	0.896		31.84		4.22		0.370		23.91	
	0.878		31.47		4.10		0.362		23.89	
	0.890		31.62		4.07		0.340		24.22	
	0.909		31.68		4.18		0.367		24.12	
	0.903		31.66		4.13		0.337		23.91	
	0.877		31.64		4.17		0.353		24.06	
	0.908		31.79		4.16		0.361		24.19	
2	0.770	1.42	27.99	0.71	3.71	1.35	0.346	2.85	22.57	0.69
	0.798		27.70		3.76		0.353		22.54	
	0.776		27.75		3.68		0.341		22.44	
	0.787		27.82		3.70		0.317		22.17	
	0.795		28.19		3.79		0.340		22.52	
	0.796		27.73		3.73		0.345		22.18	
	0.805		27.91		3.63		0.306		22.57	
	0.781		27.70		3.71		0.348		22.38	
	0.799		28.17		3.76		0.314		22.29	
	0.794		27.65		3.65		0.331		22.30	



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Waste Materials

CHN/O determination

DUST FROM WASTE MATERIALS (2/3)

Heat Values and CO₂ Emission Trade calculation

Sample	G.H.V. (Kcal/Kg)	RSD%	N.H.V. (Kcal/Kg)	RSD%	CO ₂ E.T.	RSD%
1	2998.1	0.19	2785.2	0.20	99.7	0.20
	3008.1		2795.2		99.3	
	3006.2		2793.3		99.4	
	3009.4		2796.5		99.3	
	3010.5		2797.6		99.3	
	2996.0		2783.0		99.8	
	3000.6		2787.7		99.6	
	3009.6		2796.7		99.3	
	3003.2		2790.2		99.5	
	2997.5		2784.6		99.7	
2	2598.5	0.26	2408.2	0.28	101.3	0.28
	2599.8		2409.4		101.2	
	2604.3		2414.0		101.0	
	2615.6		2425.2		100.6	
	2600.6		2410.2		101.2	
	2615.4		2425.1		100.6	
	2598.4		2408.1		101.3	
	2606.8		2416.5		100.9	
	2610.7		2420.4		100.8	
	2610.0		2419.6		100.8	

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Waste Materials

CHN/O determination

DUST FROM WASTE MATERIALS (3/3)

Sample information for CHN determination

Standard:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard volume:	2.0 - 3.0 mg	
Sample volume:	3.0 - 4.0 mg	

Sample information for Oxygen determination

Standard:	Cystine	26.63 O%
Standard volume:	1.0 - 1.5 mg	
Sample volume:	1.0 - 1.5 mg	

Note

Sample 1 is dust from rubber/plastic, for power/heat production.

Sample 2 is dust from finder, for power/heat production.

Samples were homogenized by a ball mill.

For CHNS determination, standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

The G.H.V. and N.H.V. and the CO_2 Emission Trade values are calculated automatically by the Thermo Scientific EagerSmart Data Handling Software.

These calculations give a quantitative value of the energetic quality of the analyzed sample.

The G.H.V./N.H.V. can also be determined directly using a calorimeter Mahler bomb (ASTM 271 Oxygen combustion method).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Waste Materials

CHN/O determination

WASTE MATERIALS (1/2)

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	0.716	2.47	36.86	0.45	5.10	0.59	0.115	4.02	30.08	0.78
	0.723		37.22		5.15		0.116		30.40	
	0.685		37.27		5.10		0.113		29.89	
	0.697		37.03		5.16		0.122		29.97	
	0.686		37.03		5.10		0.124		30.38	
2	0.718	1.37	48.88	0.58	5.89	1.00	0.118	3.99	27.90	0.80
	0.706		48.40		5.75		0.118		27.56	
	0.713		48.14		5.85		0.127		280.3	
	0.694		48.55		5.79		0.119		27.56	
	0.700		48.70		5.77		0.114		27.94	
3	0.790	1.70	44.28	0.36	5.44	0.58	0.158	3.29	26.71	0.84
	0.789		44.63		5.46		0.157		27.24	
	0.777		44.66		5.38		0.158		26.88	
	0.795		44.61		5.40		0.146		27.08	
	0.814		44.43		5.42		0.154		26.74	

Heat Values and CO₂ Emission Trade calculation

Sample	G.H.V. (Kcal/Kg)	RSD%	N.H.V. (Kcal/Kg)	RSD%	CO ₂ E.T.	RSD%
1	3511.2	0.29	3248.5	0.31	99.9	0.31
	3497.7		3235.0		100.4	
	3519.5		3256.8		99.7	
	3516.1		3253.4		99.8	
	3498.6		3235.9		100.3	
2	4781.5	0.21	4483.4	0.21	94.8	0.21
	4796.0		4497.9		94.5	
	4775.9		4477.8		94.9	
	4796.2		4498.1		94.5	
	4779.6		4481.4		94.8	
3	4370.6	0.22	4092.5	0.24	95.2	0.24
	4347.8		4069.7		95.8	
	4363.4		4085.3		95.4	
	4354.6		4076.5		95.6	
	4369.0		4090.9		95.27	



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CHN/O determination

WASTE MATERIALS (2/2)

Sample information for CHN determination

Standard:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight:	2.0 - 3.0 mg	
Sample volume:	3.0 - 4.0 mg	

Sample information for Oxygen determination

Standard:	Aspartic acid	48.08 O%
Standard weight:	1.0 - 1.5 mg	
Sample volume:	1.0 - 1.5 mg	

Note

Samples contain plastics, paper, dust, wood. Samples were homogenized by a ball mill.
For CHNS determination, standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

The G.H.V. and N.H.V. and the CO_2 Emission Trade values are calculated automatically by the Thermo Scientific EagerSmart Data Handling Software.

These calculations give a quantitative value of the energetic quality of the analyzed sample.

The G.H.V./N.H.V. can also be determined directly using a calorimeter Mahler bomb (ASTM 271 Oxygen combustion method).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Water

N Org determination

WATER

Sample	N%									
100 ppm solution	0.0100	0.0091	0.0105	0.0102	0.0093	0.0102	0.0091	0.0095	0.0100	0.0093
10 ppm solution	0.0014	0.0010	0.0015	0.0015	0.0013	0.0010	0.0011	0.0009	0.0009	0.0010

Sample information

Standard: 100 ppm
 Standard volume: 80 - 100 µl

Standard Urea Water Solution

Note

The samples have been introduced using the Manual Injection Device (p/n 190 04138) at 8 seconds after the start. Same samples can be analyzed using a liquid autosampler.



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Water

NC determination

WATER

Sample Lysine chlorhydrate water solution	ppm N	RSD%	ppm C	RSD%
39 ppm N - 100 ppm C	35		98	
	40		99	
	36		97	
	42		98	
	40	6.565	98	1.014
	38		97	
	40		98	
	42		99	
	42		97	
	37		100	
19 ppm N - 50 ppm C	16		52	
	14		49	
	17		52	
	17		49	
	17	8.718	51	2.681
	17		51	
	16		51	
	14		49	
	18		52	
	18		49	



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Water

Total Carbon (TC) and Total Organic Carbon (TOC)

WATER

Sample	TC%	TOC%
1	0.0031	0.0011
	0.0028	0.0008
2	0.0036	0.0013
	0.0040	0.0017
3	0.0158	0.0044
	0.0151	0.0047
4	0.0052	0.0013
	0.0049	0.0014
5	0.0042	0.0011
	0.0040	0.0010

Sample information

Standard: Lysine Chlorhydrate or Urea Water Solution 0.01 C%
 Volume injected: 80 - 125 µl

Note

The analyses can be performed using the Manual Injection Device (p/n 190 04138) or liquid autosampler. The injection is at 8 seconds after the start. Set Oxygen Injection Time 2 seconds. For TOC determination, samples were acidified with HCl and shaken to remove the carbonate present.



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Water

NC determination

WATER

Sample	TC ppm	RSD%	TOC ppm	RSD%
1	3.6	2.86	1.0	5.97
	3.5		0.9	
	3.4		1.0	
2	42.6	2.13	41.8	0.14
	44.1		41.9	
	44.3		41.8	

Sample information

Standard: Urea water solution 5 and 40 ppm C
 Standard volume: 250 ul
 Sample volume: 250 ul

Note

Set the Oxygen Flow at 250 ml/min and the Oxygen Injection Time at 2 seconds.
 Use a 3 meters GC column (p/n 260 07931) installed in the oven at 50°C.
 Standard and samples were injected manually using the Manual Injection kit (p/n 190 04138) at 8 seconds after the start of the analysis.

For Total Organic Carbon (TOC), liquid samples were acidify with chlorhydric acid and shaken to remove any carbonate present (alternatively a helium carrier flow from the vent of the Analyzer could be used).



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Water

CHN/O determination

WATER

Sample	N%	RSD%	C%	RSD%	H%	RSD%	O%	RSD%
1	0.349	0.87	4.91	0.31	6.87	0.25	60.68	0.24
	0.353		4.93		6.84		60.41	
	0.355		4.90		6.87		60.64	
2	11.70	0.18	30.31	0.22	7.22	0.08	49.60	0.18
	11.74		30.18		7.23		49.52	
	11.71		30.26		7.22		49.42	

Sample information for CHN determination

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
 Standard weight: 2.0 - 3.0 mg
 Sample volume: 1.8 - 2.5 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%
 Standard weight: 0.8 - 1.0 mg
 Sample volume: 0.2 - 1.0 mg

Note

For CHN determination, set Oxygen Injection Time at 4 seconds, samples were weighed in double tin containers.
 Sample 1: 30% K₂CO₃, 1% diethanol amine, 1% glycine, 0.5% V₂O₅, rest water.
 Sample 2: 60% formaldehyde, 25% urea, rest water.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Amino Phosphate - Bovine Albumin

N Org determination

AMINO PHOSPHATE - BOVINE ALBUMIN

Sample	N%		
Amine phosphate	0.58	0.58	0.57
Amine phosphonate	1.20	1.20	1.22
Bovine albumin	4.62	4.62	4.61
Bovine serum	1.24	1.23	1.24

Sample information

Standard:	Atropine	4.84 N%
Standard weight:	10 - 15 mg	
Sample weight:	20 - 30 mg	

Note

The samples have been introduced using the Manual Injection Device (p/n 190 04138) at 8 seconds after the start. Same samples can be analyzed using a liquid autosampler.



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Fertilizers

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Fertilizers - Feed - Soils

NC Soils determination

FERTILIZERS, HUMAN, ANIMAL FEED & SOILS

Sample	N%			C%		
Soil A	0.650	0.652	0.656	6.540	6.499	6.503
Soil B	0.395	0.383	0.386	4.517	4.425	4.464
Soil Meal	7.258	7.374	7.466	31.360	31.198	32.292
Milk Powder	2.822	2.806	2.800	50.618	50.472	50.480
Compost A	1.310	1.337	1.337	16.591	16.975	16.955
Compost B	2.215	2.256	2.214	25.522	25.864	26.228
Lucerne	3.951	4.001	3.918	41.642	41.817	41.933
Pasture	4.002	3.978	3.978	42.150	42.294	42.268
Fertilizer A	13.142	12.962	13.102	1.274	1.061	1.231
Fertilizer B	17.873	17.807	17.874	0.231	0.227	0.228
An. Grade Chem	20.835	20.945	20.833			

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
Standard weight:	Soil A and B	5.0 mg
	An. Grade Chem	2.0 - 3.0 mg
	Others	10 mg
Sample weight:	Soil A and B	50 - 80 mg
	An. Grade Chem	2.0 - 3.0 mg
	Others	10 - 30 mg

Note

The geological material has been ground by ball mill. These materials can be analyzed *as received* or dried (105°C, 2 hours).



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Fertilizers - Wood Powders

N Org determination

FERTILIZERS - WOOD POWDERS

Sample	N%		
Fertilizer P41018	38.342	38.182	38.359
Fertilizer DA VF	38.164	37.876	38.368
Wood Powder 1	0.227	0.233	0.225
Wood Powder 2	0.170	0.171	0.175

Sample information
For Fertilizer samples

Standard: Urea 46.65 N% (use 20 sec Oxygen Injection Time)
Standard weight: 100 mg
Sample weight: 100 - 150 mg (using the categories, set a Delta 0.4)

For Wood powder

Standard: Aspartic acid 10.52 N% (use 30 sec Oxygen Injection Time)
Standard weight: 80 - 100 mg
Sample weight: 100 - 150 mg (using the categories, set a Delta 1.8)

Note

N/Protein configuration is suggested for the analysis.

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Fertilizers - Wood Powders

Sulfur determination

FERTILIZERS

Fertilizer 1		Fertilizer 2		Fertilizer 3	
S%	RSD%	S%	RSD%	S%	RSD%
2.6853		3.6155		2.7404	
2.7677		3.6138		2.6977	
2.7448	1.3368	3.6637	0.8571	2.7223	0.9073
2.6915		3.6230		2.7496	
2.7001		3.6819		2.7382	
				2.6888	

Sample information

Standard:	BBOT*	7.44 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	2.0 - 4.0 mg	

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Samples were homogenized with a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Liquid Fertilizers

N Org determination

LIQUID FERTILIZERS

Sample	N%		
A	7.688	7.596	7.586
B	0.834	0.852	0.842
C	2.830	2.916	2.876
D	0.310	0.316	0.316
E	0.056	0.052	0.052
F	10.197	10.160	10.167

Sample information

For samples B, D and E

Standard: Standard Urea Water Solution 0.3 N%
Standard volume: 100 µl

For samples A, C and F

Standard: Standard Urea Water Solution 6 N%
Standard volume: 100 µl



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N determination

FERTILIZERS

Sample	N%	RSD%
Urea	46.59 - 46.56 - 46.56	0.0310
Potassium nitrate KNO_3	13.80 - 13.82 - 13.94	0.5610
Ammonium nitrate NH_4NO_3	34.93 - 34.93 - 34.93	0.0088
Mix Urea + Ammonium sulphate $(\text{NH}_4)_2\text{SO}_4$	34.56 - 34.71 - 34.78	0.3241
Mix fertilizer A	17.55 - 17.51 - 17.55	0.1472
Mix fertilizer B	15.44 - 15.42 - 15.57	0.5236
Water solution A (mix Urea + NH_4NO_3 + $(\text{NH}_4)_2\text{SO}_4$)	23.63 - 23.53 - 23.59	0.2134
Water solution B (mix Urea + NH_4NO_3)	27.90 - 27.79 - 27.87	0.2041

Sample information

Standard:	Urea	46.65 N%
Standard weight:	Urea	70 - 120 mg
	Urea (for ammonium nitrate analysis)	4.0 - 5.0 mg
Sample weight:	Urea	70 - 120 mg
	Potassium nitrate and mix solid mix fertilizers	240 - 270 mg
	Ammonium nitrate	5.0 - 6.0 mg
	Water solutions	200 - 250 mg absorbed on
		50 - 60 mg
		Chromosorb WAW (30 - 60 mesh)
		(p/n 338 37530)

Analytical conditions

Oxygen Flow: 300 ml/min

Oxygen Injection Time: 10 seconds (20 seconds weighing 120 mg Urea)

Note

For ammonium nitrate set Oxygen Flow 250 ml/min and Oxygen Injection Time 4 seconds.



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N determination

FERTILIZERS (LIQUID)

Sample	N%	RSD%	C%	RSD%
1	0.7881	0.2412	0.4552	1.8852
	0.7752		0.4675	
2	1.6335	0.0260	0.0133	
	1.6329		0.0122	
3	4.0065	0.9506	0.0416	2.0696
	3.9530		0.0404	
4	4.0576	0.8256	0.3475	1.5497
	4.0105		0.3552	
5	0.6753	1.3483	0.4791	0.1180
	0.6883		0.4799	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Standard weight: 4.0 - 5.0 mg
Sample weight: 10 - 15 mg adsorbed on 10 mg Chromosorb WAW (30 - 60 mesh) (p/n 338 37530)

Note

Set Oxygen Flow 250 ml/min, Oxygen Injection Time 8 seconds.
Evaluate the blank value with a tin container (p/n 252 08000) plus 10 mg Chromosorb WAW (30 - 60 mesh) (p/n 338 37530).

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NCS determination

FERTILIZERS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	24.0099		0.3495		11.7380	
	24.0071	0.0269	0.3630	2.6343	11.6329	0.4732
	23.9976		0.3452		11.6559	
2	13.9874		0.1163		0.0344	
	13.9915	0.2693	0.1334	8.2515	0.0346	2.6522
	13.9244		0.1157		0.0361	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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NCS determination

FERTILIZERS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	10.5382		4.5833		0.2178	
	10.5824	0.2304	4.5226	1.8209	0.2224	1.8621
	10.5780		4.6881		0.2143	
2	24.6134		0.2208		1.2315	
	24.7318	0.2473	0.2227	0.6865	1.2342	0.1265
	24.6983		0.2197		1.2315	
3	25.5003		0.0456		0.0851	
	25.5375	0.0945	0.0422	3.9014	0.0839	0.7131
	25.5455		0.0436		0.0846	
4	33.4664		0.0380			
	33.5051	0.1252	0.0375	1.8605	-	-
	33.5502		0.0389			
5	20.6318		0.9435		23.9392	
	20.7547	0.3046	0.9358	0.4107	23.9863	0.1145
	20.6692		0.9392		23.9872	

Sample information

Standard:	BBOT* Nicotinamide Urea Cystine	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S% 22.94 N%, 59.01 C%, 4.95 H% 46.65 N%, 20.00 C% 11.66 N%, 29.99 C%, 5.03 H%, 26.69 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

BBOT* standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Samples in granules were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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NC determination

FERTILIZERS

N%	RSD%	C%	RSD%
11.28		0.33	
11.29	0.051	0.33	1.732
11.28		0.34	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
Standard weight:	19 - 20 mg	
Sample weight:	19 - 20 mg	

Note

It is suggested to use the 3 meters GC column (p/n 260 07931) installed into the oven at 50 °C.



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NC determination

FERTILIZERS

Sample	N%	RSD%	C%	RSD%
Solid 1	9.38	0.16	35.66	0.17
	9.36		35.60	
	9.35		35.54	
Solid 2	9.77	0.10	8.01	0.22
	9.79		8.04	
	9.78		8.04	
Liquid 1	0.208	1.10	15.85	0.16
	0.212		15.90	
	0.208		15.87	
Liquid 2	9.69	0.30	26.14	0.29
	9.74		26.19	
	9.74		26.04	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%

Standard weight: 4.0 - 5.0 mg

Sample weight: 4.0 - 5.0 mg

Note

Set the Oxygen Flow at 250 ml/min and Oxygen Injection Time at 10 seconds.

Solid fertilizers were homogenized by a ball mill, liquid fertilizers were weighed directly in tin container.



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CHNS determination

FERTILIZERS (1/2)

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Inorganic solid 1	34.27		0.237		5.20		0.767	
	34.31	0.34	0.234	0.88	5.20	0.11	0.760	0.62
	34.49		0.238		5.19		0.758	
Inorganic solid 2	18.06		1.04		2.50		1.51	
	17.99	0.47	1.06	1.10	2.46	0.84	1.49	0.77
	18.16		1.06		2.47		1.51	
Inorganic solid 3	14.55		6.07		8.14		0.0194	
	14.43	0.55	6.02	0.48	8.16	0.31	0.0191	1.30
	14.40		6.02		8.11		0.0196	
Organic liquid 1	8.46		9.67		7.54		0.845	
	8.40	0.38	9.67	0.42	7.53	0.08	0.837	0.48
	8.41		9.60		7.54		0.842	
Organic liquid 2	3.47		11.04		7.01		1.86	
	3.43	0.76	11.06	0.18	7.05	0.28	1.89	0.81
	3.48		11.08		7.03		1.88	
Organic liquid 3	0.284		10.73		7.32		0.519	
	0.286	0.89	10.75	0.28	7.28	0.32	0.523	0.51
	0.281		10.69		7.28		0.518	
Molasses	2.20		25.24		6.98		0.510	
	2.20	0.26	25.14	0.22	7.03	0.52	0.516	0.60
	2.19		25.15		6.96		0.514	
Leonardite	0.708		29.59		4.72		0.240	
	0.707	0.53	29.48	0.26	4.70	0.25	0.239	1.10
	0.714		29.63		4.70		0.244	
Lignosulfonate	0.0640		20.42		7.06		2.62	
	0.0631	0.86	20.56	0.36	7.11	0.37	2.63	0.22
	0.0641		20.53		7.10		2.63	



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CHNS determination

FERTILIZERS (2/2)

Sample information for CHNS determination

Standard:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
	Urea	46.65 N%, 20.00 C%, 6.71 H%
Standard weight:	BBOT*	2.0 - 3.0 mg
	Urea	3.0 - 4.0 mg
Sample weight:		3.0 - 4.0 mg

Note

Set Oxygen Injection Time at 4 seconds.

Standard and solid samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510) while liquid samples were analyzed without the additive.

Leonardite sample was homogenized by a ball mill.

The inorganic solid fertilizers contain different amount of ammonium nitrate.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CHNS/O determination

FERTILIZERS

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
14.54	0.36	50.39	0.17	7.14	0.10	0.816	0.99	24.53	0.28
14.61		50.42		7.14		0.804		24.44	
14.54		50.34		7.14		0.810		24.55	
14.65		50.57		7.13		0.809		24.40	
14.64		50.43		7.15		0.825		24.42	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Sulfanilic acid 27.71 O%
Standard weight: 1.0 - 1.5 mg
Sample weight: 1.0 - 1.5 mg

Note

For CHNS determination, standards and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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CHNS/O determination

FERTILIZERS INORGANIC

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
Solid	19.01		27.05		10.57				40.90	
	18.97	0.29	27.00	0.28	10.55	0.11	-	-	40.85	0.06
	19.08		26.90		10.57				40.86	
Liquid	12.18		14.03		4.72		11.77		39.23	
	12.21	0.25	14.13	0.36	4.71	0.21	11.70	0.31	39.31	0.13
	12.15		14.10		4.73		11.72		39.21	

Sample information for CHNS determination

Standard: Sulfamethazine 20.12 N%, 51.78 C%, 5.07 H%, 11.52 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 3.0 - 4.0 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%
 Standard weight: 1.0 - 1.5 mg
 Sample weight: 1.0 - 1.5 mg

Note

For CHNS, standard and solid sample were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Nitrogen determination

FERTILIZERS INORGANIC

Sample	N%	RSD%
Urea	46.58	0.12
	46.68	
	46.52	
	46.62	
	46.58	
	46.66	
	46.65	
	46.63	
	46.52	
	46.62	
Ammonium chloride	26.48	0.19
	26.36	
	26.42	
	26.42	
	26.32	
	26.38	
	26.40	
	26.36	
	26.40	
	26.46	
Ammonium sulphate	26.33	0.53
	21.18	
	21.15	
	21.35	
	21.05	
	21.23	
	21.32	
	21.37	
	21.35	
	21.30	
	21.40	

Sample information

Standard: Urea 46.65 N%

Standard weight: 90 - 100 mg

Sample weight: 90 - 100 mg for Urea
150 - 160 mg for Ammonium chloride
180 - 200 mg for Ammonium sulphate

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 10 sec.
The theoretical values are 46.65 N% for urea, 26.18 N% for ammonium chloride and 21.20 N% for ammonium sulphate.



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Nitrogen determination

FERTILIZERS INORGANIC

Sample information

Sample No.	Inorganic fertilizer mixture composition
1	Urea
2	Urea, biammonium phosphate, ammonium sulphate, monobasic calcium phosphate, bibasic calcium phosphate, calcium phosphate, zinc oxide, potassium chloride
3	Biammonium phosphate
4	Urea, biammonium phosphate, ammonium sulphate, monobasic calcium phosphate, bibasic calcium phosphate, calcium phosphate, zinc oxide, magnesium oxide, calcium carbonate, boron
5	Urea, biammonium phosphate, ammonium sulphate, monobasic calcium phosphate, bibasic calcium phosphate, calcium phosphate, magnesium oxide, calcium carbonate, potassium chloride, boron
6	Urea, biammonium phosphate, ammonium sulphate, monobasic calcium phosphate, bibasic calcium phosphate, calcium phosphate, magnesium oxide, calcium carbonate, potassium chloride, boron
7	Potassium carbonate, potassium nitrate, monobasic potassium phosphate, ammonium sulphate, iron EDTA, copper EDTA, zinc EDTA, boron

Standard and sample weight

Two tests A and B were performed using different range of sample weight.

Test	Urea Standard	Fertilizer			
	Helium & Argon carrier gas	Helium carrier gas		Argon carrier gas	
	Weight (mg)	Sample No.	Weight (mg)	Sample No.	Weight (mg)
A	95 - 100	1	98 - 100	1	92 - 95
		2	180 - 190	2	170 - 190
		3	216 - 222	3	198 - 212
		4	194 - 201	4	191 - 197
		5	202 - 208	7	200 - 227
		6	259 - 278	8	260 - 280
		7	250 - 290	9	262 - 305
B	45 - 50	1	48 - 50	1	43 - 50
		2	94 - 96	2	91 - 100
		3	108 - 111	3	105 - 113
		4	97 - 98	4	93 - 100
		5	198 - 211	7	176 - 183
		6	197 - 203	8	183 - 190
		7	148 - 177	9	165 - 184

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Nitrogen determination

FERTILIZERS INORGANIC

Nitrogen data of inorganic fertilizers						
Sample No.	Test A			Test B		
	N%	Average %	RSD%	N%	Average %	RSD%
1	46.86	46.81	0.20	46.70	46.84	0.17
	46.65			46.86		
	46.84			46.89		
	46.81			46.89		
	46.89			46.87		
2	22.94	22.95	0.25	23.26	23.15	0.46
	23.01			23.04		
	23.00			23.18		
	22.87			23.03		
	22.92			23.22		
3	18.38	18.34	0.28	18.35	18.44	0.34
	18.35			18.48		
	18.37			18.48		
	18.25			18.48		
	18.34			18.39		
4	22.02	21.99	0.10	22.14	22.08	0.61
	22.01			22.22		
	21.99			21.89		
	21.97			22.16		
	21.97			22.00		
5	10.41	10.30	0.95	10.31	10.40	0.73
	10.19			10.43		
	10.39			10.45		
	10.22			10.32		
	10.31			10.47		
6	10.72	10.76	0.40	10.82	10.82	0.24
	10.81			10.81		
	10.79			10.79		
	10.75			10.85		
	10.71			10.85		
7	15.35	15.32	0.15	15.38	15.41	0.30
	15.33			15.44		
	15.31			15.39		
	15.32			15.37		
	15.29			15.48		

Note

FlashSmart N/Protein configuration was used for these analysis.

Set Oxygen flow 300 ml/min and Oxygen injection Time 10 sec for test A while 270 ml/min and 5 sec for test B.



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- Soy Products
- Starch

Animal Feed and Faeces

NCS determination

ANIMAL FEED & ANIMAL FAECES

Sample	N%	C%	S%
Animal feed 1	2.525	40.432	0.160
	2.523	40.342	0.143
	2.444	40.215	0.155
Animal feed 2	3.892	44.752	0.287
	3.845	44.893	0.282
	3.810	44.235	0.277
Animal faeces 1	3.206	40.475	0.343
	3.098	40.414	0.339
	3.134	39.869	0.336
Animal faeces 2	2.399	40.193	0.247
	2.423	40.068	0.249
		40.174	0.248

Sample information

Standard:	BBOT*	6.51 N%, 72.53 C%, 7.44 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

Standard and samples were analyzed with addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Animal Feed and Faeces

NC determination

ANIMAL FEED & ANIMAL FAECES

NC Determination by Single Combustion/Reduction Reactor - Method C					
Sample	W (mg)	N%	RSD%	C%	RSD%
France Maize	19.393	1.21		42.02	
	19.908	1.21	0	41.96	0.18
	20.273	1.21		41.87	
Russian Maize	19.580	1.55		43.14	
	18.960	1.55	0	43.12	0.14
	19.001	1.55		43.03	
Soja	19.626	7.93		41.82	
	19.036	7.95	0.15	41.93	0.77
	19.226	7.95		41.43	
Alfalfa	19.858	2.53		44.00	
	19.767	2.56	0.68	43.48	0.59
	19.742	2.56		43.74	
Sunflower	19.222	5.81		43.68	
	19.765	5.77	0.46	43.61	0.10
	20.313	5.82		43.69	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Acetanilide	10.36 N%, 71.09 C%
Standard weight:	2.0 - 7.0 mg Aspartic acid, 6.0 - 7.0 mg Benzoic acid, 4.0 - 12 Acetanilide	
Sample weight:	18 - 20 mg	

Note

The analytical parameters of method C are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.

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Animal Feed and Faeces

NCS determination

ANIMAL FEED FOR HORSE

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	3.69		30.86		12.00	
	3.67	1.14	30.54	0.57	12.20	0.95
	3.61		30.58		12.20	
2	1.79		43.39		1.87	
	1.78	0.32	43.38	0.18	1.89	1.94
	1.79		43.52		1.82	
3	10.37		45.40		1.51	
	10.40	0.55	45.36	0.15	1.57	2.09
	10.29		45.27		1.52	
4	7.45		48.06		2.04	
	7.47	0.34	48.52	0.48	2.00	1.52
	7.42		48.24		1.98	
5	4.76		43.99		0.15	
	4.71	1.06	43.90	0.10	0.16	3.68
	4.66		43.93		0.16	

Sample information

Standard:

Standard weight:

Sample weight :

BBOT*

2.0 - 3.0 mg BBOT,
3.0 - 4.0 Sulfanilamide
3.0 - 4.0 mg

6.51 N%, 72.56 C%, 7.44 S%

Note

Samples were homogenized by a ball mill.
Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Animal Feed and Faeces

Sulfur determination

ANIMAL FEED

Sample Nature	S%	RSD%
Feed Mixture	0.114	0.88
	0.113	
	0.113	
	0.115	
	0.115	
Feed Mixture	0.167	0.69
	0.165	
	0.164	
	0.166	
	0.165	
Soybean Extract	0.382	0.68
	0.380	
	0.384	
	0.383	
	0.387	
Fish meal	3.63	0.42
	3.66	
	3.63	
	3.65	
	3.66	

Sample information

Standard:	BBOT*	7.44 N%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

Set Oxygen Injection Time at 5 seconds.
Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
Samples were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Animal Feed and Faeces

CHNS determination

ANIMAL GELATINE

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Fish gelatine	16.249		43.023		6.902		0.394	
	16.212	0.185	43.099	0.089	6.608	2.632	0.408	2.004
	16.189		43.051		6.586		0.408	
Bovine gelatine	15.796		44.615		6.623		0.531	
	15.835	0.148	44.647	0.037	6.658	0.309	0.536	0.601
	15.838		44.624		6.622		0.537	
Porcine gelatine	16.088		44.460		6.631		0.670	
	16.016	0.226	44.397	0.096	6.659	0.585	0.675	0.970
	16.043		44.379		6.582		0.683	

Sample information

Standard:	BBOT* Nicotinamide	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S% 22.94 N%, 59.01 C%, 4.95 H%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	2.0 - 3.0 mg	

Note

BBOT* standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Animal Feed and Faeces

Sulfur determination

FORAGE

S%	RSD%
0.0724	0.08
0.0723	
0.0723	

Sample information

Standard:	BBOT*	7.44 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

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Animal Feed and Faeces

NCS determination

PVL (Natural Bio-Nutrient)

N%	RSD%	C%	RSD%	S%	RSD%
8.51		23.35		1.96	
8.50	0.18	23.46	0.28	1.98	0.57
8.48		23.47		1.98	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

PVL is a natural bio-nutrient with aminoacids and polysaccharides.
Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Animal Feed and Faeces

Sulfur determination

DRIED BAKERS YEAST

S%	RSD%
0.277	0.41
0.278	
0.280	
0.279	
0.278	

Sample information

Standard:	BBOT* Nicotinamide	7.44 S% 22.94 N%, 59.01 C%, 4.95 H%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	2.8 - 3.2 mg	

Note

Standard and sample were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Animal Feed and Faeces

Sulfur determination

CEREAL FLAKES

Sample Name	S%	RSD%
Honey cereals	0.0607	0.84
	0.0597	
	0.0603	
Corn cereals	0.0641	1.08
	0.0655	
	0.0644	
Chocolate cereals	0.0790	1.03
	0.0795	
	0.0806	

Sample information

Standard: BBOT* 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Animal Feed and Faeces

Sulfur determination

BISCUIT

S%	RSD%
0.0687	1.36
0.0692	
0.0674	

Sample information

Standard:	BBOT*	7.44 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	2.0 - 3.0 mg	

Note

Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

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Animal Feed and Faeces

NCS/O determination

STARCH

N%	RSD%	C%	RSD%	S%	RSD%	O%	RSD%
0.410	0.95	38.44	0.11	0.0643	1.05	45.57	0.17
0.415		38.41		0.0659		45.65	
0.415		38.50		0.0643		45.53	
0.407		38.50		0.0648		45.56	
0.406		38.50		0.0644		45.72	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Sample information for for Oxygen determination

Standard: Aspartic acid 48.08 O%
Standard weight: 1.0 - 1.2 mg
Sample weight: 1.0 - 1.2 mg

Note

For CHNS determination, standards and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Animal Feed and Faeces

CHNS determination

INSECT ANIMAL FEED

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Blood Worm	7.37	0.15	33.72	0.15	4.82	0.15	0.377	0.12
	7.38		33.76		4.83		0.377	
	7.35		33.62		4.81		0.376	
	7.36		33.69		4.82		0.377	
	7.37		33.70		4.82		0.377	
Midge Larva	7.68	0.11	39.11	0.12	5.85	0.14	0.437	0.13
	7.70		39.22		5.87		0.438	
	7.69		39.14		5.85		0.437	
	7.69		39.16		5.86		0.438	
	7.70		39.21		5.86		0.438	
Barley Pests	7.93	0.14	55.54	0.14	8.34	0.16	0.202	0.27
	7.94		55.59		8.35		0.202	
	7.95		55.70		8.37		0.203	
	7.96		55.73		8.37		0.203	
	7.94		55.64		8.36		0.203	
Mealworms	8.98	0.16	57.84	0.17	8.72	0.17	0.357	0.15
	8.99		57.90		8.72		0.357	
	8.96		57.73		8.70		0.356	
	8.96		57.70		8.69		0.356	
	8.96		57.68		8.69		0.356	
Mealworms powder	8.63	0.10	50.69	0.08	7.53	0.08	0.285	0.19
	8.64		50.74		7.54		0.286	
	8.62		50.67		7.53		0.285	
	8.63		50.72		7.54		0.286	
	8.64		50.77		7.55		0.286	
Cricket Flour	11.06	0.14	55.08	0.14	8.03	0.14	0.463	0.18
	11.05		55.00		8.02		0.462	
	11.08		55.16		8.04		0.464	
	11.08		55.19		8.05		0.464	
	11.05		55.05		8.03		0.463	
Maggot Powder (Fly Larva)	8.73	0.17	48.05	0.14	7.07	0.16	0.480	0.11
	8.72		48.01		7.07		0.480	
	8.75		48.15		7.09		0.481	
	8.75		48.13		7.08		0.481	
	8.72		48.00		7.06		0.480	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510). Samples were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Beverage

NC determination

COFFEE (LIQUID BEVERAGE)

N%	RSD%	C%	RSD%
0.186	0.78	3.233	0.84
0.187		3.232	
0.189		3.228	
0.190		3.146	
0.188		3.233	
0.188		3.220	
0.189		3.235	
0.190		3.210	
0.189		3.218	
0.186		3.235	

Sample information

Standard:	Urea water solution	0.3 N%
	Glucose water solution	4 C%
Standard volume:	25 ul	
Sample volume:	25 ul	

Note

Set Oxygen Flow 250 ml/min and Oxygen Injection Time 6 seconds.
A 3 m GC column (P/N 260 07931) installed into the oven at 50 °C was used.
Standard and samples were analyzed by liquid injection using the AS 1310 Liquid Autosampler.

In EagerSmart Data Handling Software, page AS 1310 method, set the following parameters: sample volume 25 ul, air volume 0 ul, plunger strokes 3, viscous sample yes, sampling depth in vial bottom, pre and post washes one Time with bidistilled water, sample washes 1Time.

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Beverage

NC determination

ORANGE JUICE

N%	RSD%	C%	RSD%
0.0501	1.48	5.28	0.32
0.0503		5.29	
0.0493		5.30	
0.0495		5.29	
0.0503		5.29	
0.0504		5.26	
0.0495		5.27	
0.0516		5.26	
0.0498		5.31	
0.0512		5.27	

Sample information

Standard: Atropine 4.84 N%, 70.56 C%
Standard weight: 1.5 - 2.0 mg
Sample weight: 5.0 - 8.0 mg

Note

Set Oxygen Injection Time at 4 seconds.
Standard Sample was mixed before weighing in double tin container.



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Blood - Maet Flour

NC determination

BLOOD - MEAT FLOUR

Sample	N%	RSD%	C%	RSD%
Blood flour	14.5365		48.7909	
	14.3067	0.7969	49.2382	0.4583
	14.4272		49.0519	
Meat flour	7.2126		32.0077	
	7.4736	1.8036	33.2874	1.9628
	7.3847		32.7223	

Sample information

Standard:	Acetanilide	10.36 N%, 71.09 C%
Standard weight:		4.0 - 5.0 mg
Sample weight:	Blood flour	4.0 - 5.0 mg
	Meat flour	9.0 - 10 mg

Note

Set Oxygen Flow to 250 ml/min and Oxygen Injection Time to 8 seconds.



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Brewery Products

Sulfur determination

MALT

Sample	S%	RSD%
1	0.0568	1.13
	0.0575	
	0.0561	
	0.0576	
	0.0565	
2	0.0328	0.65
	0.0334	
	0.0331	
	0.0332	
	0.0331	
3	0.0203	1.16
	0.0206	
	0.0205	
	0.0208	
	0.0209	

Sample information

Standard:

BBOT*

7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Corn and Oats

NCS determination

CORN AND OATS

Sample	DAY 1						DAY 2					
	N%	RSD%	C%	RSD%	S%	RSD%	N%	RSD%	C%	RSD%	S%	RSD%
Corn	1.3138		40.9608		0.0879		1.3108		41.2764		0.0875	
	1.3312	0.7758	40.8630	0.3214	0.0895	1.0078	1.3285	0.6748	41.2432	0.0811	0.0881	0.4733
	1.3320		41.1237		0.0894		1.3180		41.2095		0.0883	
Oats	0.7582		42.5815		0.0625		0.7365		42.1449		0.0596	
	0.7536	1.7321	42.0927	0.5856	0.0638	4.5778	0.7524	1.0680	42.1705	0.1620	0.0648	4.7523
	0.7338		42.4108		0.0584		0.7447		42.0416		0.0599	

Sample information

Standard: BBOT* 6.51 N%, 72.56 C%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510). Samples were analyzed in two days to evaluate the reproducibility.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Dairy Products

Sulfur determination

MILK

S%	RSD%
0.0487	1.68
0.0471	
0.0478	

Sample information

Standard:	BBOT*	7.44 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

Standard was weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Dairy Products

Sulfur determination

PARMESAN CHEESE

S%	RSD%
0.183	0.71
0.186	
0.184	
0.186	
0.185	

Sample information

Standard: BBOT* 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Fertilizers - Feed - Soils

NC determination

FERTILIZERS - FEED - SOILS

Sample	N%			C%		
Soil A	0.650	0.652	0.656	6.540	6.499	6.503
Soil B	0.395	0.383	0.386	4.517	4.425	4.464
Soil Meal	7.258	7.374	7.466	31.360	31.198	32.292
Milk Powder	2.822	2.806	2.800	50.618	50.472	50.480
Compost A	1.310	1.337	1.337	16.591	16.975	16.955
Compost B	2.215	2.256	2.214	25.522	25.864	26.228
Lucerne	3.951	4.001	3.918	41.642	41.817	41.933
Pasture	4.002	3.978	3.978	42.150	42.294	42.268
Fertilizer A	13.142	12.962	13.102	1.274	1.061	1.231
Fertilizer B	17.873	17.807	17.874	0.231	0.227	0.228
An. Grade Chem	20.835	20.945	20.833			

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
Standard weight:	Soil A and B	5.0 mg
	An. Grade Chem	2.0 - 3.0 mg
	Others	10 mg
Sample weight:	Soil A and B	50 - 80 mg
	An. Grade Chem	2.0 - 3.0 mg
	Others	10 - 30 mg

Note

The geological material has been ground by ball mill. These materials can be analyzed “as received” or dried (105°C, 2 hours).



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Flours

NC determination

FLOURS

Sample	N%	Av. N%	RSD%	C%	Av. C%	RSD%
Wheat Flour	1.30			39.95		
	1.29	1.30	0.44	39.93	39.94	0.03
	1.30			39.93		
Rice Flour	1.51			43.43		
	1.51	1.52	0.11	43.55	43.54	0.25
	1.53			43-63		
Barley Flour	1.89			43.51		
	1.78	1.79	0.64	43.45	43.46	0.10
	1.78			43.42		
Soy Bean Meal	7.81			45.31		
	7.86	7.84	0.33	45.43	45.40	0.25
	7.85			45.46		

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
Standard weight: 4.0 - 5.0 mg
Sample weight: 4.0 - 5.0 mg

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Flours

CHNS determination

FLOURS

N%	RSD %	C%	RSD%	H%	RSD%	S%	RSD%
1.73	0.486	40.13	0.148	6.22	0.663	0.092	0.907
1.72		40.12		6.31		0.093	
1.73		40.26		6.29		0.091	
1.71		40.19		6.31		0.092	
1.72		40.22		6.24		0.093	

Sample information

Standard: BBOT* 10.52 N%, 36.09 C%, 5.30 H%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Flours

NC determination

FLOURS

NC Determination by Single Combustion/Reduction Reactor - Method B					
Sample	W (mg)	N%	RSD%	C%	RSD%
Soja Bean	5.884	7.50		43.07	
	5.775	7.52	0.86	42.97	0.12
	5.917	7.40		42.98	
Barley flour	6.126	1.83		41.35	
	5.900	1.81	0.63	41.37	0.04
	5.877	1.81		41.33	
Wheat Flour	6.069	1.38		39.78	
	5.759	1.38	0.42	39.80	0.04
	5.808	1.37		39.77	
Rice flour	6.013	1.43		40.23	
	5.814	1.40	1.08	40.26	0.05
	5.910	1.41		40.26	
Oatmeal	5.987	1.98		45.41	
	6.154	1.98	0.87	45.32	0.34
	6.544	2.01		45.62	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Thermo Scientific Soil Ref. Mat.	021 N%, 2.29 C%
Standard weight:	2.0 - 7.0 mg Aspartic acid	
	6.0 - 7.0 mg Benzoic acid	
	6.0 - 7.0 Thermo Scientific Soil Ref. Mat.	
Sample weight:	5.0 - .07 mg	

Note

The analytical parameters of method B are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.

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Flours

NC determination

FLOURS

NC Determination by Single Combustion/Reduction Reactor - Method C					
Sample	W (mg)	N%	RSD%	C%	RSD%
Soja Bean	20.333	7.59		43.20	
	20.656	7.56	0.33	43.20	0
	20.179	7.54		43.20	
Barley flour	20.188	1.83		41.56	
	20.349	1.81	1.09	41.55	0.06
	20.119	1.85		41.60	
Wheat Flour	20.441	1.37		40.00	
	20.513	1.38	0.42	40.03	0.07
	19.914	1.37		40.06	
Rice flour	20.162	1.35		40.74	
	20.267	1.33	1.26	40.70	0.13
	20.201	1.38		40.75	
Oatmeal	20.354	1.87		42.56	
	20.067	1.83	1.43	42.54	0.22
	20.152	1.82		42.39	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Acetanilide	10.36 N%; 71.09 C%
Standard weight:	2.0 - 7.0 mg Aspartic acid	
	6.0 - 7.0 mg Benzoic acid	
	4.0 - 12 mg Acetanilide	
Sample weight:	18 - 20 mg	

Note

The analytical parameters of method C are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.

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Food

NC determination

FOOD

Sample	N%	RSD%	C%	RSD%
Food Powder	1.65		40.64	
	1.67	0.602	40.79	0.1854
	1.66		40.73	
Food Liquid	0.42		12.93	
	0.43	1.3532	12.82	0.5163
	0.43		12.94	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Standard weight: 18 - 20 mg
Sample weight: 15 - 16 mg for food powder
19 - 20 mg for food liquid (adsorbed on Chromosorb WAW (30 - 60 mesh) (p/n 338 37530))

Note

It is suggested to use the 3 meters GC column (p/n 260 079 31) installed into the oven at 50 °C.

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Food

CHNS determination

INSECT FOOD

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Tenebrio Beetle	9.08	0.30	49.59	0.31	7.29	0.33	0.245	0.34
	9.04		49.39		7.26		0.244	
	9.11		49.78		7.32		0.246	
	9.10		49.71		7.31		0.246	
	9.07		49.53		7.28		0.245	
Sigillatus Crickets	9.03	0.29	49.86	0.27	7.38	0.25	0.320	0.26
	9.04		49.93		7.39		0.320	
	8.99		49.66		7.35		0.319	
	9.00		49.72		7.36		0.319	
	9.05		49.97		7.39		0.321	
Tenebrio Beetle Barbecue	8.50	0.19	48.22	0.20	7.11	0.22	0.279	0.25
	8.52		48.33		7.13		0.28	
	8.53		48.42		7.14		0.280	
	8.51		48.31		7.12		0.280	
	8.54		48.46		7.15		0.281	
Tenebrio Beetle Salsa	8.80	0.27	49.90	0.24	7.26	0.25	0.292	0.23
	8.81		49.94		7.27		0.292	
	8.76		49.68		7.23		0.290	
	8.76		49.70		7.23		0.290	
	8.77		49.76		7.24		0.291	
Pasta with worms	3.54	0.15	40.14	0.11	6.18	0.11	0.169	0.00
	3.54		40.20		6.19		0.169	
	3.53		40.12		6.18		0.169	
	3.54		40.18		6.18		0.169	
	3.53		40.06		6.17		0.169	
Worm Chocolate	2.36	0.30	57.45	0.21	8.79	0.19	0.093	0.48
	2.36		57.53		8.81		0.093	
	2.36		57.43		8.79		0.093	
	2.37		57.66		8.82		0.094	
	2.35		57.34		8.78		0.093	
Crispy Silkworms	7.92	0.17	55.64	0.16	8.16	0.16	0.474	0.12
	7.94		55.79		8.18		0.475	
	7.94		55.76		8.17		0.475	
	7.95		55.81		8.18		0.475	
	7.92		55.61		8.15		0.474	
Crispy Small Crickets	8.94	0.18	47.33	0.14	6.96	0.14	0.386	0.14
	8.91		47.18		6.94		0.385	
	8.93		47.30		6.96		0.385	
	8.92		47.22		6.95		0.385	
	8.90		47.14		6.94		0.384	
Silkworm Chrysalis	8.74	0.17	51.33	0.16	7.63	0.14	0.292	0.23
	8.74		51.15		7.60		0.291	
	8.71		51.24		7.62		0.291	
	8.72		51.35		7.63		0.292	
	8.71		51.19		7.61		0.291	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
Samples were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Food

CHNS determination

SPIRULINA ALGAE

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
10.79	0.13	47.22	0.10	6.89	0.29	0.612	0.69
10.80		47.22		6.94		0.619	
10.80		47.20		6.88		0.612	
10.83		47.28		6.91		0.619	
10.80		47.30		6.88		0.619	
10.80		47.20		6.88		0.615	
10.82		47.17		6.89		0.609	
10.83		47.31		6.91		0.613	
10.80		47.26		6.92		0.615	
10.81		47.19		6.91		0.607	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Food Supplements

NC determination

FOOD SUPPLEMENTS

Sample	N%	RSD%	C%	RSD%
1	5.7388		14.5980	
	5.7468	0.0713	14.6226	0.0845
	5.7443		14.6122	
2	11.3650		45.6246	
	11.3911	0.1232	45.3035	0.3854
	11.3692		45.3432	
3	5.8447		17.1273	
	5.8313	0.2686	17.1149	0.1376
	5.8626		17.1605	
4	3.6302		37.0935	
	3.6131	0.3101	36.9753	0.2010
	3.6343		36.9562	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Standard weight: 10 - 12 mg
Sample weight: 10 - 20 mg

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Food Supplements

CHNS determination

FOOD SUPPLEMENTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
A	13.1682		52.1789		6.6654			
	13.1599	0.1367	52.0845	0.1040	6.6263	0.3111	-	-
	13.1944		52.1779		6.6259			
B	0.0713		8.0197		2.2073			
	0.0710	1.1086	8.0251	0.0358	2.1985	0.2540	-	-
	0.0725		8.0241		2.2089			
C	0.3300		40.6153	-	6.2740		0.3657	
	0.3325	0.5330	40.3958	0.3234	6.3308	0.4880	0.3683	1.5805
	0.3291		40.6298		6.3230		0.3573	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg (sample A)
8.0 - 10 mg (sample B)
3.0 - 4.0 mg (sample C)

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Hazelnuts

CHNS/O determination

HAZELNUTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	2.0216	1.77	66.3930	0.50	10.0906	0.84	0.0885	2.38	19.9560	0.73
	2.0817		66.9480		10.1971		0.0879		20.0411	
	2.0118		67.1602		10.2607		0.0845		20.1758	
	2.0312		66.8965		10.2144		0.0847		19.8460	
	2.0910		66.4351		10.0593		0.0886		19.8204	
2	2.3434	1.05	64.2224	0.24	9.9488	0.57	0.1150	1.17	21.2210	0.37
	2.3423		64.5045		9.8600		0.1171		21.2499	
	2.3896		64.5794		9.9342		0.1178		21.4174	
	2.3657		64.3494		9.8231		0.1173		21.3175	
	2.3948		64.5702		9.8402		0.1187		21.3573	
3	2.4399	0.64	65.9111	0.62	10.1144	0.79	0.1193	1.19	20.0741	0.99
	2.4159		65.8256		10.1963		0.1163		20.1346	
	2.4520		66.5499		10.1377		0.1171		20.4347	
	2.4193		65.9181		10.0003		0.1182		19.9592	
	2.4207		66.5493		10.1941		0.1159		19.9356	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Sample information for CHNS determination

Standard: Methionine 21.45 O%

Standard weight: 1.0 - 2.0 mg

Sample weight: 1.0 - 2.0 mg

Note

Samples were homogenized by a grinder first and secondly by a ball mill.
For CHNS Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Meat

NCS determination

MEAT

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	13.7263		50.3151		0.7758	
	14.0565	1.1988	50.1069	0.2978	0.7898	0.9005
	13.9312		50.0255		0.7843	
2	12.9388		51.0643		0.7239	
	12.9790	0.2859	50.8862	0.2059	0.7315	0.7418
	13.0129		50.8793		0.7211	
3	12.2551		53.3815		0.7636	
	12.2426	0.0937	53.4856	0.1177	0.7742	0.7978
	12.2322		53.4947		0.7636	
4	12.4510		52.6034		0.7845	
	12.3691	0.3994	52.7009	0.1106	0.7832	0.1988
	12.4586		52.5971		0.7814	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and meat samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oatmeal Reference Material

NC determination

OATMEAL REFERENCE MATERIAL

Expected NC of Oatmeal Reference Materials				
Sample Description	Supplier Specification			
	N%	Uncertainty (±)	C%	Uncertainty (±)
Oatmeal Reference Material	1.9	0.10	45.51	0.17

Note

The percentages varies from batch to batch.

Expected NC of Oatmeal Reference Materials				
N%	Av. N%	RSD%	C%	RSD%
1.99			45.65	
2.06	1.99	0.64	45.72	0.30
1.92			45.45	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%

Standard weight: 4.0 - 5.0 mg

Sample weight: 4.0 - 5.0 mg



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Pureed Tomato

NCS determination

PUREED TOMATO

N%	RSD%	C%	RSD%	S%	RSD%
0.273	2.08	3.53	1.30	0.0105	6.32
0.260		3.66		0.0115	
0.260		3.55		0.0124	
0.261		3.65		0.0125	
0.275		3.58		0.0116	
0.262		3.60		0.0112	
0.262		3.64		0.0129	
0.266		3.64		0.0124	
0.260		3.66		0.0113	
0.263		3.59		0.0123	

Sample information

Standard:

Standard weight:

Sample weight:

BBOT*

1.5 - 2.0 mg

5.0 - 8.0 mg

6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%

Note

Set Oxygen Injection Time at 4 seconds.

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Sample was mixed before weighing in double tin container.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Soy Products

NC determination

SOY PRODUCTS

Sample	N%	RSD%	C%	RSD%
De-hulled soybean meal	7.64	0.2782	41.61	0.6144
	7.61		41.25	
Soy protein concentrate	10.49	0.9500	43.85	0.0645
	10.35		43.80	
Cream colored soy protein isolate	13.87	0.2544	47.94	0.9523
	13.92		48.59	

Sample information

Standard:	Acetanilide	10.36 N%, 71.09 C%
Standard weight:	3.0 - 5.0 mg	
Sample weight:	3.0 - 5.0 mg	

Comment

The de-hulled soy bean meal is for animal consumption while the soy protein concentrate is for human food industries. The cream colored soy protein isolate is applicable for a wide range of food products requiring particularly high protein and bland flavor profile, providing gel strength and emulsifying properties.

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Soy Products

Sulfur determination

SOY BEAN AND SOY MEAL

Sample Name	S%	RSD%
Soy Bean	0.250	1.80
	0.255	
	0.246	
Soy Meal 1	0.306	1.15
	0.302	
	0.309	
Soy Meal 2	0.371	1.17
	0.379	
	0.372	

Sample information

Standard:	BBOT*	7.44 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Soy Products

Sulfur determination

SOY AND FISH ASIAN SAUCES

Sample Name	S%	Std. Dev.	RSD%
Soy sauce 1	0.0437	0.0006	1.50
	0.0425		
	0.0427		
Soy sauce 2	0.0358	0.0004	1.14
	0.0350		
	0.0353		
Soy sauce 3	0.0520	0.0003	0.57
	0.0526		
	0.0523		
Fish sauce 1	0.308	0.0010	0.33
	0.307		
	0.306		
Fish sauce 2	0.277	0.0046	1.66
	0.280		
	0.271		

Sample information

Standard: BBOT* 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard was weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Starch

CHNS determination

STARCH

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
2.530	0.3293	31.008	0.2043	5.396	1.0037	0.399	0.9017
2.516		30.850		5.456		0.396	
2.537		31.000		5.415		0.391	
2.520		30.956		5.373		0.392	
2.528		30.967		5.310		0.398	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Activated Carbon

Oxygen determination

ACTIVATED CARBON

Sample	O%	RSD%
1	1.291	0.316
	1.288	
	1.292	
	1.294	
	1.299	
2	1.209	0.314
	1.205	
	1.204	
	1.200	
	1.200	

Sample information

Standard:

Standard weight:

Sample weight:

BBOT*

1.0 - 2.0 mg

1.0 - 2.0 mg

7.43 O%

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Activated Carbon

NCS determination

ACTIVATED CARBON

N%	RSD%	C%	RSD%	S%	RSD%
0.35	1.68	70.66	0.14	2.30	0.25
0.34		70.59		2.29	
0.34		70.46		2.30	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Note

Standard and sample were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Activated Carbon

Oxygen determination

ACTIVATED CARBON

Sample	O%	RSD%
1	20.14	0.15
	20.08	
	20.11	
2	13.76	0.04
	13.77	
	13.77	

Sample information

Standard:

Standard weight:

Sample weight:

Cystine

1.0 - 1.5 mg

1.0 - 1.5 mg

26.63 O%



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Asphalt-Bitumen

CHNS determination

ASPHALT - BITUMEN

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
0.8306		86.4952		9.0187		2.6874	
0.8361	0.3413	86.5939	0.1967	9.0241	0.1551	2.6702	0.5622
0.8321		86.2627		9.0452		2.7003	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

The sample was heated before weighing.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Asphalt-Bitumen

CHNS determination

BITUMEN - ASPHALT

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
3.090		84.137		10.088		0.260	
3.082		83.635		10.060		0.254	
3.099	0.299	83.871	0.345	10.126	0.641	0.260	1.402
3.090		84.388		9.974		0.258	
3.106		83.867		10.134		0.264	

Sample information

Standard:

BBOT*

6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

1.8 - 2.2 mg

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 10 sec.

Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Asphalt-Bitumen

Oxygen determination

ASPHALT

Sample	O%	RSD%
Asphalt flux	0.760	0.27
	0.757	
	0.756	
Asphalt coating	1.37	0.42
	1.38	
	1.38	

Sample information

Standard:

BBOT*

7.43 O%

Standard weight:

0.5 - 1.0 mg

Sample weight:

0.5 - 0.7 mg

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Asphalt-Bitumen

NCS determination

PEAT

N%	RSD%	C%	RSD%	H%	RSD%
3.08	0.38	44.89	0.08	0.305	0.86
3.06		44.96		0.304	
3.06		44.92		0.309	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Bioash

CHN determination

BIOASH

N%	RSD%	C%	RSD%	H%	RSD%
0.0081		1.7933		0.1500	
0.0068	9.2105	1.6862	3.1814	0.1362	8.4407
0.0079		1.7172		0.1269	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%, 5.30 H%
Standard weight:	3.0 - 4.0 mg	
Sample weight:	3.0 - 4.0 mg	



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Biofuels

CHN/O determination

BIOFUELS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	O%	RSD%
Biofuel 1	0.149		86.610		11.174		2.023	
	0.151	0.667	86.396	0.370	11.201	0.260	2.013	1.236
	0.150		86.025		11.143		1.976	
Biofuel 2	0.322		82.583		10.336		6.804	
	0.313	1.629	82.208	0.231	10.486	0.833	6.782	1.027
	0.322		82.344		10.487		6.913	
Biofuel 3	0.307		84.924		11.971		2.642	
	0.292	4.886	85.187	0.168	12.067	0.676	2.658	0.777
	0.322		84.959		11.906		2.683	
Biofuel 4	0.229		74.289		8.757		16.510	
	0.220	2.097	74.181	0.268	8.812	0.634	16.624	0.765
	0.227		74.567		8.701		16.372	
Bio-oil	0.123		38.790		8.036		49.946	
	0.123	0.934	38.677	0.171	8.070	0.506	50.167	0.244
	0.123		38.793		7.989		49.971	

Sample information for CHN determination

Standard: Atropine 4.84 N%, 70.56 C%, 8.01 H%

Standard weight: 2.0 - 3.0 mg

Sample weight: 1.8 - 2.2 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%, Atropine 16.59 O%, BBOT* 7.43 O%

Standard weight: 1.0 - 2.0 mg

Sample weight: 1.0 - 2.0 mg

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Biofuels

CHNS determination

BIOFUELS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.5029		45.1975		5.6710		0.0324	
	0.4987	0.4252	45.1794	0.3032	5.6376	0.6631	0.0317	1.5904
	0.5002		44.9521		5.5964		0.0327	
2	1.3304		42.9851		5.9337		0.1419	
	1.3369	1.1964	43.0168	0.2522	5.9671	0.3071	0.1441	0.9284
	1.3609		42.8154		5.9376		0.1443	
3	1.9883		42.2647		6.0413		0.2241	
	1.9649	1.1224	42.0550	0.3374	5.9561	0.8696	0.2173	1.6879
	2.0095		41.9938		5.9470		0.2234	
4	1.9743		50.6413		5.1610		0.7477	
	1.9339	1.5070	50.5287	0.1343	5.1110	0.8623	0.7507	0.9589
	1.9955		50.6509		5.1997		0.7371	

Sample information

Standard: BBOT* 6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Biofuels

Oxygen determination

BIO DIESEL

Sample	O %	RSD%
1	0.0051	3.0756
	0.0050	
	0.0048	
2	0.1019	1.1649
	0.1043	
	0.1032	
3	0.1136	0.9516
	0.1118	
	0.1117	
4	1.0257	0.9197
	1.0374	
	1.0187	
5	1.9371	1.2119
	1.8956	
	1.9347	

Sample information

Standard:

Ethanol in iso-Octane solution

Standard volume:

2 µl

Sample volume:

2 µl

Note

Standard and samples were analyzed by liquid injection using the Thermo Scientific AI / AS1310 liquid autosampler (p/n 251 17572).

In Thermo Scientific EagerSmart Data Handling Software, AI / AS1310 method page, set the following parameters: sample volume 2 µl, air volume 3 µl, plunger strokes 3, viscous sample: yes, sampling depth in vial bottom, pre and post washes one Time with iso-octane, sample washes 1 Time.



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Biomass

CHNS determination

BIOMASS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	1.3820		40.0906		6.4208		0.0870	
	1.3691	0.9769	40.0903	0.0247	6.4044	0.3262	0.0861	2.0125
	1.3961		40.0733		6.4460		0.0895	
2	1.1872		39.9993		5.5979		0.1117	
	1.1814	1.4988	40.1926	0.5365	5.5742	0.6342	0.1112	0.2588
	1.2149		39.7642		5.6441		0.1117	
Stroh Pellets	0.5282		43.2777		5.6953		0.1495	
	0.5160	1.4515	43.3100	0.0751	5.7591	1.0083	0.1493	3.6305
	0.5300		43.2450		5.6444		0.1402	
Wood Pellets	0.0714		46.5512		5.9404			
	0.0739	2.0152	46.7954	0.2828	6.0413	0.9857		
	0.0740		46.7606		6.0446			
Sunflower	0.7121		45.5314		5.7164		0.1252	
Pellets	0.7191	0.4983	45.5903	0.1584	5.7148	1.0489	0.1243	1.7906
	0.7168		45.6751		5.6124		0.1210	

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Biomass

CHNS determination

BIOMASS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.1565		45.3661		6.0530		0.0216	
	0.1643	2.9939	45.2565	0.1366	5.9745	0.7800	0.0207	3.1909
	0.1654		45.3613		6.0586		0.0203	
2	0.2140		45.7542		6.0378		0.0226	
	0.2043	2.4294	45.7211	0.0648	6.0171	1.3495	0.0210	3.7191
	0.2119		45.7803		5.8888		0.0216	
3	0.4456		44.6293		5.7358		0.0497	
	0.4671	2.5863	44.5896	0.1554	5.6279	0.9601	0.0498	0.3065
	0.4651		44.7246		5.6964		0.0500	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Biomass

CHN determination

BIOMASS

N%	RSD%	C%	RSD%	H%	RSD%
0.67	3.390	46.59	0.236	5.74	1.197
0.63		46.69		5.91	
0.65		46.45		5.72	
0.64		46.71		5.78	
0.69		46.46		5.86	
0.64		46.70		5.68	
0.62		46.67		5.74	
0.66		46.71		5.83	
0.68		46.78		5.77	
0.65		46.68		5.76	

Sample information

Standard:
Standard weight:
Sample weight:

Acetanilide
2.0 - 3.0 mg
3.0 - 4.0 mg

10.36 N%, 71.09 C%, 6.71 H%

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Biomass

CHNS/O determination

WOODCHIPS

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1.62	0.36	36.34	0.15	4.70	0.21	0.604	0.59	37.13	0.19
1.63		36.43		4.69		0.606		37.20	
1.62		36.44		4.71		0.611		37.06	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 3.0 - 4.0 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

For CHNS, samples were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Biomass

CHNS/O determination

SAWDUST

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.0734	0.86	48.02	0.14	6.14	0.25		-	44.39	0.17
0.0725		47.89		6.16		-		44.54	
0.0722		47.92		6.13				44.45	

G.H.V. (Kcal/Kg)	RSD%	N.H.V. (Kcal/Kg)	RSD%	CO ₂ E.T.	RSD%
4134.47	0.08	3819.43	0.09	109.88	0.09
4128.01		3812.96		110.07	
4131.97		3816.92		109.96	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

Comment

The G.H.V. and N.H.V. and the CO₂ Emission Trade values are calculated automatically by the Thermo Scientific EagerSmart Data Handling Software. These calculations give a quantitative value of the energetic quality of the analyzed sample. The G.H.V./N.H.V. can also be determined directly using a calorimeter Mahler bomb (ASTM 271 Oxygen combustion method).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Bitumen

CHNS determination

BITUMEN

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
16.0078		67.0810		4.4375		0.2864	
15.9510		67.1931		4.4385		0.2869	
15.8429	0.3999	67.1904	0.1243	4.4430	0.7170	0.2860	0.3091
15.9111		67.0012		4.4344		0.2873	
15.8798		67.1657		4.5094		0.2883	

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

The samples were homogenized by a ball mill.

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Bitumen

CHNS/O determination

SCABBARD BITUMINOUS

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.323	2.666	47.719	0.573	5.056	0.415	1.361	1.152	17.196	0.188
0.337		47.835		5.089		1.388		17.156	
0.321		47.315		5.050		1.389		17.132	

Heat Values calculations

G.H.V.	RSD%	N.H.V.	RSD%
4942.488	0.028	4682.603	0.030
4944.229		4684.343	
4945.254		4685.369	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Sample information for for Oxygen determination

Standard: Sulfanilamide 18.58 O%

Standard weight: 1.0 - 2.0 mg

Sample weight: 1.0 - 2.0 mg

Note

For CHNS Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). The sample was cut in small pieces.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Carbon Black

CHNS determination

CARBON BLACK

Element	N%	C%	H%	S%
	0.1891	95.6934	0.3208	0.2962
	0.1862	95.6294	0.3238	0.2885
	0.1855	95.8250	0.3221	0.2920
	0.1812	95.8352	0.3187	0.2799
Statistical data	0.1804	96.0818	0.3173	0.2897
Average %	0.1845	95.8130	0.3205	0.2893
RSD %	1.9684	0.1815	0.8107	2.0746

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
Modified analytical conditions: set Oxygen Flow to 300 ml/min and Oxygen Injection Time to 10 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Carbon Black

CHNS determination

CARBON BLACK

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.1307		95.6094		0.3843		1.4329	
	0.1372	2.4931	95.5422	0.1238	0.3607	3.8610	1.4516	0.6493
	0.1327		95.7725		0.3588		1.4432	
2	0.1355		96.3290		0.4197		0.7106	
	0.1339	2.1564	96.2412	0.0465	0.4119	1.4959	0.7039	0.5046
	0.1396		96.3005		0.4075		0.7094	
3	0.1719		94.5915		0.5204		1.7407	
	0.1711	0.3311	94.5117	0.4576	0.5198	0.4576	1.7281	0.8407
	0.1722		94.6417		0.5242		1.7573	
4	0.0896		99.3649		0.3222			
	0.0843	3.1785	99.4976	0.0795	0.3193	0.4522	0	0
	0.0884		99.5056		0.3207			

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 2.5 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 14 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Carbon Black

Carbon determination

CARBON BLACK

Sample	C%	RSD%
HPG AR-2029	99.79	0.0810
	99.85	
	99.68	
	99.66	
	99.70	
Thermal Black	99.26	0.0552
	99.16	
	99.16	
	99.16	
	99.26	
Soft Black (carcass)	97.63	0.1186
	97.33	
	97.53	
	97.50	
	97.59	

Sample information

Standard: BBOT* 72.53 C%

Standard weight: 2.5 - 3.0 mg

Sample weight: 2.0 - 2.5 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 13 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Carbon Black

CHNS determination

CARBON BLACK

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1.335		79.863		4.563		0.345	
1.330	0.271	79.668	0.136	4.569	0.110	0.340	1.595
1.328		79.685		4.559		0.351	

Sample information

Standard: BBOT* 6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 13 sec.
 Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Carbon Black

CHNS determination

CARBON BLACK

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
A	0.188	0.676	96.559	0.111	0.300	1.843	0.829	2.193
	0.185		96.734		0.295		0.848	
	0.186		96.817		0.304		0.868	
	0.186		96.706		0.308		0.868	
B	0.273	0.810	96.178	0.159	0.267	2.086	0.823	0.493
	0.277		95.899		0.280		0.814	
	0.272		95.351		0.272		0.815	
	0.273		96.079		0.277		0.817	
C	0.239	2.155	95.768	0.196	0.343	2.697	1.016	0.311
	0.229		96.126		0.350		1.020	
	0.239		95.826		0.341		1.019	
	0.232		95.700		0.328		1.013	
D	0.148	1.681	97.073	0.076	0.282	1.465	1.273	0.583
	0.146		97.066		0.285		1.267	
	0.149		96.966		0.292		1.256	
	0.152		97.146		0.286		1.261	



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Carbon Black

Oxygen determination

CARBON BLACK

Oxygen data, Heat Values and CO ₂ Emission Trade								
Sample	O%	RSD%	GHV (kcal/kg)	RSD%	NHV (kcal/kg)	RSD%	CO ₂ E.T.	RSD%
A	1.149		8005.53		7990.03		105.96	
	1.158	0.397	8005.13	0.003	7989.63	0.003	105.96	0.000
	1.152		8005.42		7989.93		105.96	
B	1.661		7915.43		7901.37		106.37	
	1.679	0.623	7915.64	0.006	7900.58	0.006	106.38	0.005
	1.661		7915.44		7901.38		106.37	
C	1.597		7933.81		7916.36		106.00	
	1.597	0.181	7933.82	0.002	7916.37	0.002	106.00	0.005
	1.602		7933.59		7916.14		106.01	
D	0.624		8062.31		8047.63		105.59	
	0.612	0.990	8062.85	0.003	8048.17	0.003	105.58	0.006
	0.616		8062.66		8047.98		105.58	

Note

The performance of the Analyzer was evaluated through the comparison of the repeatability of the CHN data obtained in comparison to the ASTM D 5373 requirements analyzing the carbon black samples in different series of analysis in duplicate.

Concentration Range and Limit of Repeatability accepted by ASTM D 5373		
Element	Concentration Range (%)	Repeatability Limit (r)
Carbon	48.6 to 90.6	0.64
Hydrogen	0.14 to 5.16	0.16
Nitrogen	0.69 to 1.57	0.11

Repeatability Limit (r): the value below which the absolute difference between two test results calculated to a dry basis of separate and consecutive test determinations, carried out on the same sample, in the same laboratory, by the same operator, using the same apparatus.

The precision of the Analyzer for CHN determination was evaluated from the results showed in Table 3. Table 6 shows the difference (Diff.) calculated between both data of each series of analyses. All differences are acceptable and less than the Repeatability Limit indicates in the Official method indicating the good homogeneity and the complete combustion of the samples.



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Carbon Black

CHN determination

CARBON BLACK

CHN data of Carbon Black samples according to ASTM D 5373 requirements							
Sample	Serie	N%	Diff.	C%	Diff.	H%	Diff.
A	1	0.188	0.003	96.559	0.175	0.300	0.005
		0.185		96.734		0.295	
	2	0.186	0	96.817	0.111	0.304	0.004
		0.186		96.706		0.308	
B	1	0.273	0.004	96.178	0.279	0.267	0.013
		0.277		95.889		0.280	
	2	0.272	0.001	95.851	0.228	0.272	0.005
		0.273		96.079		0.277	
C	1	0.239	0.010	95.768	0.358	0.343	0.007
		0.229		96.126		0.350	
	2	0.239	0.003	95.826	0.125	0.341	0.013
		0.232		95.700		0.328	
D	1	0.148	0.002	97.073	0.070	0.282	0.003
		0.146		97.066		0.285	
	2	0.149	0.003	96.966	0.180	0.292	0.006
		0.152		97.146		0.286	

Sample information

Standard:	BBOT	6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
Standard weight:	2.0 - 3.0 mg for CHNS determination	1.0 - 2.0 mg for Oxygen determination
Sample weight:	1.8 - 2.2 mg for CHNS determination	1.0 - 2.0 mg for Oxygen determination

Note

Set the Oxygen Flow to 280 ml/min and the Oxygen Injection Time to 11 sec.
 Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
 Samples were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Carbon Black

CHN determination

CARBON MESOPOROUS REFERENCE MATERIAL (ALDRICH No. 699624)

Carbon determination		
C%	Average C %	RSD%
99.91		
99.58		
99.86		
99.71		
99.68		
99.69		
99.82	99.71	0.143
99.72		
99.69		
99.41		
0.239		
0.232		
0.148		
0.146		
0.149		
0.152		

Sample information

The certificate data of the Reference Material is 99.95 C%.

Standard: BBOT

6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 1.8 - 2.2 mg

Note

Set the Oxygen Flow to 280 ml/min and the Oxygen Injection Time to 11 sec.

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Coal - Coke

CHNS/O determination

COAL and COKE

Sample	N%	C%	H%	S%	O%	G.H.V.	N.H.V.
Coal	1.104	68.240	4.938	0.216	16.559	7303	7049
	1.112	68.679	4.894	0.219	16.231	7323	7072
	1.094	68.325	4.821	0.215	16.471	7268	7021
	1.109	68.370	4.923	0.205	16.382	7307	7054
	1.102	68.141	4.856	0.204	16.259	7266	7017
Coke 1	1.464	93.325	2.788	1.668			
	1.514	93.266	2.979	1.704			
	1.462	92.612	2.965	1.652			
Coke 2	0.940	94.850	0.183	3.998			
	0.973	94.480	0.194	3.989			

G.H.V. (Gross Heat Value) and N.H.V. (Net Heat Value) determined by the Thermo Scientific FlashSmart™ EA Data Handling Software

Sample information

Standard: BBOT* 6.51 N% 72.53 C%, 6.09 H%, 7.44 S%, 7.43 O%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

Standard and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

For the analysis increase the Oxygen Flow to 280 - 300 ml/min and the Oxygen Injection Time to 7 - 8 seconds.

It is possible to calculate the G.H.V. and the N.H.V. values using a special algorithm incorporated in the Thermo Scientific EagerSmart Data Handling Software.

These calculations give a quantitative value of the energetic quality of the analyzed fuel.

The G.H.V./N.H.V. can also be determined directly using a calorimeter Mahler bomb (ASTM 271 Oxygen combustion method).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Coal - Coke

CHNS/O determination

COAL and COKE

Sample	N%	C%	H%	S%
A	1.06	90.03	5.69	0.49
	1.06	90.16	5.56	0.49
	1.09	90.62	5.60	0.51
B	0.44	87.37	10.77	0.87
	0.45	87.14	10.72	0.88
	0.41	87.42	10.78	0.88
C	0.36	80.20	12.21	0.93
	0.33	79.95	12.23	0.90
	0.35	80.12	12.20	0.86
D	1.56	81.13	4.62	0.76
	1.51	81.00	4.58	0.74
	1.50	81.30	4.57	0.72
E	1.30	86.70	0.31	0.68
	1.25	86.72	0.26	0.68
	1.33	86.74	0.29	0.69

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Note

Standard and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

For the analysis increase the Oxygen Flow to 280 - 300 ml/min and the Oxygen Injection Time to 7 - 8 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Coal - Coke

CHNS determination

COAL and PITCH

Sample	N%	C%	H%	S%
Pitch	2.18	88.84	5.89	0.34
	2.10	89.43	5.84	0.28
	2.25	89.30	5.93	0.34
	2.23	89.33	5.95	0.35
	2.20	89.02	5.93	0.33
	2.19	89.14	5.91	0.33
	2.19	88.94	5.90	0.32
	2.19	88.72	5.89	0.33
	2.26	88.81	5.91	0.33
	2.24	89.19	5.92	0.35
	2.19	88.66	5.88	0.32
	2.19	88.68	5.90	0.32

Sample	N%	C%	H%	S%
Coal	1.66	79.46	4.82	0.69
	1.60	78.94	4.91	0.76
	1.66	79.58	4.79	0.79
	1.69	79.81	4.85	0.78
	1.63	79.19	4.78	0.78
Coal extract	2.71	84.69	5.45	0.79
	2.72	85.37	5.48	0.79
	2.74	85.18	5.46	0.79
	2.68	84.86	5.48	0.77
	2.70	84.83	5.46	0.77

Sample information

Standard: BBOT*
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Note

Standard and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

For the analysis increase the Oxygen Flow to 280 - 300 ml/min and the Oxygen Injection Time to 7 - 8 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Coal - Coke

CHNS determination

COAL and TAR

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1.829		87.087		3.652		5.345	
1.814		87.255		3.654		5.361	
1.804		87.373		3.647		5.381	
1.795		87.370		3.653		5.351	
1.777	0.842	87.818	0.366	3.657	0.878	5.363	0.991
1.797		87.715		3.620		5.296	
1.798		87.798		3.630		5.316	
1.803		87.217		3.581		5.214	
1.819		87.992		3.575		5.279	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 1.5 - 2.0 mg

Note

The sample was homogenized by a ball mill.
Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 14 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Coal - Coke

CHNS determination

COAL DERIVATIVES

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Anthracite	1.87	0.88	79.46	0.35	3.63	0.95	0.36	4.32
Amorphous Coal	0.58	2.84	93.09	0.51	0.12	4.97	0.68	2.02
Carbon Anode	0.86	0.99	93.78	0.20	0.59	0.98	2.27	1.29

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

Each value is the average of 10 runs.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Coal - Coke

CHN determination

COALS

ASTM D5373-02 Concentration Range and Limit of Repeatability accepted		
Element	Concentration Range (%)	Repeatability Limit (r)
Nitrogen	0.69 to 1.57	0.11
Carbon	48.6 to 90.6	0.64
Hydrogen	0.14 to 5.16	0.16

Repeatability Limit (r): the value below which the absolute difference between two test results calculated to a dry basis of separate and consecutive test determinations, carried out on the same sample, in the same laboratory, by the same operator, using the same apparatus.

Note

Coal samples were analyzed in duplicate in different series of analysis and the data were evaluated according to the Official Method ASTM D 5373-02 requirements.



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Coal - Coke

CHN determination

COALS

Serie	Element	Coal 1		Coal 2	
		%	Diff.	%	Diff
1	N	1.28	0	1.37	0.01
		1.28		1.38	
	C	86.12	0.47	72.37	0.59
		86.59		71.78	
	H	4.43	0.09	5.01	0.12
		4.52		4.89	
2	N	1.31	0.01	1.38	0.01
		1.30		1.39	
	C	86.81	0.61	72.13	0.27
		86.20		72.40	
	H	4.47	0.04	4.80	0.06
		4.43		4.86	
3	N	1.32	0	1.40	0.01
		1.32		1.41	
	C	86.67	0.04	72.56	0.38
		86.71		72.18	
	H	4.41	0.04	4.93	0.04
		4.45		4.89	
4	N	1.32	0	1.40	0.01
		1.32		1.41	
	C	86.49	0.03	71.88	0.28
		86.46		72.16	
	H	4.38	0.07	4.84	0.03
		4.45		4.87	
5	N	1.34	0.01	1.43	0
		1.33		1.43	
	C	86.63	0.05	71.83	0.64
		86.68		72.47	
	H	4.41	0.03	4.86	0.02
		4.45		4.88	

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Set the Oxygen Flow to 280 ml/min and the Oxygen Injection Time to 11 sec.
Method ASTM D 5373-02 requirements.



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Coal - Coke

CHNS determination

COALS

Sample	A				B			
Element	N%	C%	H%	S%	N%	C%	H%	S%
	1.93	88.48	3.76	4.16	1.15	81.54	4.18	0.41
	1.95	88.51	3.76	4.19	1.15	82.45	4.17	0.41
	1.94	88.34	3.76	4.21	1.14	82.53	4.17	0.41
	1.93	88.21	3.75	4.20	1.14	82.36	4.17	0.40
	1.93	87.95	3.74	4.21	1.13	81.99	4.17	0.41
	1.95	88.49	3.75	4.20	1.14	82.14	4.16	0.40
	1.93	88.21	3.74	4.20	1.13	81.86	4.16	0.40
	1.94	88.45	3.75	4.21	1.14	82.60	4.18	0.40
	1.94	88.46	3.76	4.21	1.13	81.59	4.14	0.41
	1.94	88.04	3.73	4.18	1.14	82.02	4.16	0.41
Av. %	1.94	88.31	3.75	4.20	1.14	82.11	4.17	0.41
RSD %	0.41	0.23	0.28	0.39	0.65	0.46	0.28	1.27

Sample	C				D			
Element	N%	C%	H%	S%	N%	C%	H%	S%
	1.00	79.31	4.34	0.31	1.75	77.77	4.27	0.54
	1.00	79.85	4.37	0.32	1.76	78.14	4.25	0.53
	1.01	80.31	4.40	0.32	1.75	78.24	4.26	0.54
	1.00	79.98	4.38	0.31	1.75	77.95	4.23	0.52
	1.00	79.41	4.34	0.31	1.75	77.94	4.23	0.52
	1.01	80.07	4.38	0.30	1.75	77.91	4.24	0.54
	1.01	79.88	4.38	0.32	1.75	77.76	4.23	0.52
	1.01	79.56	4.37	0.31	1.75	77.90	4.24	0.54
	1.01	79.82	4.36	0.31	1.76	78.23	4.24	0.53
	1.02	80.16	4.40	0.30	1.77	78.64	4.26	0.53
Av. %	1.01	79.83	4.37	0.31	1.75	78.05	4.24	0.53
RSD %	0.67	0.40	0.48	2.37	0.40	0.34	0.34	1.65



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Coal - Coke

CHNS determination

COALS (1/2)

Sample	E				F			
Element	N%	C%	H%	S%	N%	C%	H%	S%
	0.81	65.85	4.43	0.18	1.14	79.71	4.30	0.28
	0.81	65.85	4.48	0.17	1.14	78.98	4.22	0.27
	0.82	65.65	4.40	0.18	1.14	79.48	4.25	0.28
	0.81	65.80	4.41	0.18	1.14	79.83	4.26	0.28
	0.82	65.96	4.46	0.16	1.14	79.54	4.24	0.27
	0.83	66.18	4.40	0.17	1.15	79.53	4.24	0.27
	0.82	65.81	4.47	0.17	1.15	79.63	4.24	0.28
	0.82	65.45	4.41	0.18	1.14	79.40	4.23	0.28
	0.81	65.53	4.39	0.16	1.15	80.07	4.27	0.27
	0.81	65.01	4.40	0.16	1.15	79.64	4.26	0.28
Av. %	0.82	65.71	4.42	0.17	1.14	79.58	4.25	0.28
RSD %	0.86	0.49	0.75	5.12	0.45	0.36	0.54	1.87

Sample	A	B	C	D	E	F
Oxygen %	1.10	3.42	5.36	3.83	14.84	4.28
	1.11	3.44	5.36	3.77	14.85	4.28
	1.09	3.43	5.34	3.80	14.94	4.26
Av. Oxygen %	1.10	3.43	5.35	3.80	14.88	4.27
RSD%	0.91	0.29	0.22	0.79	0.37	0.27

Heat Values and CO ₂ Emission Trade calculation of coal samples						
Sample	A	B	C	D	E	F
GHV (kcal/kg)	8589	8030	7827	77.09	6273	7810
NHV (kcal/kg)	8397	7816	7602	7491	6047	7592
CO ₂ E.T.	92.07	91.97	91.93	91.22	95.14	91.76

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Coal - Coke

Oxygen determination

COALS (2/2)

Sample information for CHNS determination

Standard:	BBOT*	6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	2.0 - 3.0 mg	

Sample information for Oxygen determination

Standard:	Atropine	16.59 O%
	BBOT*	7.43 O%
Standard weight:	1.0 - 2.0 mg	
Sample weight:	1.0 - 2.0 mg	

Note

For CHNS analysis set the Oxygen Flow to 280 ml/min and the Oxygen Injection Time to 11 sec.; standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). The heat values GHV and NHV (Gross Heat Value and Net Heat Value) and the CO_2 Emission Trade are calculated automatically by the EagerSmart Data Handling Software.

The performance of the Analyzer was evaluated through the comparison of the repeatability of the CHN data obtained in comparison to the ASTM D 5373-02 requirements analyzing the coal samples in different series of analysis in duplicate.

Concentration Range and Limit of Repeatability accepted by ASTM D 5373-02

Element	Concentration range (%)	Repeatability Limit (r)
Carbon	48.6 to 90.6	0.64
Hydrogen	0.14 to 5.16	0.16
Nitrogen	0.69 to 1.57	0.11

Repeatability Limit (r): the value below which the absolute difference between two test results calculated to a dry basis of separate and consecutive test determinations, carried out on the same sample, in the same laboratory, by the same operator, using the same apparatus.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Coal - Coke

CHN determination

COALS

CHN data obtained and the difference (Diff.) calculated between both data													
		Coal samples											
		A		B		C		D		E		F	
		%	Diff	%	Diff	%	Diff	%	Diff	%	Diff	%	Diff
1	C	88.36	0.08	82.58	0.04	80.04	0.38	78.34	0.27	65.82	0.02	79.93	0.06
		88.44		82.54		79.66		78.61		65.80		79.87	
	H	3.72	0.02	4.24	0.04	4.45	0.07	4.36	0.05	4.60	0.13	4.30	0.02
		3.74		4.20		4.38		4.31		4.47		4.28	
	N	1.88	0.02	1.17	0.03	1.01	0.02	1.71	0.03	0.80	0.00	1.15	0.04
		1.90		1.14		0.99		1.74		0.80		1.11	
2	C	88.04	0.09	82.25	0.19	79.46	0.30	77.82	0.56	66.20	0.17	80.09	0.09
		87.95		82.06		79.73		78.38		66.03		80.18	
	H	3.75	0.02	4.19	0.01	4.38	0.00	4.27	0.03	4.45	0.04	4.28	0.02
		3.73		4.18		4.38		4.30		4.41		4.30	
	N	1.88	0.00	1.13	0.02	0.98	0.01	1.71	0.03	0.80	0.00	1.15	0.00
		1.88		1.11		0.99		1.74		0.80		1.15	
3	C	88.28	0.24	82.35	0.02	80.06	0.45	77.96	0.50	65.94	0.07	80.10	0.09
		88.04		82.37		79.61		78.46		66.01		80.01	
	H	3.74	0.02	4.20	0.01	4.44	0.06	4.27	0.03	4.49	0.01	4.29	0.02
		3.72		4.19		4.38		4.30		4.48		4.27	
	N	1.83	0.02	1.14	0.00	1.00	0.01	1.71	0.03	0.80	0.00	1.18	0.01
		1.85		1.14		0.99		1.74		0.80		1.17	

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Coal - Coke

CHNS determination

COALS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	1.54	0.00	68.37	0.06	4.02	0.52	0.393	1.01
	1.54		68.31		3.99		0.397	
	1.54		68.29		3.98		0.401	
2	1.85	0.31	79.61	0.07	4.42	0.13	0.520	0.91
	1.84		79.52		4.41		0.518	
	1.85		79.50		4.42		0.527	
3	1.38	0.42	66.60	0.06	4.69	0.12	2.29	0.25
	1.37		66.61		4.68		2.30	
	1.38		66.54		4.69		2.29	
4	1.79	0.56	78.44	0.05	4.35	0.27	0.529	1.26
	1.80		78.48		4.33		0.533	
	1.81		78.52		4.33		0.520	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

Standard and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

For the analysis increase the Oxygen Flow to 280 ml/min and the Oxygen Injection Time to 8 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Coal - Coke

CHNS determination

COALS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	1.53	0.38	68.41	0.11	4.03	0.29	0.393	0.76
	1.54		68.45		4.03		0.390	
	1.53		68.30		4.01		0.396	
2	1.86	0.31	79.50	0.04	4.38	0.26	0.529	0.96
	1.86		79.57		4.40		0.519	
	1.85		79.54		4.38		0.525	
3	1.38	0.72	66.61	0.10	4.68	0.25	2.31	0.25
	1.37		66.73		4.70		2.31	
	1.39		66.71		4.68		2.32	
4	1.80	0.32	78.68	0.08	4.37	0.40	0.537	0.71
	1.81		78.55		4.34		0.531	
	1.80		78.64		4.34		0.530	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 3.0 - 3.5 mg

Sample weight: 3.8 - 4.0 mg

Note

Set the Oxygen Flow to 280 ml/min and the Oxygen Injection Time to 11 seconds.
Standard and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Coal - Coke

CHN determination

COKE

Coke sample was analyzed in duplicate in different series of analysis and the data were evaluated according to the Official Method ASTM D 5373-02 requirements.

ASTM D5373-02 Concentration Range and Limit of Repeatability accepted		
Element	Concentration Range (%)	Repeatability Limit (r)
Nitrogen	0.69 to 1.57	0.11
Carbon	48.6 to 90.6	0.64
Hydrogen	0.14 to 5.16	0.16

Repeatability Limit (r): the value below which the absolute difference between two test results calculated to a dry basis of separate and consecutive test determinations, carried out on the same sample, in the same laboratory, by the same operator, using the same apparatus.



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Coal - Coke

CHN determination

COKE

Sample	Element	Coke	
		%	Diff.
1	N	1.03	0.01
		1.03	
	C	87.47	0.09
		87.61	
2	H	0.30	0.01
		0.29	
	N	1.04	0.01
		1.05	
3	C	87.00	0.46
		87.46	
	H	0.30	0.01
		0.29	
4	N	1.05	0
		1.05	
	C	86.54	0.55
		87.09	
5	H	0.29	0
		0.29	
	N	1.07	0.02
		1.09	
6	C	87.20	0.30
		87.50	
	H	0.30	0.01
		0.29	
7	N	1.09	0.02
		1.11	
	C	87.22	0.11
		87.33	
8	H	0.28	0.01
		0.29	

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Note

Set the Oxygen Flow to 280 ml/min and the Oxygen Injection Time to 11 sec.



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Coal - Coke

NC determination

PET COKE

N%	RSD%	C%	RSD%
1.0466		60.4159	
1.0416		60.4312	
1.0397	0.3769	60.3839	0.1658
1.0459		60.6376	
1.0375		60.4482	

Sample information

Standard:

Atropine

4.84 N%, 70.56 C%

Standard weight:

6.0 - 7.0 mg

Sample weight:

6.0 - 7.0 mg

Note

Set the Oxygen Flow at 300 ml/min and the Oxygen Injection Time at 10 seconds.



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Coal - Coke

CHNS determination

CALCINATED COKE

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1.0862		96.9342		0.0741		1.2134	
1.0865		97.1609		0.0703		1.2196	
1.0856	0.2954	97.2668	0.1418	0.0716	2.8102	1.2132	0.2617
1.0895		96.9655		0.0738		1.2131	
1.0933		97.0807		0.0754		1.2113	

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 2.5 mg

Note

Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 13 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Diesel - Kerosene - Oil

NCS determination

DIESEL, KEROSENE and OIL

Sample	N%	C%	S%
Oil	0.1731	84.208	2.281
	0.1685	84.472	2.288
	0.1711	84.238	2.330
Diesel	0.0552	83.988	0.9950
	0.0566	83.801	0.9856
	0.0327	83.983	0.9908
Kerosene		71.698	0.1172
		71.990	0.1223
		71.586	0.1155

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

Samples are closed in double tin containers (p/n 260 06400).
 Volatile samples must be sealed in hard tin containers (p/n 240 08820), using the sealing device for liquids (p/n 205 03002).
 Standard has been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

If there is a ghost peak between nitrogen and carbon during the analysis of diesel, kerosene or oil, modify the sample delay from 12 to 15 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



Sealing device (p/n 205 03002)

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Diesel - Kerosene - Oil

CHNS determination

DIESEL, KEROSENE and OIL

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.1404		87.5877		12.0730		0.0661	
	0.1338	2.4795	87.5066	0.0812	12.1801	2.7392	0.0665	4.7521
	0.1386		87.6483		12.7036		0.0719	
2	0.0696		86.9961		12.8777		0.0518	
	0.0670	2.8710	87.1259	0.1251	12.9090	0.2349	0.0557	4.5999
	0.0709		86.9097		12.8485		0.0565	

Sample information

Standard:

BBOT*

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Note

Samples are closed in double tin containers (p/n 260 06400).
 Volatile samples must be sealed in hard tin containers (p/n 240 08820) using the sealing device for liquids (p/n 205 03002).
 Standards are analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

If there is a ghost peak between nitrogen and carbon during the analysis of diesel, modify the sample delay from 12 to 15 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Diesel - Kerosene - Oil

CHNS/O determination

DIESEL, KEROSENE and OIL

Sample	N%	C%	H%	S%	O%	G.H.V.	N.H.V.
1	0.0618	90.5431	9.3908	0.0587	0.3002	10211	9709
	0.0644	90.2020	9.3915	0.0585	0.2711	10212	9710
	0.0657	90.1525	9.3860	0.0596	0.2862	10212	9710
2	0.0579	90.0577	9.7041	0.0342	0.2259	10289	9770
	0.0681	90.0643	9.7179	0.0398	0.2560	10288	9769
	0.0614	90.0235	9.7036	0.0381	0.2431	10288	9769

G.H.V. (Gross Heat Value) and N.H.V. (Net Heat Value) determined by the Thermo Scientific FlashSmart™ EA Data Handling Software

Sample information For CHNS analysis

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

For Oxygen analysis

Standard: BBOT* 7.43 O%
 Standard weight: 1.0 - 1.5 mg
 Sample weight: 2.0 - 3.0 mg

Note

For CHNS analysis, samples are closed in double tin containers (p/n 260 06400).
 Volatile samples must be sealed in hard tin containers (p/n 240 08820) using the sealing device for liquids (p/n 205 03002).
 Standards are analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

It is possible to determine the G.H.V. and N.H.V. values using a special algorithm incorporated into the Thermo Scientific EagerSmart Data Handling Software, dedicated software for Thermo Scientific FlashSmart™ EA. If there is a ghost peak between nitrogen and carbon during the CHNS analysis of diesel, modify the sample delay from 12 to 15 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Diesel - Kerosene - Oil

Oxygen determination

DIESEL

Sample	O%	RDS%
Diesel 1	0.0265	
	0.0224	
	0.0214	8.1793
	0.0233	
	0.0233	
Diesel 2	0.0191	
	0.0192	
	0.0181	3.8480
	0.0196	
	0.0201	
Diesel 3	0.6116	
	0.6372	3.4055
	0.5957	

Sample information

Standard: Solution containing ethanol and iso-Octane 1.0 O%

Standard volume: 2.0 - 3.0 µl

Sample volume: 2.0 - 3.0 µl

Note

Due to the low content of oxygen in some materials, it is necessary to evaluate the blank analyzing an empty container.

Comment

Depending on the density, samples can be weighed in a tin container or analyzed by manual or automatic liquid injection.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Diesel - Kerosene - Oil

CH determination

DIESEL

Sample	Diesel 1		Diesel 2		Diesel 3	
Element	C%	H%	C%	H%	C%	H%
%	85.34	14.32	84.67	15.37	86.45	13.87
	85.35	14.31	84.72	15.39	86.51	13.92
	85.64	14.39	84.49	15.32	86.26	13.82
	85.67	14.37	84.62	15.34	86.32	13.86
	85.72	14.38	84.53	15.36	86.41	13.90
	85.73	14.38	84.71	15.36	86.59	13.88
	85.61	14.37	84.60	15.36	86.57	13.90
	85.25	14.34	84.55	15.32	86.52	13.93
	85.26	14.37	84.37	15.35	86.67	13.85
	85.67	14.39	84.43	15.33	86.47	13.88
RSD%	0.23	0.20	0.14	0.14	0.02	0.05

Sample information

Standard: iso-Octane 84.12 C%, 15.88 H%, density 0.692 g/ml
 Standard volume: 2 µl
 Sample volume: 2 µl

Note

Set the Oxygen Flow at 250 ml/min and the Oxygen Injection Time at 3 seconds.
 Standard and samples were analyzed by liquid injection using the Thermo Scientific AI / AS1310 Liquid Autosampler (p/n 251 17572). In Thermo Scientific EagerSmart Data Handling Software, AI / AS 1310 method page, set the following parameters: sample volume 2 µl, air volume 3 µl, plunger strokes 3, viscous sample yes, sampling depth in vial bottom, pre and post washes one Time with iso-Octane.

AN 42152 Improvements to diesel and bio-diesel and bio-diesel characterization using a Thermo Scientific Flash EA.

Comment

To improve the analyses depending of the type of diesel and biodiesel it is suggest the use an insulator on the injector (p/n 247 05250) and a collar on the top of the reactor (p/n 321 00310) to allow a proper volatilization and combustion of the sample.

For more information, please see Application Note AN 42152.



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Diesel - Kerosene - Oil

CHN determination

DIESEL

Sample	N%	RDS%	C%	RDS%	H%	RDS%
1	0.140	0.71	87.12	0.01	13.71	0.28
	0.142		87.13		13.77	
	0.141		87.13		13.78	
2	0.174	1.20	86.37	0.10	13.77	0.26
	0.175		86.52		13.70	
	0.171		86.51		13.74	

Sample information

Standard:

Tocopherol nicotinate

2.61 N%, 78.46 C%, 9.97 H%

Standard volume:

2.0 - 3.0 mg

Sample volume:

1.8 - 2.0 mg

Note

Set the Oxygen Flow at 250 ml/min and Oxygen Injection Time at 5 seconds.



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Diesel - Kerosene - Oil

NCS determination

DIESEL

N%	RSD%	C%	RSD%	S%	RSD%
0.144	0.80	87.08	0.06	0.0406	0.65
0.146		87.12		0.0405	
0.11		87.13		0.0401	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%

Standard volume: 2.0 - 3.0 mg

Sample volume: 2.0 - 3.0 mg

Note

Standard was weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Diesel - Kerosene - Oil

CHNS/O determination

DIESEL

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.105	0.59	85.51	0.08	12.84	0.09		-	0.421	0.59
0.104		85.58		12.82		-		0.426	
0.103		85.44		12.82				0.424	

Heat Values and CO ₂ Emission Trade calculation					
G.H.V. (Kcal/Kg)	RSD%	N.H.V. (Kcal/Kg)	RSD%	CO ₂ E.T.	RSD%
10845.17	0.00	10159.28	0.00	73.69	0.00
10844.98		10159.08		73.69	
10845.06		10159.17		73.69	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard volume: 2.0 - 3.0 mg
 Sample volume: 1.8 - 2.2 mg

Sample information for Oxygen determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard volume: 1.0 - 2.0 mg
 Sample volume: 1.0 - 2.0 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

Comment

The G.H.V. and N.H.V. and the CO₂ Emission Trade values are calculated automatically by the Thermo Scientific EagerSmart Data Handling Software.

These calculations give a quantitative value of the energetic quality of the analyzed sample.

The G.H.V./N.H.V. can also be determined directly using a calorimeter Mahler bomb (ASTM 271 Oxygen combustion method).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Gasolines

Oxygen determination

GASOLINES

Sample	O%					
Gasoline 1	2.723	2.713	2.742	2.741	2.763	2.766
Gasoline 2	3.522	3.531	3.547	3.546	3.543	3.537
Gasoline 3	4.781	4.816	4.861	4.831	4.999	4.954
Gasoline 4	3.084	3.090	3.076	3.069	3.052	3.077
Gasoline 5	2.027	2.012	2.027	2.008	2.016	2.021
Gasoline 6	2.654	2.645	2.640	2.632	2.625	2.620

Sample information

Standard:

Hexane/Ethanol mixture

4.5 O%

Standard volume:

3 µl

Sample volume:

3 µl

Note

The analyses have been performed using a liquid autosampler.



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Graphite

CHNS determination

GRAPHITE

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.0700		97.5200		0.0200		0.0600	
	0.0722	3.0471	97.5057	0.0516	0.0199	8.9837	0.0658	4.9116
	0.0744		97.5991		0.0170		0.0612	
2	0.0600		91.5900		0.0900			
	0.0563	3.2534	91.2704	0.3019	0.0823	4.5552	-	-
	0.0589		91.8209		0.0850			

Sample information

Standard: BBOT* 6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 1.8 - 2.2 mg

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 13 sec.

Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Graphite samples were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Lignite

CHNS/O and Heat Value determination

LIGNITE

Sample	N%	C%	H%	S%	O%	G.H.V.	N.H.V.
Mineralized lignited	0.2748	16.5121	2.4871	0.2217	13.0358	1651	1524
	0.2733	16.4805	2.4762	0.2259	13.0462	1651	1524
	0.2736	16.5527	2.4691	0.2230			
Lignite	0.7581	62.2809	4.6359	0.3767	25.2017	5589	5357
	0.7503	62.3566	4.5438	0.3728	25.5396	5574	5343
	0.7570	62.2736	4.3774	0.3715			
Lignite	0.7782	68.6279	6.3159	0.0379	21.4177	6886	6561
	0.7777	68.5848	6.3588	0.0350	21.1999	6895	6571
	0.7768	68.8289	6.2867	0.0355			
Liptodentritic lignite	0.7951	70.2393	7.5746	0.4706	16.8897	7596	7211
	0.7942	69.8062	7.4901	0.4720	16.8337	7599	7214
	0.7963	69.5674	7.4492	0.4732			
Mineralized bituminous coal	0.3416	36.1974	1.0591	9.3816	2.1338	3496	3443
	0.3358	36.6124	1.0244	9.4110	2.1432	3495	3442
	0.3375	36.9321	1.0116	9.1864			
Bituminous coal	0.3926	50.9986	2.1179	2.8063	19.5336	4121	4012
	0.3920	50.5592	2.1333	2.7609	19.6258	4117	4008
	0.3837	50.6419	2.1253	2.8046			
Fly ash	0.0532	4.7193	0.1302	0.1813	1.6454	367	361
	0.0544	4.7713	0.1307	0.1817	1.6505	367	360
		4.7154	0.1352	0.1850			

G.H.V. (Gross Heat Value) and N.H.V. (Net Heat Value) determined by the Thermo Scientific EagerSmart Data Handling Software

Sample information

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%, 7.43 O%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

For CHNS analysis, samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

It is possible to determine the G.H.V. and N.H.V. values using special algorithm incorporated in the Thermo Scientific EagerSmart Data Handling Software.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Lignite

CHNS determination

LIGNITE

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
0.494		43.104		4.392		4.689	
0.495		43.209		4.304		4.757	
0.491	0.585	42.896	0.436	4.281	1.427	4.806	1.078
0.494		42.883		4.258		4.817	
0.488		43.307		4.232		4.789	

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

3.0 - 4.0 mg

Note

The lignite sample was homogenized by a ball mill and dried at 105°C for 3 hours. Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Lignite

CHNS determination

LIGNITE COKE AND LIGNITE COKE DUST

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Lignite Coke	0.305		89.93		0.159		0.422	
	0.310	0.82	89.88	0.10	0.157	0.63	0.426	0.49
	0.308		89.76		0.158		0.425	
Lignite Coke Dust	0.0707		86.45		0.0351		2.75	
	0.0710	0.36	86.56	0.08	0.0360	1.74	2.75	0.42
	0.0705		86.44		0.0363		2.73	

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

1.5 - 2.0 mg

Note

Set Oxygen Flow at 300 ml/min and Oxygen Injection Time at 10 seconds.

Sample was dried at 110°C. Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Lignocellulosic Liquid Extractions

Nitrogen determination

LIGNOCELLULOSIC LIQUID EXTRACTIONS

Sample	N%	RDS%
1	0.0337	
	0.0333	2.3159
	0.0318	
2	0.0337	
	0.0339	0.9083
	0.0333	
3	0.0406	
	0.0399	0.8722
	0.0403	
4	0.0219	
	0.0217	1.1474
	0.0222	
5	0.0026	
	0.0028	7.6923
	0.0024	
6	0.0510	
	0.0509	0.5178
	0.0514	

Sample information

Standard:	Urea Water Solution	0.025 and 0.1 N%
Standard weight:	80 µl	
Sample weight:	80 µl	

Note

Standard and samples were analyzed by liquid injection using the Thermo Scientific AS 1310 Liquid Autosampler (p/n 251 17572). Set the Oxygen Flow at 300 ml/min and the Oxygen Injection Time at 10 seconds.

In Thermo Scientific EagerSmart Data Handling Software, AS 1310 method page, set the following parameters: sample volume 80 µl, air volume 0 µl, plunger strokes 5, viscous sample yes, sampling depth in vial bottom, pre and post washes one Time with distilled water.



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Liquid

NCS determination

SOLVENTS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	3.98	0.29	14.63	0.37		-
	3.97		14.59			
	3.98		14.61		-	
	4.00		14.70			
	3.99		14.71			
2	2.15	0.42	9.68	0.28		-
	2.16		9.64			
	2.16		9.61		-	
	2.14		9.63			
	2.16		9.62			
3	6.83	0.24	22.98	0.14		-
	6.84		23.04			
	6.87		23.06		-	
	6.85		23.01			
	6.83		23.00			
4	0.348	0.58	1.67	0.69	0.0868	0.90
	0.351		1.64		0.0874	
	0.351		1.65		0.0866	
	0.353		1.65		0.0872	
	0.353		1.66		0.0854	

Sample information

Standard:	Thermo Scientific Soil Reference Material Aspartic acid	0.21 N%, 2.29 C%, 0.023 S%
Standard weight:	Thermo Scientific Soil Reference Material Aspartic acid	10.52 N%, 36.09 C%
Sample weight:	3.0 - 4.0 mg for sample A, B, C 6.0 - 7.0 mg for sample D	15 - 17 mg 3 - 4 mg

Note

Standards and sample D were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Samples were weighed in double tin containers. Oxygen Injection Time 4 seconds.

In petrochemical, these solvents are used in sour gas sweetening process for H_2S and CO_2 removal.



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Liquefied Coals - Petrochemical Samples

N Org determination

LIQUIFIED COALS & PETROCHEMICALS SAMPLES

Sample	N %		
Coal liquid residue	0.94	0.92	0.94
Coal liquid medium oil	0.23	0.23	0.22
Tar	0.61	0.62	0.61
Tar sand	0.21	0.22	0.22
Pitch	1.08	1.10	1.11
Asphalt	0.87	0.88	0.87
Heavy oil	0.46	0.46	0.45
Mineral oil	0.22	0.22	0.21

Sample information

Standard:

Atropine

4.84 N%

Standard weight:

5.0 - 10 mg

Sample weight:

Coal

10 mg

Tar, Tar sand, Pitch, Asphalt

30 - 50 mg

Heavy oil, Mineral oil

10 mg

Note

Samples are closed in double tin containers.

Tin container (p/n 260 06400) have been used.



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Liquefied Coals - Petrochemical Samples

CHNS determination

PETROLEUM

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
0.188	1.32	75.84	0.12	10.16	0.20	4.48	0.51
0.189		75.91		10.20		4.50	
0.192		75.71		10.17		4.45	
0.194		75.86		10.15		4.49	
0.189		75.72		10.15		4.45	

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 2.5 mg

Note

For CHNS determination, standards and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Lubricants

NC determination

LUBRICANTS

Sample	N%	RSD%	C%	RSD%
1	0.1639		83.6843	
	0.1633		83.8676	
	0.1653	0.7255	83.5222	0.1581
	0.1643		83.7662	
	0.1621		83.6229	
2	0.2166		84.9820	
	0.2210		84.8903	
	0.2163	0.9694	85.2036	0.1505
	0.2184		85.1354	
	0.2203		84.9774	

Sample information

Standard:

Standard weight:

Sample weight:

Atropine

4.0 - 5.0 mg

3.0 - 4.0 mg

4.84 N%, 70.56 C%

Note

Set Oxygen Flow 300 ml/min, Oxygen Injection Time 8 seconds and the 3 metre GC column (p/n 260 08205).
Samples were weighed in double tin container (p/n 240 06400).



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Lubricants

NCS determination

LUBRICANTS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	1.9692		83.5652		0.0334	
	1.9533	0.4065	83.3596	0.1459	0.0360	3.9498
	1.9623		83.3495		0.0340	
2	0.0848		84.3010		0.2374	
	0.0825	1.6698	84.7778	0.3616	0.2316	1.3201
	0.0823		84.8720		0.2324	
3	0.1205		84.5046		0.6492	
	0.1185	1.0425	84.5403	0.0746	0.6477	0.4716
	0.1208		84.4177		0.6536	

Sample information

Standard:

Standard weight:

Sample weight:

BBOT*

2.0 - 3.0 mg

2.0 - 2.5 mg

6.51 N%, 72.53 C%, 7.44 S%

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Lubricants

CHNS determination

LUBRICANTS

Sample	N%	C%	H%	S%
A	0.1422	86.185	12.816	0.42
	0.1408	86.109	12.832	0.33
	0.1484	85.899	12.791	0.35
	0.1428	85.832	12.824	0.36
B	0.1868	85.767	12.134	1.59
	0.1791	85.452	12.107	1.54
	0.1875	86.009	12.178	1.52
	0.1597	85.560	12.106	1.54

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

BBOT* has been analyzed with the addition of about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510). The use of double tin containers allows weighing liquid and viscous material directly into the containers.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Lubricants

NCS determination

LUBRICANTS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	1.9692		83.5652		0.0334	
	1.9533	0.4065	83.3596	0.1459	0.0360	3.9498
	1.9623		83.3495		0.0340	
2	0.0848		84.3010		0.2373	
	0.0825	1.6698	84.7778	0.3616	0.2316	1.3201
	0.0823		84.8720		0.2324	
3	0.1205		84.5046		0.6492	
	0.1185	1.0425	84.5403	0.0746	0.6477	0.4716
	0.1208		84.4177		0.6536	

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 2.5 mg

Note

Standard BBOT* was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Lubricants

Nitrogen determination

LUBRICANTS

Sample	N%	RSD%
1	0.3047	0.3154
	0.3065	
	0.3062	
2	0.4580	0.6253
	0.4539	
	0.4594	
3	0.8461	0.7908
	0.8420	
	0.8331	
4	1.4617	0.5825
	1.4664	
	1.4783	
5	3.9927	0.3135
	3.9683	
	3.9760	

Sample information

Standard:

Atropine

4.84 N%

Standard weight:

4.0 - 5.0 mg

Sample weight:

8.0 - 10 mg

Note

Samples were weighed in the double tin container (p/n 240 06400).



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Lubricants

Nitrogen determination

LUBRICANTS

Sample	N%	RSD%
Lubricant 1	0.436	0.52
	0.440	
	0.436	
Lubricant 2	0.470	0.95
	0.479	
	0.473	
Lubricant 3	0.520	0.43
	0.524	
	0.520	
Lubricant 4	0.186	0.92
	0.189	
	0.189	
Lubricant 5	0.147	1.19
	0.147	
	0.144	
Lubricant 6	0.144	1.37
	0.143	
	0.143	
Lubricant 7	0.108	2.36
	0.108	
	0.109	
Additive 1	0.105	1.39
	0.103	
	0.694	
Additive 2	0.674	0.54
	0.685	
	0.675	
Additive 2	0.693	0.54
	0.691	
	0.691	
Additive 2	0.698	0.54
	0.693	
	0.688	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 4.0 - 5.0 mg
Sample weight: 8.0 - 10 mg

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 8 sec.



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Lubricants

Nitrogen determination

LUBRICANT REFERENCE MATERIAL

N%	RSD%
1.054	
1.057	
1.061	
1.054	
1.045	0.698
1.052	
1.054	
1.066	
1.058	
1.071	

Sample information

The certificate data of the Thermo Scientific Lubricant Reference Material are 1.12 N% and 0.10 of uncertainty ($\pm$).

Standard:	Atropine	4.84 N%
Standard weight:	4.0 - 5.0 mg	
Sample weight:	8.0 - 10 mg	

Note

Samples were weighed in the double tin container (p/n 240 06400).



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Lubricants

Nitrogen determination

ASTM LUBRICANTS

Table 1 ASTM information	Sample Name -YearMonth	Number of labs participants	ASTM Robust Mean N%	ASTM Range accepted N%
	ALA 0702	26	0.708	0.669 - 0.769
	ALA 0706	31	0.788	0.748 - 0.848
	ALA 0802	25	0.701	0.650 - 0.747
	ALA 0902	31	0.561	0.500 - 0.606
	ALA 1102	32	0.931	0.854 - 0.974

Table 2. Nitrogen reproducibility of ASTM lubricants	Sample Name -YearMonth	Helium carrier gas		
		N%	Average N%	RSD%
	ALA 0702	0.729	0.726	0.59
		0.727		
		0.721		
	ALA 0706	0.785	0.781	0.41
		0.780		
		0.779		
	ALA 0802	0.716	0.723	0.91
		0.729		
		0.724		
	ALA 0902	0.565	0.564	0.14
		0.563		
		0.564		
	ALA 1102	0.941	0.939	0.49
		0.933		
		0.941		

Sample information

Lubricant samples are from an ASTM International Interlaboratory Program. ASTM organize periodic comparison of test results and calculated statistical parameters with the laboratories participants in the petrochemical and analytical community worldwide to help the analytical laboratories monitor their performance in conducting ASTM methods. The participating laboratories receive different lubricants samples by year and analyze the samples according to the own procedures. The results are collected and processed by ASTM and a complete report is sent to each participants. The samples were analyzed as received. The Sample Code include the name ALA follow by the year and the month in which the sample was analyzed and evaluated by ASTM.

Table 1 shows the ASTM data information while Table 2 shows the Nitrogen data obtained by the Analyzer. All data obtained are inside in the range indicated in the ASTM reports.

Standard:	Atropine	4.84 N%
Standard weight:	4.0 - 5.0 mg	
Sample weight:	8.0 - 10 mg	

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 8 sec.



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Mining Materials

CHNS/O determination

MINING MATERIALS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	0.719		23.794		1.695		0.772		18.143	
	0.715	1.328	23.792	0.102	1.709	2.512	0.779	1.247	18.165	0.100
	0.701		23.835		1.630		0.760		18.179	
2	0.592		27.874		1.785		0.619		22.170	
	0.591	0.351	27.529	0.102	1.787	1.764	0.595	2.001	22.148	0.278
	0.595		27.647		1.732		0.611		22.054	

Sample information for CHNS determination

Standard: BBOT*
 Standard weight: 2.0 - 3.0
 Sample weight: 3.0 - 3.5 mg

6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%

Sample information for Oxygen determination

Standard: Benzoic acid (26.20 O%), Atropine (16.59 O%)
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

Samples were homogenized by a ball mill.
 CHNS Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oils

CHNS determination

OILS

Sample	N%	RDS%	C%	RDS%	H%	RDS%	S%	RSD%
Oil A	0.503	1.488	85.462	0.116	10.349	0.591	2.821	1.107
Oil B	0.428	3.071	85.424	0.004	11.236	0.235	2.020	2.307
Oil C	0.491	1.680	85.902	0.077	11.325	0.454	1.752	1.188
Oil D	0.558	1.901	85.623	0.218	11.532	0.572	2.037	1.023
Oil E	0.601	0.946	85.332	0.394	11.478	0.869	1.856	0.494

Sample information

Standard: Lubricant Standard (p/n 338 35240) 0.58 N%, 76.30 C%, 11.96 H%, 2.42 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Note

Each value is the average of 8 runs.

BBOT* has been analyzed with the addition of about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).
 The use of double tin containers allows weighing liquid and viscous material directly into the containers.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oils

N Org determination

OILS

Sample	N%	
Paranox 147	2.139	2.137
Paranox 3281	0.426	0.429
BX 667	0.669	0.674
Parabar 9367	0.081	0.075
Parabar 9260	0.869	0.866
ALA 9906	0.575	0.580
SAP 002	0.016	0.014
SAP 008	0.013	0.010

Sample information

Standard & Ref. Material:

Atropine 4.84 N%
Paranox 105 1.11 N%

Standard weight:

Atropine 5 mg
Paranox 105 5 - 10 mg

Sample weight:

5.0 - 10 mg (in double caps)

Note

The use of double tin containers allows weighing liquid and viscous material directly into the containers. As alternative, a single container filled with Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) can be used.



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Oils

Sulfur determination

OILS

Sample	S%	RSD%
Model oil	11.461	0.540
	11.514	
	11.520	
	11.632	
	11.531	
Crude oil 1	8.534	0.796
	8.573	
	8.499	
	8.645	
	8.471	
Crude oil 2	4.146	0.677
	4.165	
	4.091	
	4.125	
	4.144	

Sample information

Standard:

BBOT* 7.44 S%

Sulfanilamide 18.62 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

1.5 - 3.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oils

CHNS determination

OILS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Crude oil 1	0.202		85.270		13.395		0.289	
	0.222		85.370		13.308		0.290	
	0.200	4.312	85.359	0.126	13.319	0.316	0.283	1.724
	0.212		85.102		13.289		0.291	
	0.214		85.283		13.355		0.297	
Crude oil 1	0.270		85.425		11.919		2.028	
	0.282		85.770		11.925		2.018	
	0.271	2.071	85.547	0.212	11.894	0.446	2.015	0.810
	0.279		85.377		11.794		1.985	
	0.270		85.752		11.870		2.018	

Sample information

Standard:

BBOT*

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 2.5 mg

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Note

Set the Oxygen Injection Time at 7 seconds. Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Samples were shaken before weighing in the double tin container (p/n 240 06400).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oils

Nitrogen determination

OILS

Sample	N%	RSD%
Heavy gas oil 1	0.272	1.5851
	0.280	
	0.273	
Heavy gas oil 2	0.242	1.1767
	0.247	
	0.247	
Heavy gas oil 3	0.069	2.9182
	0.073	
	0.072	
Slurry oil	0.213	1.2363
	0.212	
	0.217	
Residual oil	0.276	1.9454
	0.274	
	0.266	
Vacuum gas oil	0.098	3.3254
	0.093	
	0.099	

Sample information

Standard:	Atropine	4.84 N%
Standard weight:	4.0 - 5.0 mg	
Sample weight:	8.0 - 10 mg	

Note

Set the Oxygen Flow at 300 ml/min and the Oxygen Injection Time at 8 seconds.



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Oils

CHN/O determination

BIOMASS PYROLYSIS OILS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	O%	RSD%
1	0.0785		42.1731		7.4361		46.9729	
	0.0774	0.7788	41.9498	0.2881	7.4751	0.3150	47.5645	0.6969
	0.0784		42.1433		7.4330		47.0198	
2	0.0856		46.5296		6.9718		43.5343	
	0.0830	1.8799	46.2804	0.4357	6.9984	0.2253	43.6605	0.2671
	0.0859		46.6817		6.9997		43.4282	

Sample information

Standard for CHNS determination:

Standard for O determination:

Standard weight:

Sample weight:

BBOT*

Benzoic acid

CHNS

Oxygen

CHNS

Oxygen

6.51 N%, 72.53 C%, 6.09 H%

26.20 O%

2.0 - 3.0 mg

1.0 - 2.0 mg

3.0 - 4.0 mg

1.0 - 2.0 mg

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Oils

CHNS determination

CRUDE OILS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.1101		85.4234		13.4245			
	0.1124	3.3417	85.0901	0.3338	13.4946	0.2613		
	0.1175		84.8581		13.4546			
2	0.2080		84.7006		12.3676		2.3255	
	0.1972	2.8023	84.5631	0.1300	12.4321	0.5452	2.3807	1.5131
	0.2058		84.7807		12.2973		2.3926	

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 2.5 mg

Note

Standard BBOT was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Oils

CHNS/O determination

GAS-OIL

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.475		85.43		10.33		2.50		0.757	
0.476	0.12	85.31	0.07	10.30	0.15	2.53	0.73	0.759	0.48
0.476		85.38		10.31		2.51		0.752	

Heat Values and CO₂ Emission Trade calculation

G.H.V.	RSD%	N.H.V.	RSD%	CO ₂ E.T.	RSD%
10127.79		9576.62		78.04	
10127.71	0.001	9576.54	0.001	78.04	0.00
10127.98		9576.81		78.04	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 3.0 mg

Sample information for Oxygen determination

Standard: BBOT* 7.43 O%

Standard weight: 1.0 mg

Sample weight: 1.0 mg

Note

For CHNS Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oils

CHNS/O determination

BIO-OIL

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.0665	0.98	64.28	0.13	6.79	0.31	1.37	0.84	24.94	0.25
0.0672		64.22		6.75		1.39		25.06	
0.0659		64.39		6.78		1.37		24.97	

Heat Values and CO ₂ Emission Trade calculation					
G.H.V. (Kcal/Kg)	RSD%	N.H.V. (Kcal/Kg)	RSD%	CO ₂ E.T.	RSD%
6402.69	0.04	6040.77	0.04	93.19	0.03
6398.34		6036.42		93.25	
6401.65		6039.72		93.20	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: CEDFNI** 23.00 O%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

Comment

The G.H.V. and N.H.V. and the CO₂ Emission Trade values are calculated automatically by the Thermo Scientific EagerSmart Data Handling Software.

These calculations give a quantitative value of the energetic quality of the analyzed sample.

The G.H.V./N.H.V. can also be determined directly using a calorimeter Mahler bomb (ASTM 271 Oxygen combustion method).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

** CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone



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Oils

CHNS determination

HEAVY FUEL OIL

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.268	0.95	87.76	0.09	12.454	0.12	0.0490	0.47
	0.266		87.66		12.48		0.0486	
	0.263		87.60		12.47		0.0490	
2	0.547	0.76	86.58	0.10	10.55	0.20	2.28	0.40
	0.549		86.68		10.59		2.30	
	0.555		86.51		10.56		2.29	

Sample information

Standard:

BBOT*

Standard weight:

2.0 - 3.0 mg

Sample weight:

1.8 - 2.0 mg

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Note

Set the Oxygen Flow at 250 ml/min and Oxygen Injection Time at 5 seconds.

The standard was weighed with about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oils

NCS determination

HEAVY FURNACE OILS

N%	RSD%	C%	RSD%	S%	RSD%
0.265	0.99	87.77	0.06	0.0491 0.0488	0.42
0.270		87.69			
0.266		87.66			

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

Standard was weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oils

CHNS determination

HEAVY FURNACE OILS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.203		86.104		12.065		1.636	
	0.191		86.249		12.148		1.645	
	0.188	2.9159	86.034	0.1798	12.131	0.3304	1.653	0.4529
	0.193		86.039		12.169		1.651	
	0.195		85.820		12.107		1.654	
2	0.605		85.640		10.380		2.886	
	0.617		85.581		10.354		2.912	
	0.594	1.6879	85.993	0.3397	10.366	0.1437	2.892	0.6481
	0.593		85.426		10.352		2.908	
	0.609		85.205		10.385		2.934	
3	0.474		87.596		11.270		0.642	
	0.489		87.397		11.238		0.641	
	0.475	1.8012	87.385	0.1280	11.225	0.2047	0.641	0.5675
	0.491		87.361		11.276		0.640	
	0.491		87.299		11.233		0.649	

Sample information

Standard:

Standard weight:

Sample weight:

Lubricant Reference Material (concentration of elements depends of the batch)

2.0 - 2.5 mg

2.0 - 2.5 mg



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Oils

CHNS/O determination

HIGH VACUUM GAS OIL

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.095		86.911		12.699		0.136		0.572	
0.092		86.852		12.683		0.137		0.571	
0.096	2.495	86.938	0.060	12.719	0.152	0.133	1.376	0.561	0.806
0.091		86.811		12.670		0.138		0.567	
0.096		86.846		12.706		0.136		0.570	

Sample information

Standard:

BBOT*

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%, 7.43 O%

Standard weight:

2.0 - 3.0 mg for CHNS

1.0 - 2.0 mg for Oxygen determination

Sample weight:

2.0 - 3.0 mg for CHNS

1.0 - 2.0 mg for Oxygen determination

Note

The sample was heated at 60°C before weighing.

For CHNS, the standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oils

Sulfur determination

RESIDUAL OILS

Sample	S%	RSD%
Ethylene Tar	0.113	2.7085
	0.111	
	0.111	
	0.106	
Residual oil A	0.870	1.1825
	0.887	
	0.891	
	0.893	
Residual oil B	2.061	0.7510
	2.086	
	2.095	
	2.093	
Residual oil C	2.937	0.9181
	2.960	
	2.904	
	2.962	
Residual oil D	4.534	0.2493
	4.541	
	4.534	
	4.558	

Sample information

Standard: BBOT* 72.53 C%

Standard weight: 2.5 - 3.0 mg

Sample weight: 1.5 - 2.5 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CHNS/O determination

ROCK OILS

Sample	N%	C%	H%	S%	O%	G.H.V.	G.H.V.
A	0.28	83.92	11.14	3.5	1.25	10378	10380
B	0.26	84.2	11.28	3.5	0.78	10373	10420
C	0.28	84.02	11.2	3.8	0.75	10231	10375
D	0.24	84.1	10.7	3.95	0.89	10091	9995
E	0.33	86.8	11.85	0.91	0.35	10727	10420
F	0.22	64.75	11.3	3.5	0.15	10249	10225

G.H.V. (Gross Heat Value) determined by the Thermo Scientific EagerSmart Data Handling Software

Sample information

Standard:

Lubricant Standard (p/n 338 35240)

0.58 N%, 76.30 C%, 11.96 H%, 2.42 S%

BBOT*

7.43 O%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

The use of double tin containers allows weighing of liquid and viscous material directly into the containers.

Comment

It is possible to calculate the G.H.V. the heat values using a special algorithm incorporated in the Thermo Scientific EagerSmart Data Handling Software, dedicated software for Thermo Scientific FlashSmart™ EA.

These calculations give a quantitative value of the energetic quality of the analyzed fuel.

The G.H.V. the heat values can be also determined directly using a calorimeter Mahler bomb (ASTM 271 Oxygen combustion method).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Carbon determination

TAR OILS

Sample	C%	RSD%
Tar oil	82.61	0.0478
	82.54	
	82.63	
	82.61	
Residual oil	85.88	0.1882
	85.57	
	85.74	
	85.93	
Coal Tar A	91.08	0.1242
	90.92	
	90.98	
	90.81	
Coal Tar B	92.04	0.1295
	92.00	
	91.81	
	91.81	

Sample information

Standard:

BBOT*

72.53 C%

Standard weight:

2.5 - 3.0 mg

Sample weight:

1.5 - 2.2 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oils

NCS determination

FUEL OILS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.240	0.97	86.45	0.13	0.0984	1.38
	0.245		86.38		0.0979	
	0.244		86.65		0.1001	
	0.241		86.37		0.0995	
	0.246		86.41		0.0974	
2	0.264	0.71	86.50	0.12	1.22	0.69
	0.260		86.69		1.21	
	0.265		86.44		1.21	
	0.263		86.53		1.22	
	0.263		86.45		1.20	

Sample information

Standard:

BBOT*

Standard weight:

2.0 - 3.0 mg

Sample weight:

1.5 - 2.0 mg

6.51 N%, 72.53 C%, 7.44 S%

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Paraffins

CH determination

PARAFFINS (REFINERY FRACTIONS)

C%	RSD%	H%	RSD%
86.536		13.629	
86.548	0.0122	13.629	0.0042
86.557		13.630	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 2.5 mg

Note

Samples were shaken before weighing.
Set Oxygen Flow 300 ml/min and Oxygen Injection Time 12 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Pitch

CHNS determination

PITCH

Sample	N%	C%	H%	S%
A	0.1311	93.479	5.414	0.1260
	0.1305	93.236	5.408	0.1327
	0.1214	93.279	5.438	0.1217
B	0.8918	92.660	3.306	0.3566
	0.8913	92.458	3.445	0.4025
	0.8305	92.395	3.499	0.3853
C	1.101	91.288	4.422	0.5009
	1.095	91.373	4.519	0.4850
	1.096	91.573	4.540	0.5044

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

BBOT and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Set Oxygen Flow 300 ml/ml and Oxygen Injection Time 7 - 8 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Pitch

CHN determination

PITCH

N%	RSD%	C%	RSD%	H%	RSD%
1.45		92.27		4.35	
1.45	0.3779	92.33	0.0992	4.35	0.1328
1.44		92.45		4.35	

Sample information

Standard: Atropine 4.84 N%, 70.56 C%, 8.08 H%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 12 seconds.



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Residual Fuels

CHNS/O determination

RESIDUAL FUELS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	0.484		86.565		11.228		1.215		0.595	
	0.475	0.9547	86.602	0.0257	11.251	0.8167	1.213	0.5785	0.609	1.1959
	0.481		86.605		11.398		1.202		0.605	
2	0.197		87.254		12.401		0.237		0.384	
	0.204	2.0040	87.156	0.0716	12.396	0.2450	0.231	1.6088	0.399	2.3927
	0.204		87.272		12.451		0.238		0.382	

Sample information

Standard:

Standard weight:

Sample weight:

BBOT*

2.0 - 3.0 mg for CHNS

1.0 - 2.0 mg

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%, 7.43 O%

1.0 - 2.0 mg for Oxygen determination

Note

For CHNS, standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
Set the Oxygen Flow at 300 ml/min Oxygen Injection Time at 13 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Tar

CHN determination

TAR

Sample	N%	RSD%	C%	RSD%	H%	RSD%
Tar 1	0.0540		92.2560		7.0311	
	0.0551	5.4717	92.5826	0.2838	7.0269	0.1777
	0.0598		92.0646		7.0077	
Tar 2	0.0519		92.7543		6.9949	
	0.0474	4.6119	92.6780	0.1388	6.9660	0.2443
	0.0505		92.5037		6.9648	

Sample information

Standard:

Standard weight:

Sample weight:

Atropine

2.0 - 3.0 mg

2.0 - 3.0 mg

4.84 N%, 70.56 C%, 8.01 H%



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Fertilizers - Feed - Soils

NC determination

FERTILIZERS, ANIMAL FEED & SOILS

Sample	N%			C%		
Soil A	0.650	0.652	0.656	6.540	6.499	6.503
Soil B	0.395	0.383	0.386	4.517	4.425	4.464
Soil Meal	7.258	7.374	7.466	31.360	31.198	32.292
Milk Powder	2.822	2.806	2.800	50.618	50.472	50.480
Compost A	1.310	1.337	1.337	16.591	16.975	16.955
Compost B	2.215	2.256	2.214	25.522	25.864	26.228
Lucerne	3.951	4.001	3.918	41.642	41.817	41.933
Pasture	4.002	3.978	3.978	42.150	42.294	42.268
Fertilizer A	13.142	12.962	13.102	1.274	1.061	1.231
Fertilizer B	17.873	17.807	17.874	0.231	0.227	0.228
An. Grade Chem	20.835	20.945	20.833			

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
Standard weight:	Soil A and B	5.0 mg
	An. Grade Chem	2.0 - 3.0 mg
	Others	10 mg
Sample weight:	Soil A and B	50 - 80 mg
	An. Grade Chem	2.0 - 3.0 mg
	Others	10 - 30 mg

Note

The samples has been ground by ball mill.

These materials can be analyzed *as received* or dried (105°C, 2 hours).

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Humic Acids

CHNS/O determination

HUMIC ACIDS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	5.46	0.38	48.82	0.09	5.03	0.30	1.09	0.53	32.34	0.18
	5.47		48.85		5.02		1.10		32.25	
	5.50		48.91		5.00		1.10		32.23	
2	5.93	0.10	49.01	0.17	5.49	0.17	1.40	0.83	34.45	0.07
	5.94		49.05		5.48		1.38		34.42	
	5.94		49.89		5.46		1.38		34.47	
3	5.46	0.38	49.33	0.15	5.29	0.38	1.11	0.52	32.26	0.11
	5.49		49.45		5.27		1.11		32.32	
	5.45		49.31		5.25		1.12		32.32	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 1.0 - 1.5 mg
 Sample weight: 0.5 - 0.8 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%
 Standard weight: 0.5 - 0.7 mg
 Sample weight: 0.5 - 0.7 mg

Note

For CHNS, samples were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Due to the low amount of humic acids, samples were weighed by the Ultramicro Balance Mettler XPR2U, (p/n 432 30087), and the Oxygen Injection Time was 3 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Humus

NC and Total Organic Carbon (TOC) determination

HUMUS

Sample	N%	RSD%	C%	RSD%	TOC%	RSD%
1	1.7476		36.6962		34.6973	
	1.7654	0.5993	36.6918	0.1176	34.3678	
	1.7663		36.6194		34.7956	0.4834
					34.5334	
					34.6845	
2	1.7057		39.3224		37.4886	
	1.6834	0.6660	39.1061	0.4979	37.7289	
	1.6916		39.4968		37.4628	0.3769
					37.4453	
					37.7159	
3	1.4094		32.5212		31.1981	
	1.4139	0.1748	32.3690	0.4014	31.0215	
	1.4099		32.6287		31.1316	0.2577
					31.0138	
					31.0444	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%

Standard weight: 20 - 25 mg

Sample weight: 20 - 25 mg

Note

Use Oxygen Flow 300 ml/min, Oxygen Injection Time 10 seconds and the 3 meter GC column (p/n 260 08205). TOC % values are determined by FlashSmart™ EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)



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Kerogene - Palm Leaf - Soil

CHNS determination

KEROGENE, PALM LEAF AND SOIL

Sample	N%	C%	H%	S%
Kerogene	0.606	41.822	5.662	12.075
	0.621	41.443	5.724	12.776
	0.625	42.380	5.801	12.496
Palm Leaf	2.888	47.539		0.189
	2.864	47.500		0.198
	2.878	47.431		0.199
	2.802	47.549		0.198
	2.927	47.489		0.186
Soil	0.124	1.174		0.042
	0.125	1.259		0.041
	0.129	1.238		0.038
	0.127	1.236		0.040
	0.129	1.231		0.040

Sample information

Standard:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight:		2.0 - 3.0 mg
Sample weight:	Kerogene	2.0 - 4.0 mg
	Palm leaf	3.0 - 4.0 mg
	Soil	10 - 15 mg

Note

The samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Rock

CHNS determination

ROCK

Element %	N%	C%	H%	S%
	0.0562	0.9822	0.6011	0.0602
	0.0560	0.9938	0.6082	0.0665
	0.0564	0.9804	0.5929	
Average %	0.0562	0.9855	0.6007	0.0633
RSD %	0.3559	0.7380	1.2745	7.0320

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 10 - 15 mg

Note

Sulfur was performed as NCS configuration using a 25 cm GC column and TCD detector.
Samples have been analyzed with the addition of about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Rock

NCS and TOC determination

ROCK

Sample	N%	RSD%	C%	RSD%	S%	RSD%	TOC%	RSD%
1	0.0546		12.2622		1.0097		1.6601	
	0.0544	0.28	12.2625	0.001	1.0095	0.640	1.6543	0.48
	0.0543		12.2624		1.0209		1.6702	
2	0.0540		5.2900		4.1788		4.6462	
	0.0552	1.17	5.3362	0.44	4.1469	0.57	4.6003	0.53
	0.0550		5.3191		4.1327		4.6381	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 4.0 - 5.0 mg for NC
5.0 - 6.0 mg for TOC

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

Note

TOC % values are determined by FlashSmart EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

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Rock

NCS and TOC determination

ROCK

Sample	N%	RSD%	C%	RSD%	S%	RSD%	TOC%	RSD%
1	0.0062		0.1511		0.1643		0.1791	
	0.0065	2.3993	0.1559	2.2025	0.1774	3.8995	0.1733	2.0491
	0.0064		0.1577		0.1690		0.1800	
2	0.0033		0.0997		0.3677		0.0269	
	0.0035	6.0600	0.0982	1.140	0.3684	0.0979	0.0255	2.682
	0.0031		0.0975		0.3682		0.0260	

Sample information

Standard: BBOT* 6.51 N%, 72.56 C%, 7.44 S%

Standard weight: 2.0 - 2.2 mg

Sample weight: 15 - 20 mg

Note

Set the Oxygen Injection Time at 4 seconds.

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Samples were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

TOC % values are determined by *FlashSmart* EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



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Rock

CHNS determination

ROCK

Weight (mg)	N%	C%	H%	S%
101.1	0.0031	0.0559	0.223	0.0551
102.5	0.0030	0.0551	0.220	0.0543
101.6	0.0031	0.0557	0.222	0.0549
101.2	0.0031	0.0558	0.223	0.0550
102.9	0.0030	0.0549	0.219	0.0541
106.0	0.0029	0.0545	0.218	0.0562
100.6	0.0029	0.0536	0.215	0.0553
100.2	0.0029	0.0538	0.216	0.0555
102.2	0.0029	0.0544	0.218	0.0561
103.5	0.0029	0.0531	0.213	0.0548
Average	0.0030	0.0547	0.219	0.0551
Std. Dev.	0.0001	0.0010	0.0034	0.0007
RSD%	2.08	1.78	1.56	1.24

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 100 - 105 mg

Note

For CHNS determination, standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
 Large tin containers (p/n 252 08000) were used to weigh the sample.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CHNS and TOC determination

ROCK

Sample information

Provenance	Sample name	Geological Unit/ Sample origin	Age (billion of years)	Weight (mg) for CHNS	Weight (mg) for TOC
USGS standard	SGR - 1	Green River Shale (USA)	Modern	3 - 4.5	3 - 4.5
USGS standard	SDO - 1	Devonian Ohio Shale (USA)	2.66	7 - 10	8 - 10
USGS standard	SHWFD - 1	Woodford Shale (USA)	2.50	7 - 10	8 - 10
USGS standard	SHBOQ - 1	Boquillas Shale (USA)	2.85	7 - 8	8 - 10
Customer	MR21011	Mt McRae Shale (Australia)	1.10	10 - 15	8 - 10
Customer	J18	Jeerinah Formation (Australia)	0.31	10 - 15	8 - 10
USGS standard	SCO - 1	Cody Shale (USA)	0.07	15 - 20	8 - 10
Customer	NS1282 - 1	Nonesuch Shale (USA)	unknown	15 -25	8 - 10
Customer	SC20 - 1	Sheep Creek, Belt Supergroup(USA)	0.37	15 - 20	8 - 10
Customer	SC20 - 51	Sheep Creek, Belt Supergroup (USA)	0.05	15 -25	8 - 10
Customer	MC - 4	Mosquito Creek Group (Australia)	0.07	15 -25	8 - 10
USGS standard	SBC - 1	Brush Creek Shale (USA)	1.45	15 -25	8 - 10
Customer	T37	Tumbiana Formation (Australia)	1.45	15 -25	8 - 10
USGS standard	BHVO - 2	Hawaiian basalt (USA)	0.36	15 -25	8 - 10
USGS standard	SDC - 1	Mica Schist (USA)	2.72	95 - 105	8 - 10



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CHNS and TOC determination

ROCK

Experimentall CHNS data

Sample name	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	TOC%	RSD%
SDO - 1	0.357	0.41	9.62	0.33	1.46	1.25	5.29	0.27	9.33	0.09
SHBOQ - 1	0.1023	1.99	11.55	0.90	0.747	1.28	1.57	1.11	5.27	0.55
SHWFD - 1	0.275	0.81	7.93	0.49	0.944	0.95	1.03	0.82	7.70	0.49
MR21011	0.0966	0.97	5.95	0.87	0.878	0.86	9.76	0.63	5.62	0.33
J18	0.0114	1.87	3.06	0.72	0.869	0.78	2.65	0.64	2.93	0.66
SCO - 1	0.0492	1.28	1.06	1.04	0.562	1.04	0.0249	1.02	0.2831	1.15
NS1282 - 1	0.0418	1.71	0.0587	1.47	0.458	1.26	< 0.0050	-	0.0562	0.98
SC20 - 1	0.0251	1.98	0.584	0.51	0.272	1.44	0.342	0.96	0.5485	0.35
SC20 - 51	0.0069	2.74	0.430	0.90	0.756	1.34	0.114	1.17	0.4000	1.02
MC - 4	0.0030	3.54	0.179	0.71	0.654	0.87	< 0.0050	-	0.1482	1.05
SBC - 1	0.0578	0.75	2.08	0.85	0.785	0.78	0.259	0.83	1.11	0.40
T37	-	-	0.470	0.30	0.336	0.41	0.379	0.33	0.3768	0.88
BHVO - 2	0.0008	6.04	0.0221	2.96	0.0246	2.75	0.0092	2.24	0.0198	1.98
SGR - 1	0.8830	0.77	27.84	0.37	3.17	0.52	1.47	1.22	24.56	0.25
SDC - 1	0.0030	3.08	0.0547	1.78	0.219	1.56	0.0551	1.24	0.0331	1.85

Sample information CHNS and TOC determination

Standard:	BBOT* for CHNS	6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
	Aspartic acid for TOC	36.09 C%
Standard weight:	BBOT* for CHNS	2.0 - 3.0 mg
	Aspartic acid for TOC	3.0 - 4.0 mg
Sample weight:	See table	

Note

The USGS is the United States Geological Survey, which is an association of scientists who study USA territories. The customer is University of St. Andrews, UK.

For CHNS determination, standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Samples were analyzed 10 Times.

TOC determination was performed using the dedicated kit p/n 190 04145. Samples were analyzed 5 Times.

As the sulfur content of NS1282-1 and MC-4 samples was less than 50 ppm S, the sulfur determination was performed by FPD Detector, see the trace sulfur data in Sulfur by FPD chapter.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Rock

CHNS determination

SILICATE ROCK POWDER

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1			0.0491		0.272		0.0082	
	-	-	0.0488	1.40	0.275	0.63	0.0079	1.90
			0.0478		0.272		0.0080	
2	0.0024		0.0136		0.128			
	0.0027	7.91	0.0128	3.03	0.124	1.66	-	-
	0.0028		0.0132		0.125			
3			0.0643		0.184			
	-	-	0.0644	0.76	0.181	0.84	-	-
			0.0652		0.183			

Sample information

Standard:	BBOT*	6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
	Thermo Scientific Soil Ref. Material	0.21 N%, 2.29 C%, 0.023 S%
Standard weight:	BBOT*	2.0 - 3.0 mg
	Thermo Scientific Soil Ref. Material	15 - 20 mg
Sample weight:	15 - 20 mg	

Note

Samples were homogenized by a ball mill.
Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Sand

NC determination

SAND

Sample %	N%	RSD%	C%	RSD%
Sand 1	0.0077		0.0722	
	0.0086	7.4345	0.0772	5.9264
	0.0089		0.0813	
Sand 2	0.0087		0.0839	
	0.0076	6.9064	0.0705	8.6689
	0.0084		0.0776	
Sand 3	0.0107		0.1091	
	0.0110	1.5890	0.1094	1.2406
	0.0110		0.1116	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Soil Reference Material	0.196 N%, 1.998 C%
Standard weight:	Aspartic acid	3.0 - 4.0 mg
	Soil Reference Material	50 - 100 mg
Sample weight:		300 - 350 mg

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Sand

NC determination

SAND

Sample	N%	RSD%	C%	RSD%
1	0.0026		0.0388	
	0.0024		0.0339	
	0.0025	6.13	0.0335	7.06
	0.0024		0.0335	
	0.0022		0.0328	
2	0.0025		0.0331	
	0.0026		0.0350	
	0.0025	2.83	0.0343	2.56
	0.0024		0.0338	
	0.0025		0.0329	
3	0.0157		4.8858	
	0.0153		4.8993	
	0.0158	1.39	4.8677	0.47
	0.0154		4.8853	
	0.0157		4.8399	

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%
 Standard weight: 10 - 12 mg
 Sample weight: 100 - 20 mg

Note

Set Oxygen Flow at 300 ml/min and Oxygen Injection Time at 10 seconds.



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Sediments

Sulfur determination

SEDIMENTS

Sample	S%	
A	0.0635	0.0674
B	0.0652	0.0683
C	0.0702	0.0656
D	0.0633	0.0661
E	0.0670	0.0611
F	0.0734	0.0738
G	0.0872	0.0824
H	0.0812	0.0838
J	0.1013	0.1033
K	0.0718	0.0768

Sample information

Standard:	Thermo Scientific Soil Reference Material	0.0320 S%
Standard weight:	10 - 15 mg	
Sample weight:	3.0 - 5.0 mg	

Note

The sediment material has been ground by ball mill.

These samples can be analyzed as *received* or dried (105°C, 2 hours).

Standard and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Sediments

NC determination

SEDIMENTS

Sample	N%	C%
1	0.0382 - 0.0355	5.6281 - 5.6061
2	0.0378 - 0.0362	4.4032 - 4.4433
3	0.2440 - 0.2404	6.0778 - 6.0825
4	0.2276 - 0.2281	6.2027 - 6.2536
5	0.0565 - 0.0573	7.2458 - 7.3001
6	0.0975 - 0.0972	2.6718 - 2.6534
7	0.1172 - 0.1158	2.8521 - 2.9076
8	0.1340 - 0.1382	3.0146 - 3.0206
9	0.1032 - 0.1043	2.8864 - 2.8987
10	0.1131 - 0.1162	2.9983 - 2.9832
11	0.1133 - 0.1139	2.8050 - 2.7941
12	0.1080 - 0.1100	2.7890 - 2.7591

Sample information

Standard: Atropine 4.84 N%, 70.56 C%
Standard weight: 2.0 - 3.0 mg
Sample weight: 10 - 15 mg



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Sediments

NCS determination

SEDIMENTS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.1029		0.7460		0.2823	
	0.1061	1.6226	0.7359	0.7281	0.2871	0.8449
	0.1055		0.7377		0.2850	
2	0.0716		1.1807		0.1507	
	0.0735	1.5186	1.1931	0.7125	0.1509	1.5570
	0.0716		1.1770		0.1549	
3	0.2891		4.2044		0.1431	
	0.2845	0.8702	4.1995	0.2225	0.1424	0.6004
	0.2885		4.2176		0.1414	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 10 - 15 mg

Note

Samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Sediments

CHN determination

SEDIMENTS (Pacific and Atlantic Ocean samples)

Sample	N%		C%		H%	
A	0.13	0.14	9.20	9.22	0.33	0.33
B	0.03	0.03	6.72	6.72	0.14	0.14
C	0.04	0.04	6.91	6.96	0.16	0.10
D	0.08	0.08	8.46	8.49	0.24	0.25
E	0.06	0.06	8.25	8.30	0.22	0.22
F	0.02	0.02	5.62	5.63	0.11	0.11
G	0.03	0.02	6.47	6.44	0.13	0.17

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 10 - 15 mg

Note

The sediment materials have been ground by ball mill.
 These samples can be analyzed as *received* or dried (105°C, 2 hours).



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Soils

NC determination

SOILS

Sample	N%	RSD%	C%	RSD%
A	0.783	0.303	9.759	0.709
B	0.149	0.336	2.052	1.180
C	0.121	0.612	7.617	1.468
D	0.186	2.012	2.078	1.672
E	0.260	0.981	4.754	0.608
F	0.162	1.867	1.825	0.958
G	0.365	0.894	0.044	1.736
H	0.462	0.625	0.051	1.820
J	0.331	1.023	0.038	1.655
K	0.118	1.724	3.286	0.964

Sample information

Standard:	Soil Reference Material	0.196 N%, 1.998 C%
Standard weight:	50 - 100 mg	
Sample weight:	50 - 100 mg	

Note

The geological materials have been ground by ball mill.
 These samples can be analyzed as *received* or dried (105°C, 2 hours).
 Each value is the average of 3 runs.



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NCS determination

SOILS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.2878	0.1963	6.2959	0.9498	0.1172	2.4552
	0.2886		6.2119		0.1132	
2	0.0734	2.6469	2.6620	0.3762	0.0188	2.6828
	0.0762		2.6762		0.0181	
3	0.0887	1.7323	1.4801	0.2009	0.0169	2.8694
	0.0909		1.4759		0.0176	
4	0.2107	1.0140	3.7616	0.1732	0.1415	2.9070
	0.2077		3.7524		0.1358	

Sample information

Standard: Soil Reference Material 0.196 N%, 1.998 C%, 0.0320 S%
Standard weight: 10 - 15 mg
Sample weight: 10 - 15 mg

Note

Samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).



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Sulfur determination

SOILS

Montana Soil - SRM 2711	
Weight (mg)	S%
12.136	0.0469
15.267	0.0433
10.824	0.0443
14.981	0.0427
15.139	0.0442
14.776	0.0442
13.645	0.0428
14.873	0.0440
11.229	0.0429
14.549	0.0458
Average	0.0439
RSD%	3.3753
NIST value	0.0420

Soil Samples	
Sample	S%
1	0.0492 - 0.0510
2	0.0185 - 0.0181
3	0.0367 - 0.0372
4	0.0219 - 0.0212
5	0.0330 - 0.0339
6	0.0209 - 0.0215
7	0.0426 - 0.0422
8	0.0233 - 0.0227

Sample information

Standard:

Thermo Scientific Soil Reference Material

0.0320 S%

Standard weight:

10 - 15 mg

Sample weight:

10 - 15 mg

Note

Samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).



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Soils

CHNS determination

SOILS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
A	0.4299	0.7939	7.0562	0.1404	1.4562	0.8795	0.0374	1.3112
B	0.4251		7.0422		1.4382		0.0381	
C	0.1931	0.7362	2.2324	0.3429	0.5481	0.1418	0.0371	0.7665
D	0.1911		2.2216		0.5492		0.0367	

Sample information

Standard:

Standard weight:

Sample weight:

BBOT*

2.0 - 3.0 mg

10 - 15 mg

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Soils

NC and TOC (Total Organic Carbon) determination

SOILS

Sample	N%	RSD%	C%	RSD%	TOC%	RSD%
1	0.155	0.3741	2.175	0.0956	1.282	1.1715
	0.154		2.179		1.310	
	0.154		2.178		1.286	
2	0.107	4.7820	1.007	3.6260	0.919	0.7510
	0.100		1.060		0.919	
3	0.081	0	1.360		0.925	0.5400
			1.356	0.2080	0.930	
					0.920	

Sample information

Standard: Aspartic acid 10.52 N, 36.04 C%

Standard weight: 4.0 - 5.0 mg

Sample weight for NC det.: 50 - 100 mg

Sample weight for TOC det.: 50 - 100 mg

Note

TOC determination was performed with the dedicated kit (p/n 190 04120).

TOC % values are determined by FlashSmart™ EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

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Sulfur determination

SOILS

Sample	S%	RSD%
1	0.0531	3.2304
	0.0540	
	0.0565	
2	0.0276	3.5166
	0.0294	
	0.0293	
3	0.0233	2.6915
	0.0222	
	0.0223	
4	0.0178	0.0179
	0.0176	
	0.0183	

Sample information

Standard: BBOT* 7.44 S%

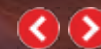
Standard weight: 2.0 - 3.0 mg

Sample weight: 10 - 15 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). The configuration suggested is NCS or only Sulfur.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Soils

NC determination

SOILS

Sample	N%	RSD%	C%	RSD%
1	0.512	1.11	5.800	0.55
	0.504		5.845	
2	0.430	0.49	5.605	0.20
	0.433		5.621	
3	0.514	0.97	6.525	0.42
	0.507		6.486	
4	0.361	1.58	4.673	0.32
	0.353		4.694	
5	0.370	1.74	4.022	0.81
	0.361		4.126	
6	0.474	0.60	5.851	0.21
	0.470		5.834	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
Standard weight:	4.0 - 5.0 mg	
Sample weight for NC det.:	50 - 100 mg	

Note

Samples were homogenized by a ball mill.



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Soils

NC and TOC determination

SOILS

Sample	N%	RSD%	C%	RSD%	TOC	RSD%
A	0.147		1.495		1.330	
	0.144		1.488		1.356	
	0.146	0.923	1.492	0.364	1.339	1.117
	0.146		1.481		1.365	
	0.144		1.486		1.334	
B	0.147		4.697		3.966	
	0.147		4.763		3.917	
	0.147	0.481	4.685	0.980	3.911	0.648
	0.146		4.782		3.929	
	0.148		4.686		3.962	
C	0.249		3.808		2.862	
	0.258		3.791		2.864	
	0.250	1.526	3.781	0.350	2.844	0.340
	0.249		3.810		2.858	
	0.250		3.785		2.870	
D	0.321		5.159		3.697	
	0.321		5.116		3.699	
	0.312	1.578	5.124	0.426	3.738	0.478
	0.311		5.149		3.705	
	0.313		5.108		3.724	
E	0.168		2.522		1.842	
	0.165		2.552		1.844	
	0.164	1.134	2.575	1.022	1.902	1.371
	0.163		2.574		1.860	
	0.165		2.523		1.881	

Sample information

Standard:

Aspartic acid

10.52 N%, 36.09 C%

Standard weight:

4.0 - 5.0 mg

Sample weight for NC det.:

50 - 100 mg

Note

Samples were homogenized by a ball mill. TOC determination was performed with the dedicated kit (p/n 190 04145).



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Soils

NC determination

SOILS

NC Determination by Single Combustion/Reduction Reactor - Method B

Soil Sample	N%	RSD%	C%	RSD%
A	0.0496		3.7189	
	0.0499	0.35	3.6894	0.40
	0.0496		3.7058	
B	0.2512		3.7728	
	0.2550	0.85	3.7496	0.36
	0.2514		3.7489	
C	1.0551		13.3457	
	1.0370	0.87	13.4326	0.95
	1.0455		13.1826	
D	0.0582		0.8836	
	0.0576	0.96	0.8779	0.74
	0.0571		0.8706	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Thermo Scientific Soil Ref. Mat.	0.21 N%, 2.29 C%
Standard weight:	2.0 - 7.0 mg Aspartic acid	
	6.0 - 7.0 mg Benzoic acid	
	6.0 - 7.0 Thermo Scientific Soil Ref. Mat.	
Sample weight:	50 - 70 mg for soils A, B and C	
	220 - 250 mg for soil D	

Note

The analytical parameters of method B are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.



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NCS determination

SOILS

Soil Sample	N%	RSD%	C%	RSD%	S%	RSD%
A	0.0482		3.6494		0.0147	
	0.0481	1.84	3.7371	1.21	0.0151	1.34
	0.0497		3.7084		0.0149	
B	0.2504		3.7595		0.0674	
	0.2484	2.41	3.7892	1.05	0.0678	0.59
	0.2598		3.7112		0.0682	
C	1.0485		13.4481		0.5253	
	1.0468	0.67	13.2674	0.78	0.5292	0.37
	1.0597		13.4497		0.5275	
D	0.0585		0.8741		0.0103	
	0.0582	0.26	0.8708	0.24	0.0104	1.49
	0.0583		0.8702		0.0101	

Sample information for NCS determination

Standard: BBOT* 6.51 N%, 72.56 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 15 - 20 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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TOC determination

SOILS

Soil Sample	TOC%	RSD%
A	0.4183	0.89
	0.4229	
	0.4258	
B	1.8075	0.44
	1.7955	
	1.8105	
C	10.0688	0.95
	10.2617	
	10.1640	
D	0.7563	1.75
	0.7304	
	0.7416	

Sample information

Standard:	Aspartic acid	36.04 C%
Standard weight:	3.0 - 4.0 mg	
Sample weight for TOC det.:	6.0 - 12 mg	

Note

TOC determination was performed with the dedicated kit (p/n 190 04145).

TOC % values are determined by *FlashSmart* EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

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NC and TOC determination

SOILS

Sample	N%	RSD%	C%	RSD%	TOC%	RSD%
A	0.147	0.92	1.495	0.36	1.330	1.12
	0.144		1.488		1.356	
	0.146		1.492		1.339	
	0.146		1.481		1.365	
	0.144		1.486		1.334	
B	0.147	0.48	4.697	0.98	3.966	0.65
	0.147		4.763		3.917	
	0.147		4.685		3.911	
	0.146		4.782		3.929	
	0.148		4.686		3.962	
C	0.125	2.07	2.099	0.51	1.008	1.85
	0.130		2.100		1.046	
	0.129		2.118		1.029	
D	0.019	3.09	0.567	1.24	0.313	2.08
	0.019		0.559		0.306	
	0.019		0.573		0.319	
E	0.159	1.08	3.200	0.74	1.400	1.13
	0.159		3.156		1.369	
	0.162		3.192		1.382	

Sample information

Standard:

Aspartic acid

10.52 N%, 36.09 C%

Standard weight:

4.0 - 6.0 mg

Sample weight:

40 - 100 mg for NC

5.0 - 10 mg for TOC

Note

Set Oxygen Injection Time at 10 seconds.

TOC determination was performed with the dedicated kit (p/n 190 04145).



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CHNS/O determination

SOILS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
A	0.0280	2.61	0.4710	0.86	0.1520	4.58	0.0060	4.02	1.269	0.60
	0.0293		0.4735		0.1662		0.0065		1.269	
	0.0283		0.4792		0.1652		0.0065		1.253	
	0.0296		0.4799		0.1682		0.0062		1.266	
	0.0296		0.4794		0.1550		0.0060		1.256	
B	0.7490	0.31	9.6360	0.39	1.4650	0.94	0.1020	2.01	7.724	0.91
	0.7446		9.6674		1.4521		0.1043		7.595	
	0.7478		9.5771		1.4354		0.1064		7.619	
	0.7451		9.5879		1.4327		0.1039		7.574	
	0.7436		9.5975		1.4386		0.1073		7.715	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 10 - 15 mg

Sample information for Oxygen determination

Standard: BBOT 7.43 O%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

For CHNS Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
 Samples were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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NC determination

SOILS

Sample	N%	RSD%	C%	RSD%
1	0.0800	0.73	1.148	0.64
	0.0790		1.159	
	0.0790		1.145	
2	0.0580	0.96	0.836	1.05
	0.0569		0.824	
	0.0574		0.841	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
Standard weight:	4.0 - 5.0 mg	
Sample weight:	50 - 100 mg	

Note

The samples were dried at 70°C for four hours.
Set the Oxygen Injection Time at 10 seconds.



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NCS determination

SOILS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.0073	2.13	0.0156	1.,30	0.0085	1.18
	0.0070		0.0152		0.0086	
	0.0072		0.0154		0.0084	
2	0.295	0.20	2.80	0.59	0.0405	0.57
	0.294		2.80		0.0401	
	0.295		2.83		0.0405	
3	0.0617	0.81	0.680	0.15	0.0109	1.05
	0.0608		0.679		0.0111	
	0.0609		0.678		0.0111	
4	0.152	0.65	1.66	0.35	0.0263	0.38
	0.153		1.65		0.0262	
	0.154		1.65		0.0264	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 15 - 30 mg

Note

Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
Soils were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Oxygen determination

SOILS

Sample	O%	RSD%
1	5.76	0.26
	5.79	
	5.78	
2	6.73	0.30
	6.77	
	6.75	
3	0.94	1.06
	0.93	
	0.95	
4	2.66	0.78
	2.70	
	2.67	

Sample information

Standard:

Tocopherol nicotinate

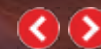
8.96 O%

Standard weight:

1.0 - 2.0 mg

Sample weight:

1.0 - 2.0 mg



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NC determination

SOILS

Sample	N%	RSD%	C%	RSD%
1	0.4839	0.75	9.7846	0.29
	0.4770		9.7843	
	0.4788		9.7353	
2	0.2246	0.46	1.9604	0.21
	0.2252		1.9531	
	0.2266		1.9597	
3	0.0754	1.22	1.4032	0.62
	0.0736		1.4155	
	0.0747		1.3988	
4	0.0535	1.51	0.9324	0.55
	0.0529		0.9291	
	0.0545		0.9392	
5	0.0435	1.07	0.6074	0.40
	0.0442		0.6115	
	0.0444		0.6071	

Sample information

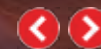
Standard: Aspartic acid 10.52 N%, 36.09 C%

Standard weight: 4.0 - 5.0 mg

Sample weight: 10 - 15 mg sample 1
50 - 100 mg sample 2 - 5

Note

Set the Oxygen Injection Time at 10 seconds.



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NCS determination

SOILS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.0242	1.08	0.257	1.43	0.0053	2.23
	0.0247		0.252		0.0051	
	0.0246		0.250		0.0051	
2	0.0594	0.43	0.718	0.28	0.0096	1.19
	0.0591		0.714		0.0096	
	0.0589		0.716		0.0098	
3	0.0416	1.10	0.478	0.75	0.0080	2.55
	0.0407		0.483		0.0084	
	0.0411		0.476		0.0081	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 50 - 60 mg

Note

Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

TOC % values are determined by *FlashSmart* EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)



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CHN and TOC determination

SOILS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	TOC%	RSD%
1	0.0729	1.25	3.28	0.27	0.298	0.96	0.792	0.66
	0.0730		3.30		0.290		0.793	
	0.0710		3.28		0.297		0.788	
	0.0717		3.29		0.298		0.780	
	0.0714		3.28		0.296		0.786	
2	0.0149	1.51	1.88	0.69	0.187	1.11	0.235	1.09
	0.0143		1.86		0.185		0.240	
	0.0152		1.89		0.180		0.239	
	0.0158		1.89		0.183		0.238	
	0.0148		1.87		0.180		0.234	

Sample information for CHN determination

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
 Standard weight: 3.0 - 4.0 mg
 Sample weight: 15 - 20 mg

Note

Samples were homogenized by a ball mill.
 TOC determination was performed using the dedicated kit (p/n 190 04145).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

TOC % values are determined by *FlashSmart* EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



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NC determination

SOILS - HISTOSOLS (organic carbon content soils)

Sample	N%	RSD%	C%	RSD%
1	1.055	0.22	24.57	0.12
	1.059		24.52	
	1.055		24.57	
2	1.611	0.69	28.44	0.20
	1.590		28.37	
	1.591		28.48	
3	0.910	1.10	17.76	0.20
	0.906		17.80	
	0.925		17.73	
4	1.470	0.58	34.76	0.13
	1.461		34.76	
	1.451		34.84	
5	1.557	0.21	28.84	0.39
	1.558		29.05	
	1.563		28.88	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Standard weight: 4.0 - 5.0 mg
Sample weight: 4.0 - 5.0 mg

Note

Samples were dried at 70°C for four hours, then maintained in a dessicator before closing the tin container to do not have any free moisture.
Set the Oxygen Injection Time at 10 seconds.



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NC determination

SOILS REFERENCE MATERIALS

Certified Nitrogen and Carbon data of Soil Reference Materials				
Reference Material Information	Specification			
	N%	Uncertainty (±)	C%	Uncertainty (±)
Low Organic Content Soil	0.133	0.023	1.61	0.09
Medium Organic Content Soil	0.27	0.02	3.19	0.07
Loamy Soil	0.27	0.02	2.75	0.12
Chalky Soil	0.35	0.02	5.39	0.09

Sample	N%	RSD%	C%	RSD%
Low Organic Content Soil	0.124		1.55	
	0.122	2.024	1.55	0.742
	0.127		1.57	
Medium Organic Content Soil	0.27		3.16	
	0.27	0.000	3.15	0.183
	0.27		3.15	
Loamy Soil	0.26		2.70	
	0.26	0.000	2.72	0.565
	0.26		2.69	
Chalky Soil	0.38		5.34	
	0.37	1.533	5.35	0.108
	0.38		5.35	

Sample information

Standard:
Standard weight:
Sample weight for NC det.:

Aspartic acid
4.0 - 5.0 mg
100 mg

10.52 N%, 36.09 C%



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CHN determination

SOILS REFERENCE MATERIALS

Reference Material	W (mg)	N%	RSD%	C%	RSD%	H%	RSD%
Low Organic Content Soil	12.635	0.128		1.651		0.360	
	15.811	0.128	1.36	1.666	0.46	0.365	1.74
	16.971	0.125		1.660		0.371	
Medium Organic Content Soil	14.802	0.259		3.173		0.702	
	15.344	0.256	1.16	3.189	0.73	0.710	0.98
	14.547	0.262		3.219		0.716	
Loamy Soil	15.525	0.254		2.751		0.651	
	14.149	0.260	1.24	2.767	0.39	0.640	0.94
	16.408	0.258		2.772		0.641	
Chalky Soil	17.277	0.365		5.401		0.839	
	17.535	0.363	0.69	5.399	0.52	0.845	0.71
	18.096	0.360		5.349		0.851	

Sample information

Standard:

Aspartic acid

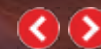
10.52 N%, 36.09 C%, 5.30 H%

Standard weight:

3.0 - 4.0 mg

Sample weight:

10 - 20 mg



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NC determination

SOILS REFERENCE MATERIALS

Certified Nitrogen and Carbon of Reference Materials				
Reference Materials Description	Specification			
	N%	Uncertainty (±)	C%	Uncertainty (±)
Thermo Scientific Soil	0.21	0.01	2.29	0.07
Low Organic Content Soil	0.133	0.023	1.61	0.09
Medium Organic Content Soil	0.27	0.02	3.19	0.07
Loamy Soil	0.27	0.02	2.75	0.12
Chalky Soil	0.35	0.02	5.39	0.09
Sandy Soil	0.07	0.01	0.83	0.05



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NC determination

SOILS REFERENCE MATERIALS

NC Determination by Single Combustion/Reduction Reactor - Method A									
Sample information		Quadratic Fit calibration method				Linear Fit calibration method			
	W (mg)	N%	RSD%	C%	RSD%	N%	RSD%	C%	RSD%
Thermo Scientific Soil	54.879	0.21		2.26		0.20		2.27	
	62.212	0.20	2.84	2.23	0.68	0.20	0	2.25	0.51
	59.210	0.20		2.25		0.20		2.27	
Low Organic Content Soil	52.310	0.12		1.57		0.12		1.58	
	59.495	0.12	4.68	1.56	0.97	0.12	4.68	1.56	0.97
	56.449	0.13		1.59		0.13		1.59	
Medium Organic Content Soil	57.837	0.27		3.15		0.27		3.17	
	66.428	0.27	0	3.15	0.18	0.27	2.17	3.16	0.32
	70.375	0.27		3.16		0.26		3.18	
Loamy Soil	66.068	0.26		2.67		0.25		2.68	
	56.356	0.26	0	2.69	0.37	0.25	2.28	2.71	0.57
	65.322	0.26		2.68		0.26		2.70	
Chalky Soil	53.043	0.37		5.32		0.36		5.34	
	59.841	0.37	0	5.34	0.47	0.36	1.59	5.35	0.28
	67.876	0.37		5.37		0.37		5.37	
Sandy Soil	240.058	0.065		0.813		0.064		0.818	
	255.114	0.066	0.88	0.817	0.32	0.065	0.89	0.821	0.31
	229.087	0.066		0.818		0.065		0.823	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Thermo Scientific Soil Ref. Mat.	0.21 N%, 2.29 C%
Standard weight:	2.0 - 6.0 mg Aspartic acid	
	6.0 - 7.0 mg Benzoic acid	
	6.0 - 8.0 mg Thermo Scientific Soil Ref. Mat.	
Sample weight:	50 - 70 mg for all soils except Sandy soil	
	220 - 250 mg for Sandy soil	

Note

The analytical parameters of method A are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.

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Soils

NC determination

SOILS REFERENCE MATERIALS

NC Determination by Single Combustion/Reduction Reactor - Method B									
Sample information		Quadratic Fit calibration method				Linear Fit calibration method			
	W (mg)	N%	RSD%	C%	RSD%	N%	RSD%	C%	RSD%
Thermo Scientific Soil	54.371	0.21		2.24		0.20		2.25	
	59.476	0.21	2.79	2.25	0.68	0.21	2.84	2.26	0.67
	52.999	0.20		2.27		0.20		2.28	
Low Organic Content Soil	67.572	0.12		1.60		0.12		1.61	
	54.559	0.13	4.68	1.61	0.96	0.13	4.56	1.61	0.72
	55.945	0.12		1.58		0.13		1.59	
Medium Organic Content Soil	54.040	0.27		3.16		0.26		3.17	
	60.170	0.27	2.17	3.18	0.8	0.26	0	3.19	0.63
	57.114	0.26		3.13		0.26		3.15	
Loamy Soil	50.217	0.25		2.68		0.25		2.69	
	57.960	0.25	2.28	2.65	0.57	0.25	0	2.66	0.57
	67.524	0.26		2.66		0.25		2.68	
Chalky Soil	62.091	0.36		5.32		0.36		5.35	
	61.176	0.36	0	5.33	0.19	0.36	0	5.35	0.22
	62.267	0.36		5.34		0.36		5.37	
Sandy Soil	216.902	0.065		0.823		0.065		0.827	
	231.937	0.066	0.88	0.826	0.56	0.065	0.89	0.829	0.57
	244.618	0.065		0.817		0.064		0.820	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Thermo Scientific Soil Ref. Mat.	0.21 N%, 2.29 C%
Standard weight:	2.0 - 7.0 mg Aspartic acid	
	6.0 - 7.0 mg Benzoic acid	
	6.0 - 7.0 mg Thermo Scientific Soil Ref. Mat.	
Sample weight:	50 - 70 mg for all soils except Sandy soil	
	220 - 250 mg for Sandy soil	

Note

The analytical parameters of method B are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.



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Soils

TOC determination

SOILS REFERENCE MATERIALS

Reference Material	Certify TOC %	Experimental TOC %	RSD%
Chalky Soil		3.338	
	3.30	3.332	0.10
		3.337	
Sandy Soil		0.757	
	0.76	0.755	0.20
		0.758	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
 Standard weight: 4.0 - 6.0 mg
 Sample weight: 40 - 100 mg for NC
 5.0 - 10 mg for TOC determination

Note

Set Oxygen Injection Time at 10 seconds.
 TOC determination was performed with the dedicated kit (p/n 190 04145).
 TOC % values are determined by *FlashSmart* EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)



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Soils

NC determination

SOILS REFERENCE MATERIALS (SANDY)

Certified Nitrogen and Carbon of Sandy Soil Reference Materia				
Reference Material Information		Specification		
	N%	Uncertainty (±)	C%	Uncertainty (±)
Sandy Soil	0.07	0.01	0.83	0.05

N%	Uncertainty (±)	C%	Uncertainty (±)
0.0662	1.0824	0.8162	0.8655
0.0652		0.8067	
0.0667		0.8301	
0.0673		0.8188	
0.0664		0.8154	
0.0662		0.8184	
0.0656		0.8171	
0.0656		0.8158	
0.0661		0.8301	
0.0649		0.8141	

Sample information

Standard:

Standard weight:

Sample weight for NC det.:

Aspartic acid

4.0 - 5.0 mg

200 - 250 mg

10.52 N%, 36.04 C%

Analytical - Classical

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Soils

CHN determination

SOILS REFERENCE MATERIALS (SANDY)

W (mg)	N%	RSD%	C%	RSD%	H %	RSD%
19.326	0.066		0.833		0.183	
16.183	0.068	1.73	0.865	1.91	0.185	0.83
16.221	0.066		0.845		0.182	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%, 5.30 H%
Standard weight:	3.0 - 4.0 mg	
Sample weight:	10 - 20 mg	

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- Urine
- Animal Hair

Blood - Hairs - Nails - Serum - Urine

Sulfur determination

BLOOD, HAIRS, NAILS, SERUM and URINE

Origin	Sample	S%
Healthy subject	Hairs	4.200 - 4.220
	Nails	2.200 - 2.210
	Blood	0.100 - 0.160
	Serum	0.075 - 0.085
	Urine	0.050 - 0.078
Children	Nails	2.600 - 3.000
	Hairs	4.340 - 4.400

Sample information

Standard:	BBOT*	7.44 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

Samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

Sulfur content is important in order to evaluate metabolism diseases or diet imbalances.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Enzymes Supernatants

Nitrogen determination

ENZYMES SUPERNATANTS

Sample	N%	RSD%
1	0.3105	0.0912
	0.3101	
2	0.3003	1.0517
	0.3048	
3	0.2947	0.0959
	0.2951	
4	0.0911	0.3870
	0.0916	
5	0.0869	1.9802
	0.0845	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 25 - 30 mg

Sample weight: 80 - 100 mg

Note

Samples were adsorbed on 30 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530).
Set the Oxygen Flow to 250 ml/min and the Oxygen Injection Time to 10 seconds.

Comment

Samples are supernatants from an *in vitro* incubation simulating the digestion in stomach and finally the small intestine.
The supernatants contain low concentration of digestive enzymes and microbial enzymes such as amylases, lipases and proteases.



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Keratin

CHNS/O determination

KERATIN

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
15.26		45.90		6.57		4.73		25.12	
15.28		45.93		6.58		4.73		25.19	
15.26	0.1421	45.83	0.1371	6.47	0.8378	4.72	0.1495	25.05	0.2117
15.23		45.78		6.47		4.74		25.16	
15.23		45.81		6.49		4.73		25.15	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Benzoic acid 26.20 O%

Standard weight: 2.0 - 2.5 mg BBOT* for CHNS
 1.0 - 2.0 mg Benzoic acid for
 oxygen determination

Sample weight: 1.0 - 2.0 mg

Note

The keratin sample was homogenized by a mortar.
 CHNS, standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
 Set the Oxygen Injection Time at 4 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Urine

Nitrogen determination

URINE

Sample	N%			
Urine	0.84	0.82	0.83	0.84

Sample information

Standard:	Urea Water Solution	1.0 N%
Standard weight:	50 - 100 µl	
Sample weight:	50 - 100 µl	

Note

The sample has been introduced using a liquid autosampler.



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Animal Hair

CHNS/O determination

ANIMAL HAIR

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
14.43	0.28	42.96	0.16	6.30	0.49	4.69	0.51	27.05	0.20
14.37		43.06		6.24		4.74		26.94	
14.32		42.98		6.31		4.70		26.91	
14.39		42.93		6.31		4.72		26.95	
14.38		43.09		6.27		4.68		27.00	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Sulfanilic acid 27.71 O%
 Standard weight: 1.0 - 1.5 mg
 Sample weight: 1.0 - 1.5 mg

Note

For CHNS determination, standards and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Ammonium Sulphate

Nitrogen and Sulfur determination

AMMONIUM SULPHATE

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
21.197				6.149		24.384		48.40	
21.231				6.181		24.208		48.44	
21.308	0.24	0.00	0.00	6.041	0.87	24.309	0.29	48.48	0.06
21.177				6.099		24.360		48.44	
21.207				6.134		24.262		48.45	

Sample information for CHNS determination

Standard: CEDFNI* 20.14 N%, 51.79 C%, 5.07 H%
Cystine 11.66 N%, 29.99 C%, 5.03 H%, 26.69 S%

Standard weight: 1.0 - 2.0 mg

Sample weight: 1.0 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%
Atropine 16.59 O%
BBOT** 7.43 O%

Standard weight: 0.7 - 0.8 mg

Sample weight: 0.4 - 0.5 mg

Note

Set Oxygen Injection Time at 2 seconds.

For CHNS Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone

**BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Ammonium Sulphate

CHNS/O determination

AMMONIUM SULPHATE

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	21.05	0.15			21.197	0.17
	21.06		-	-	21.231	
	21.11				21.308	
2	21.05	0.15			21.197	0.17
	21.06		-	-	21.231	
	21.11				21.308	
3	21.24	0.20			21.197	0.16
	21.16		-	-	21.231	
	21.18				21.308	

Sample information

Standard: Cystine 11.66 N%, 26.69 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 4.0 - 5.0 mg

Note

Set Oxygen Injection Time at 3 seconds.
 Three different ammonium sulfate batch were analyzed.
 Standards and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Carbides

Carbon determination

CARBIDES

Sample	Found C%	Calculated C%
Covalent carbide Al_4C_3	25.60	25.03
Covalent carbide SiC	29.88	29.96
Ionic carbide LaC_2	13.88	14.74
Ionic carbide BaC_2	14.38	14.89
Metallic carbide TaC	6.32	6.22
Metallic carbide ZrC	11.54	11.64
Metallic carbide NbC	11.21	11.45
Metallic carbide Mo_2C	5.87	5.89
Metallic carbide Cr_3C_2	13.31	13.34
Metallic carbide WC	6.16	6.13

Sample information

Standard:	Acetanilide	71.09 C%
Standard weight:	1.0 - 2.0 mg	
Sample weight:	0.5 - 2.0 mg	
Additive:	V_2O_5 (p/n 338 37510) or Pb_3O_4 (p/n 338 37540)	
Additive weight:	10 - 15 mg	

Note

Each value is the average of 5 runs.
Considering the high melting point of these materials, additives (Oxygen donors) such as V_2O_5 or Pb_3O_4 are highly recommended.

Comment

For their particular physical properties, carbides have been applied in various fields of technology.
The evaluation of the carbon content is of primary importance during the manufacture of materials for specific applications.



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Carbides

CHN determination

CARBIDES

Sample	N%	RSD%	C%	RSD%	H%	RSD%
PCS	-	-	38.85	0.24	8.34	0.16
			38.72		8.32	
			38.87		8.33	
			38.76		8.35	
			38.64		8.35	
SiC	-	-	30.21	0.31	1.05	0.67
			30.00		1.05	
			30.20		1.04	
			30.05		1.05	
			30.09		1.06	
SiC	0.251	0.83	32.64	0.15	0.252	0.73
	0.253		32.63		0.248	
	0.248		32.52		0.249	
	0.249		32.60		0.248	
	0.252		32.57		0.251	

Sample information for CHN determination

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
 Standard weight: 0.5 - 1.0 mg
 Sample weight: 0.5 - 0.8 mg

Note

Set the Oxygen Flow at 300 ml/min and Oxygen Injection Time at 8 seconds.
 Samples were homogenized by a ball mill and weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Carbides

NCS determination

SILICON CARBIDES

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.0489	0.77	21.49	0.15	0.127	0.45
	0.0496		21.55		0.128	
	0.0495		21.54		0.127	
2	4.50	0.45	14.53	0.35	0.0370	0.57
	4.53		14.57		0.0366	
	4.54		14.47		0.0369	
3	0.260	0.38	24.73	0.18	0.107	1.43
	0.261		24.82		0.108	
	0.262		24.78		0.105	

Sample information for CHN determination

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%

Standard weight: 1.0 - 2.0 mg

Sample weight: 0.7 - 1.0 mg

Note

Set Oxygen Injection Time at 5 seconds.

Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510) as follows:

- Tara of the tin container on the balance
- Addition of about 5 mg V_2O_5 , tara again on the balance
- Addition of about 0.7 - 1.0 mg of silicon carbide sample, take the proper weight in the balance
- Addition of about 5 mg V_2O_5
- Close the tin container

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Carbides

CHN determination

BORON CARBIDE

N%	RSD%	C%	RSD%	H%	RSD%
0.186	1.57	21.63	0.39	0.52	1.89
0.181		21.66		0.54	
0.186		21.50		0.53	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 0.5 mg

Note

Set Oxygen Injection Time at 5 seconds. Sample was weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510) as follows:

- Tara of the tin container on the balance
- Addition of about 5 mg V_2O_5 , tara again on the balance
- Addition of about 0.5 mg of boron carbide sample, take the proper weight in the balance
- Addition of about 5 mg V_2O_5
- Close the tin container



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Ferrosilicon

Carbon determination

FERROSILICON

C%	RSD%
0.0372	
0.0336	6.3342
0.0321	
0.0352	

Sample information

Standard:	Soil Reference Material	1.998 C%
Standard weight:	8.0 - 10 mg	
Sample weight:	30 - 100 mg	



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Inorganic Calcium Mixtures

CHN determination

INORGANIC CALCIUM MIXTURES, CaO - Ca(OH)_2 - SO_3

Sample	N%	RSD%	C%	RSD%	H%	RSD%
1	0.0035		1.0512		2.6016	
	0.0039	9.939	1.0596	1.1768	2.5982	0.6098
	0.0032		1.0353		2.6273	
2	0.0021		0.8660		1.0872	
	0.0018	8.660	0.8698	0.2762	1.0897	0.2725
	0.0021		0.8713		1.0838	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%

Standard weight: 2.0 - 3.0 mg

Sample weight: 10 - 20 mg

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Inorganic Compounds

CHNS determination

INORGANIC COMPOUNDS

Sample	N%	C%	H%	S%
BaSO ₄	0.138	0.125	0.136	13.854
	0.139	0.099	0.111	13.790
	0.138	0.136	0.116	13.875
BaSO ₄ / CaCO ₃ / KNO ₃ mixture	0.161	0.259	0.661	0.170
	0.148	0.269	0.595	0.154
	0.157	0.277	0.707	0.165

Sample information

Standard:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight:		2.0 - 3.0 mg
Sample weight:	BaSO ₄	1.0 - 2.0 mg
	Inorganic Mixture	4.0 - 5.0 mg

Note

Samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Inorganic Compounds

CH determination

INORGANIC COMPOUNDS

Sample	C%	RSD%	H%	RSD%
Zinc carbonate	3.816		1.070	
	3.806	0.3999	1.048	1.7003
	3.836		1.084	
Zinc oxide	1.233		0.564	
	1.225	0.3550	0.552	3.2436
	1.226		0.529	
Magnesium oxide	0.857		0.941	
	0.855	1.2964	0.955	2.8839
	0.837		0.903	

Sample information

Standard: Aspartic acid 36.09 C%, 5.30 H%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 10 - 30 mg

Note

TOC % values are determined by FlashSmart™ EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

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Inorganic Compounds

CHN determination

INORGANIC COMPOUNDS

Sample	N%	RSD%	C%	RSD%	H%	RSD%
Palladium on alumina 1			4.995		0.691	
	-	-	5.071	0.815	0.725	2.405
			5.008		0.711	
Palladium on alumina 2	0.8130		5.913		2.490	
	0.8500	2.403	5.894	0.285	2.451	0.915
	0.8450		5.879		2.450	
Nickel oxide on alumina 1	0.0594		3.856		0.789	
	0.0608	1.389	3.760	1.300	0.811	1.753
	0.0609		3.789		0.813	
Nickel oxide on alumina 2			6.153		0.691	
	-	-	6.033	1.776	0.700	0.679
			5.938		0.698	
Nickel oxide on alumina 3			4.139		0.613	
	-	-	4.201	1.338	0.621	0.818
			4.091		0.623	

Sample information

Standard:

Atropine

4.84 N%, 70.56 C%, 8.01 H%

Standard weight:

2.0 - 3.0 mg

Sample weight:

9.0 - 10 mg



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Inorganic Gypsum Mix

Total Carbon (TC) and Total Organic Carbon determination (TOC)

INORGANIC GYPSUM MIX

N.	Sample	C%	RSD%	H%	RSD%
1	Raw material calcium sulfate dehydrate + calcium sulfate	0.4908		0.0881	
		0.4878	0.3148	0.0887	1.5535
		0.4887		0.0861	
2	Calcium sulfate hemihydrate, clay, limestone, quartz, additives	2.1550		1.3686	
		2.1459	0.5322	1.3742	2.2268
		2.1687		1.3194	
3	Calcium carbonate, mica, talc, perlite, crystalline silica (quartz)	12.4292		1.9822	
		12.4431	0.0719	2.0574	1.9418
		12.4459		2.0399	

Sample information

Standard: Aspartic acid 36.09C%

Standard weight: 2.0 - 5.0 mg

Sample weight: For TC analysis 50 - 60 mg of sample 1 and 2 while 4 - 5 mg for sample 3
For TOC analysis, 6.0 - 8.0 mg for sample 1 and 2 while 2 - 3 mg for sample 3.

Note

Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 10 seconds.
TOC determination was performed with the dedicated kit (p/n 190 04120).



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Iron Sulfides

Sulfur determination

IRON SULFIDES

Sample	S%			
Pyrite	44.82	44.91	45.02	0.84
Pyrrolite	30.58	30.49	30.79	0.84

Sample information

Standard: Cystine 26.69 S%

Standard weight: 3.0 - 4.0 mg

Sample weight: 2.0 - 3.0 mg



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Minerals

CHN determination

ZEOLITE

N%	RSD%	C%	RSD%	H%	RSD%
0.0459		0.6869		1.3259	
0.0457	0.78	0.6860	0.98	1.3341	0.46
0.0464		0.6981		1.3223	

Sample information for CHN determination

Standard: Atropine 4.84 N%, 70.56 C%, 8.01 H%

Standard weight: 1.0 - 2.0 mg

Sample weight: 15 - 20 mg

Note

Set Oxygen Injection Time at 4 seconds.

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Minerals

NCS determination

CORUNDUM (Aluminium oxide and sulfanilic acid mixture)

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.0035	1.63	0.0620	1.32	0.0143	1.23
	0.0035		0.0636		0.0140	
	0.0036		0.0632		0.0140	
2	0.0091	0.63	0.0797	0.82	0.0295	0.98
	0.0092		0.0803		0.0300	
	0.0092		0.0790		0.0303	
3	0.0619	0.73	0.355	0.56	0.221	0.90
	0.0615		0.353		0.223	
	0.0624		0.357		0.225	
4	0.102	0.56	0.575	0.56	0.381	1.10
	0.103		0.576		0.373	
	0.102		0.581		0.379	
5	0.0044	1.88	0.0452	0.67	0.0211	0.48
	0.0046		0.0458		0.0209	
	0.0045		0.0456		0.0210	

Sample information

Standard:	Thermo Scientific Soil Reference Material	0.21 N%, 2.29 C%, 0.023 S%
	Thermo Scientific Pasta Reference Material	0.136 S%
Standard weight:	Thermo Scientific Soil Reference Material	15 - 20 mg
	Thermo Scientific Pasta Reference Material	3.0 - 4.0 mg
Sample weight:		15 - 20 mg

Note

Standards and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Phosphates/Sulphates Mixtures

CHNS/O determination

PHOSPHATES / SULPHATES MIXTURES

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
	9.101	0.17	0.266	2.86	1.148	0.80	11.62	0.30	23.10	0.15
	9.079		0.277		1.161		11.67		23.05	
	8.314	0.14	0.279	1.80	0.930	1.80	2.488	0.63	1.089	0.13
	8.331		0.272		0.954		2.466		1.091	
	10.311	0.23	0.272	1.31	1.108	0.38	21.744	0.10	30.28	0.28
	10.277		0.267		1.114		21.713		30.40	
	10.168	0.17	0.303	3.34	1.392	0.51	17.77	0.11	34.51	0.06
	10.144		0.289		1.382		17.79		34.54	

Sample information for CHNS determination

Standard: CEDFNI* 20.14 N%, 51.79 C%, 5.07 H%
 Cystine 11.66 N%, 29.99 C%, 5.03 H%, 26.69 S%

Standard weight: 1.0 - 2.0 mg

Sample weight: 1.0 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%
 Atropine 16.59 O% for samples 3 and 4,
 BBOT** 7.43 O% for sample 2
 CEDFNI 23 O% for sample 1

Standard weight: 0.7 - 0.8 mg

Sample weight: 0.4 - 0.5 mg

Note

Set Oxygen Injection Time at 2 seconds.
 CHNS Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

*CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone

** BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Steel

CHN determination

STEEL

Sample	ppm N	Std. Dev.	RSD%	ppm C	Std. Dev.	RSD%	ppm H	Std. Dev.	RSD%
1	52	0.0001	2.12	1250	0.0008	0.67	3.6	0.00002	4.38
	52			1250			3.6		
	49			1260			3.3		
	51			1240			3.5		
	49			1260			3.3		
2	1.0	0.00001	6.45	11	0.00004	3.99	3.9	0.00001	1.43
	0.9			11			3.8		
	1.0			11			3.8		
	1.1			11			3.9		
	1.0			12			3.8		

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 200 - 700 mg

Note

Large tin containers (p/n 252 08000) were used to weigh the samples.

*BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Sulfur Powder

Sulfur determination

SULFUR POWDER

REFERENCE MATERIAL (99.98 S%, ±0.30)		
S%	RSD%	
99.83	0.09	
99.98		
99.99		
99.81		
99.86		

Sample information for CHNS determination

Standard:	Cystine	26.69 S%
Standard weight:	2.5 - 3.0 mg	
Sample weight:	0.4 - 0.5 mg	

Note

Standard and sample were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Titanium

CHN determination

TITANIUM POWDER (Titanium grade 2)

N%	RSD%	C%	RSD%	H%	RSD%
0.0448	0.78	0.0492	1.11	0.0076	1.53
0.0452		0.0503		0.0074	
0.0455		0.0497		0.0076	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%

Standard weight: 1.8 - 2.0 mg

Sample weight: 20 mg

Note

Set the Oxygen Flow at 280 ml/min and Oxygen Injection Time at 4 seconds.

*BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Algae

CHNS determination

ALGAE

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
4.4654	0.1617	28.7541	0.5059	4.7493	0.2401	1.0274	2.9186
4.4552		28.5491		4.7332		1.0707	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 3.0 - 4.0 mg

Note

Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Algae

NCS determination

AGAROSE DRIED SEAWEED

Sample	DAY 1						DAY 2					
	N%	RSD%	C%	RSD%	S%	RSD%	N%	RSD%	C%	RSD%	S%	RSD%
4.4654	3.4327	0.8520	43.9364	0.2213	0.0791	1.6206	3.4445	0.6690	44.1584	0.2266	0.0759	3.2932
	3.4737		44.1283		0.0786		3.4909		44.0284		0.0799	
	3.4169		44.0621		0.0767		3.4679		43.9622		0.0752	
4.4654	0.3131	2.1118	47.2085	0.2945	0.0476	5.5921	0.3351	0.6995	47.0452	0.1129	0.0556	5.4002
	0.3141		46.9504		0.0533		0.3346		46.9396		0.0499	
	0.3023		46.9920		0.0521		0.3389		46.9833		0.0529	
4.4654	0.4344	1.7505	46.5956	2.0342	0.3719	2.0342	0.4514	0.5317	46.2315	0.1087	0.3763	1.2048
	0.4253		46.2845		0.3849		0.4558		46.3173		0.3746	
	0.4196		46.2679		0.3857		0.4519		46.3200		0.3832	

Sample information

Standard:
Standard weight:
Sample weight:

BBOT*
2.0 - 3.0 mg
3.0 - 4.0 mg

6.51 N%, 72.56 C%, 7.44 S%

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510). Samples were analyzed in two days to evaluate the reproducibility.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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CHNS/O determination

MARINE MICROALGAE (FREEZE DRIED BIOMASS FROM DIATOMACEOUS CROPS)

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
A	3.35	0.80	19.62	0.36	3.94	0.58	1.21	1.28	21.99	0.50
	3.30		19.48		3.98		1.19		21.86	
	3.31		19.57		3.98		1.18		21.77	
B	6.44	0.39	31.87	0.36	4.71	0.87	1.40	1.10	20.41	0.59
	6.42		31.68		4.79		1.37		20.55	
	6.47		31.89		4.77		1.38		20.31	
C	4.17	0.24	32.89	1.08	5.00	0.20	1.38	0.83	22.42	0.31
	4.16		32.19		4.98		1.40		22.31	
	4.15		32.58		4.99		1.38		22.44	
D	3.85	0.54	25.92	0.15	4.74	0.32	1.31	0.89	22.25	0.21
	3.82		25.88		4.71		1.29		22.34	
	3.81		25.96		4.72		1.31		22.31	
E	7.66	0.15	39.33	0.18	5.82	0.45	1.17	0.86	20.65	0.50
	7.68		39.44		5.83		1.15		20.46	
	7.66		39.31		5.87		1.16		20.49	
F	5.36	0.28	40.45	0.02	6.17	0.25	1.11	0.52	23.42	0.11
	5.37		40.46		6.14		1.11		23.43	
	5.39		40.47		6.15		1.10		23.38	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 3.0 - 4.0 mg

Sample information for Oxygen determination

Standard: Methionine 21.45 O%
 CEDFNI** 23.00 O%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
 Samples were analyzed in two days to evaluate the reproducibility.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

** CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone



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Sediments

CHNS and TOC determination

SEDIMENTS

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	TOC%	RSD%
0.15	0.000	4.58	0.097	0.54	1.555	0.755	0.151	2.2.15	0.000
0.15		4.59		0.53		0.752		2.15	
0.15		4.59		0.54		0.754		2.156	
0.15		4.59		0.55		0.753		2.15	
0.15		4.59		0.53		0.753		2.15	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 10 - 15 mg for CHNS
5.0 - 6.0 mg for TOC

Note

Set Oxygen Injection Time at 4 seconds.

For CHNS Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

TOC determination was performed with the dedicated kit (p/n 190 041 45).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Sediments

NC determination

SEDIMENTS

Sample	N%	RSD%	CThe %	RSD%
1			0.0106	
	-	-	0.0100	2.9757
			0.0102	
2	0.0282		0.8419	
	0.0283	0.3546	0.8312	0.7366
	0.0281		0.8313	
3 (Coastal)	0.0612		3.4320	
	0.0622	0.8153	3.3371	1.4827
	0.0618		3.3570	
4	0.1917		1.8368	
	0.1940	0.6899	1.8227	0.5425
	0.1917		1.8177	
5 (Stream)	0.6427		8.9137	
	0.6367	0.6430	8.8485	0.4548
	0.6446		8.9226	
6 (Lake)	0.7739		12.8951	
	0.7922	1.2636	12.8367	0.4714
	0.7897		12.7741	
7 (Reef)	0.0109		12.0334	
	0.0110	4.0737	11.9596	0.3628
	0.0102		11.9567	

Sample information

Standard:

Aspartic acid
Methionine
EDTA

10.52 N%, 36.09 C%
9.39 N%, 40.25 C%
9.59 N%, 41.15 C%

Standard weight:

5.0 - 6.0 mg

Sample weight for NC determination:

70 - 150 mg sample 1
50 - 100 mg samples 2 and 4
50 - 70 mg sample 3
15 - 20 mg samples 5 and 6
10 - 15 mg sample 7



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Sediments

Sulfur determination

SEDIMENTS

Sample	S%	RSD%	Sample	S%	RSD%	Sample	S%	RSD%
A	0.0854	1.15	F	0.1704	0.25	K	0.2191	0.64
	0.0868			0.1710			0.2211	
B	0.0934	0.61	G	0.2035	0.83	L	0.2344	0.85
	0.0926			0.2059			0.2316	
C	0.1136	1.19	H	0.2090	0.88	M	0.2355	0.39
	0.1117			0.2064			0.2342	
D	0.1133	0.00	I	0.2094	0.34	N	0.2494	0.66
	0.1133			0.2104			0.2471	
E	0.1314	0.81	J	0.2110	0.94	O	0.3235	0.11
	0.1299			0.2082			0.3230	

Sample information

Standard:

Standard weight:

Sample weight:

BBOT*

1.0 - 1.5 mg BBOT

5.0 - 6.0 mg

6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%

Note

The 0.80 m GC column (P/N 260 078009 installed into the oven at 60°C was used.

Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Marine Sediments

NC determination

MARINE SEDIMENTS

Sample	N%	RSD%	C%	RSD%
1	0.191	0.737	1.986	0.726
	0.193		1.966	
2	0.139	1.510	1.018	0.277
	0.142		1.022	
3	0.138	1.017	0.990	0.498
	0.140		0.997	
4	0.136	1.543	0.979	0.144
	0.139		0.981	

Sample information

Standard:

Aspartic acid

10.52 N%, 36.04 C%

Standard weight:

4.0 - 5.0 mg

Sample weight:

50 - 100 mg



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Marine Sediments

NC determination

MARINE SEDIMENTS

Sample	N%	RSD%	C%	RSD%
1	0.1641	1.18	1.9903	1.43
	0.1595		1.9153	
	0.1623		1.9466	
	0.1621		1.9464	
	0.1642		1.9684	
2	0.5031	0.18	5.3869	0.36
	0.5010		5.3560	
	0.5019		5.3751	
	0.5016		5.3961	
	0.5029		5.4063	

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%
Standard weight: 10 - 12 mg
Sample weight: 120 - 130 mg

Note

Set Oxygen Flow at 300 ml/min and Oxygen Injection Time at 10 seconds.

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Marine Sediments

NCS and TOC determination

MARINE SEDIMENTS

Sample	N%	RSD%	C%	RSD%	S%	RSD%	TOC%	RSD%
1	0.0664	0.52	0.7583	0.35	0.0368	1.38	0.7486	0.71
	0.0670		0.7635		0.0378		0.7498	
	0.0670		0.7601		0.0371		0.7590	
2	0.8943	0.22	9.8773	0.35	1.1723	0.72	8.7689	0.90
	0.8980		9.9216		1.1881		8.7114	
	0.8971		9.8533		1.1859		8.8676	

Sample information

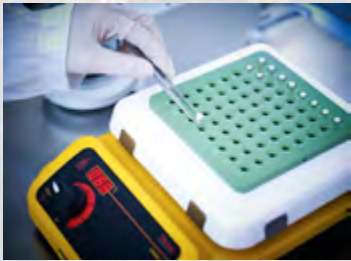
Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 10 - 15 mg for NC
8.0 - 10 mg for TOC

*BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene.

Note

TOC % values are determined by *FlashSmart* EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

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Marine Sediments

NCS determination

MARINE SEDIMENTS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.244	0.98	4.55	0.99	0.0451	1.00
	0.248		4.62		0.0458	
	0.246		4.58		0.0454	
	0.250		4.66		0.0462	
	0.245		4.56		0.0452	
2	0.0519	0.58	0.704	0.54	0.0117	0.71
	0.0524		0.710		0.0118	
	0.0525		0.712		0.0119	
	0.0522		0.707		0.0118	
	0.0518		0.703		0.0117	
3	0.326	0.64	5.61	0.71	0.0433	0.66
	0.325		5.59		0.0432	
	0.328		5.64		0.0436	
	0.329		5.66		0.0437	
	0.324		5.56		0.0430	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 10 - 15 mg

Note:

Set Oxygen Injection Time at 5 seconds.
Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

*BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene.



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Additives

CHNS determination

ADDITIVES

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	1.9279	0.8094	82.6353	0.1985	13.1922	0.1843		-
	1.9592		82.5659		13.1999		-	
	1.9409		82.3234		13.1545			
2	1.8012	0.2137	83.2566	0.2639	13.4322	0.3034		-
	1.8082		83.2203		13.4248		-	
	1.8019		83.6182		13.4989			
3	0.8321	1.5593	84.8515	0.0686	13.6535	0.0730	0.0221	4.1296
	0.8508		84.9292		13.6522		0.0240	
	0.8576		84.8153		13.6369		0.0232	
4	0.5358	1.4482	65.9378	0.1026	10.2275	0.1377	2.8994	0.3965
	0.5206		65.8302		10.2124		2.9202	
	0.5268		65.8132		10.1994		2.9185	
5	0.9247	0.6645	75.437	0.0991	11.9445	0.1948	2.9884	0.3180
	0.9296		75.2986		11.9065		2.9801	
	0.9174		75.3193		11.9487		2.9695	
6	0.9907	0.8415	70.7058	0.2959	11.2589	0.3116	3.4933	1.2457
	1.0056		70.5085		11.2487		3.5678	
	0.9915		70.9267		11.3140		3.5716	
7	0.5711	0.8502	68.0991	0.1024	10.7840	0.2597	4.1173	0.9732
	0.5710		68.0864		10.7619		4.1959	
	0.5795		67.9725		10.7285		4.1736	
8	0.9828	0.8622	50.6778	0.1469	9.0660	0.4119	31.6587	0.3663
	0.9976		50.8023		9.0866		31.7461	
	0.9829		50.6692		9.0142		31.5165	

Sample information

Standard:

BBOT*
Cystine
Nicotinamide

6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
11.66 N%, 29.99 C%, 5.03 H%, 26.69 S%
22.94 N%, 59.01 C%, 4.95 H%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Additives

NC determination

ADDITIVE FOR CEMENT

Water solutions				
Sample	N%	RSD%	C%	RSD%
A	0.0017	6.5360	0.2275	0.8981
	0.0019		0.2278	
	0.0017		0.2312	
B	0.0027	6.9282	0.2326	0.2607
	0.0024		0.2336	
	0.0024		0.2337	
C	0.0012	7.6923	0.2286	0.1156
	0.0013		0.2291	
	0.0014		0.2290	

Sample information

Standard: Urea Water Solutions
 Standard volume: 50 - 125 µl (according with the syringe)
 Sample volume: 50 - 125 µl (according with the syringe)

Note

The analyses can be performed using the Manual Injection Device (p/n 190 04138) or Thermo Scientific AI / AS 1310 Liquid Autosampler.
 The injection is at 8 seconds after the start.
 Set Oxygen Injection Time 3 seconds.



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ADHESIVE AND GLUE

Sample	N%	RSD%
Adhesive	0.1162	1.2691
	0.1131	
	0.1135	
	0.1157	
	0.1134	
Glue	0.0760	0.9116
	0.0767	
	0.0752	
	0.0770	
	0.0763	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 4.0 - 5.0 mg
Sample weight: 8.0 - 12 mg

Note

Set the Oxygen Flow at 300 ml/min and the Oxygen Injection Time at 10 seconds.

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Adhesive and Glue

NC determination

GLUE

Sample	N%	RSD%	C%	RSD%
1	33.561		23.425	
	33.581	0.255	23.464	0.213
	33.708		23.500	
	33.729		23.542	
2	24.598		23.336	
	24.458	0.679	22.899	1.758
	24.464		22.758	
	24.201		22.363	
3	25.261		23.309	
	25.091	0.341	23.312	0.619
	25.203		23.062	
4	22.131		22.042	
	22.267	0.394	22.279	0.536
	22.295		22.171	

Sample information

Standard: Nicotinamide 22.94 N%, 59.01 C%

Standard weight: 1.5 - 2.5 mg

Sample weight: 1.5 - 2.5 mg

Note

Set the analytical conditions for NC organic configuration: Oxygen Flow to 250 ml/min, Oxygen Injection Time 10 seconds, Sample Delay 12 seconds.



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Adhesive and Glue

NC determination

ADHESIVES (viscous)

Sample	N%	RSD%	C%	RSD%
1	26.04	0.14	22.26	0.18
	26.06		22.30	
	25.99		22.34	
2	27.37	0.22	22.51	0.25
	27.48		22.43	
	27.47		22.40	
3	24.45	0.11	22.95	0.29
	24.49		23.08	
	24.50		22.99	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Nicotinamide 22.94 N%, 59.01 C%

Standard weight: 18 - 20 mg
Sample weight: 20 - 25 mg

Note

Set the Oxygen Flow at 250 ml/min and Oxygen Injection Time at 10 seconds.
Samples were shaken before weighing in a single tin container. A 3 meters GC column (p/n 260 07931) is suggested.

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Adhesive and Glue

CHN determination

ADHESIVES (viscous)

Sample	N%	RSD%	C%	RSD%	H%	RSD%
1	26.06	0.08	22.27	0.09	7.63	0.20
	26.02		22.25		7.60	
	26.05		22.23		7.61	
2	27.52	0.14	22.45	0.14	7.33	0.21
	27.51		22.51		7.35	
	27.45		22.50		7.36	
3	24.51	0.07	23.02	0.21	7.29	0.28
	24.54		23.09		7.27	
	24.54		23.00		7.25	

Sample information

Standard: Nicotinamide 22.94 N%, 59.01 C%, 4.95 H%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 4.0 mg

Note

Set the Oxygen Flow at 250 ml/min and Oxygen Injection Time at 4 seconds.
Samples were shaken before weighing in a single tin container.

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Adhesive and Glue

NC determination

ADHESIVES MIXTURES

Sample	N%	RSD%	C%	RSD%
1	26.09	0.10	19.93	0.03
	26.14		19.93	
	26.10		19.94	
2	26.18	0.13	19.96	0.12
	26.22		19.92	
	26.25		19.96	
3	24.68	0.13	20.01	0.18
	24.73		20.08	
	24.67		20.06	
4	24.64	0.12	20.04	0.10
	24.59		20.02	
	24.64		20.00	

Sample information for NC determination

Standard: Imidazole 41.15 N%, 52.93 C%
 Standard weight: 4.0 - 5.0 mg
 Sample weight: 10 - 13 mg

Note

Set Oxygen Flow 250 ml/min and Oxygen Injection Time 10 seconds.
 3 m GC column (p/n 260 07931) was installed into the oven at 50 °C.
 Large tin containers (p/n 252 08000) were used to weigh the samples.



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Batteries

Carbon determination

BATTERIES - LiFePO₄

Sample	Weight (mg)	C %
100056 F60x-1	8.17	4.544
100056 F60x-2	8.53	4.596
100056 X601-1	8.92	7.573
100056 X601-2	8.64	7.523
100056 X601-3	8.64	7.398
CH1-1	8.16	5.299
CH1-2	8.14	4.825
CH1-3	8.16	4.813
CH4-1	8.45	5.162
CH4-2	9.29	5.109
CH4-3	9.29	4.941

Sample information

Standard:	Aspartic acid	36.09 C%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	8.0 - 10 mg	

Note

Set the Oxygen Injection Time to 4 sec.
Thanks to Joy Allied Technology, FLASH 2000 user.



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Batteries

Sulfur determination

BATTERIES - LEAD PASTE (PbSO_4 , PbO_2 , Pb) (Exhausted batteries)

Sample	S%	RSD%
A	6.23	0.43
	6.22	
	6.18	
B	1.67	0.92
	1.66	
	1.64	
C	7.18	0.29
	7.19	
	7.22	
D	0.778	0.97
	0.772	
	0.762	
E	1.74	0.67
	1.72	
	1.72	

Sample information

Standard:	BBOT*	7.44 S%
	Thermo Scientific Soil Reference Material	0.023 S%
Standard weight:	BBOT	1.8 - 2.2 mg
	Thermo Scientific Soil Reference Material	10 - 15 mg
Sample weight:	3.0 - 4.0 mg for sample A	
	4.0 - 5.0 mg for samples B and E	
	2.0 - 2.5 mg for sample C	
	5.0 - 6.0 mg for sample D	

Note

Set Oxygen Injection Time at 3 seconds.

Standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Bromine Products

CHN determination

BROMINE PRODUCTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%
DBNPA (C ₃ H ₂ ON ₂ Br ₂)*	11.50		15.07		0.82	
	11.49		15.06		0.83	
	11.49	0.073	15.04	0.089	0.82	0.544
	11.50		15.04		0.82	
	11.51		15.06		0.82	
SR 245 (C ₂₁ H ₆ Br ₉ N ₃ O ₃)**	3.90		23.87		0.54	
	3.90		23.73		0.54	
	3.90	0.281	23.75	0.266	0.54	0
	3.91		23.74		0.54	
	3.88		23.71		0.54	
CaBr ₂	0.0218					
	0.0220	0.909	-	-	-	-
	0.0222					
HBr	0.0339					
	0.0295					
	0.0315	5.582	-	-	-	-
	0.0336					
	0.0328					

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%

Standard weight: 3.0 - 4.0 mg

Sample weight: 3.0 - 4.0 mg

Note

The HBr sample was weighed in a single silver capsule (p/n 240 05400).

*DBNPA: 2,2-dibromo-3-nitrilopropionamide (11.58 N%, 14.90 C%, 0.83 H%)

**SR 245: 2,4,6-tris(2,4,6-tribromophenoxy)-1,3,5-triazine (3.94 N%, 23.63 C%, 0.57 H%)



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Catalysts

NC determination

CATALYSTS

Sample	N%	RSD%	C%	RSD%
1	0.0019		0.0802	
	0.0019	13.0721	0.0813	1.4765
	0.0015		0.0826	
2	0.0126		0.1010	
	0.0154	12.1941	0.1007	0.2498
	0.0125		0.1005	
3	0.0010		0.1270	
	0.0014	17.8429	0.1287	0.6840
	0.0011		0.1275	
4	0.0074		0.9788	
	0.0083	6.8559	0.9794	0.1562
	0.0084		0.9817	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Standard weight: 4.0 - 5.0 mg
Sample weight: 140 - 150 mg

Note

Samples were homogenized with a ball mill.
The configuration used is NC Soil with Oxygen Flow 250 ml/min and Oxygen Injection Time 10 seconds.

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CATALYSTS

Sample	S ppm		
Catalyst A	752	729	745
Catalyst B	322	301	315

Sample information

Standard:	White Cast Iron Std (BCR no.247/5)	0.167 S%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	25 - 30 mg	

Note

The catalyst samples are not homogeneous. The catalyst samples are platinum supported on aluminium oxide. The samples have been ground by homogenizer. Vanadium pentoxide (V_2O_5) (p/n 338 37510) has been added to sample (10 mg).

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Catalysts

NC determination

CATALYSTS

Sample	N%	RSD%	C%	RSD%
1	0.0039	5.24	0.0833	0.76
	0.0042		0.0842	
2	0.0049	2.83	0.3141	0.27
	0.0051		0.3129	
3	0.0044	1.63	0.3400	0.02
	0.0043		0.3399	
4	0.0030	6.73	0.2909	0.19
	0.0033		0.2901	
5	0.1402	1.69	0.3202	0.07
	0.1436		0.3199	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Standard weight: 3.0 - 4.0 mg
Sample weight: 10 - 15 mg

Note

Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 4 seconds.



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Catalysts

NCS determination

CATALYSTS (POISONED)

Sample	C%	S%
New Mo/Bauxite	0	3.0
Aqed Mo/Bauxite	11.25	4.15
New W/Bauxite	0	4.10
Aged W/Bauxite	11.80	4.10
New Ni Mo/Bauxite	0	2.1
Aged Ni Mo/Bauxite	11.9	4.7
New CoMo/Bauxite	0	2.6
Aged CoMo/Bauxite	12.2	4.25
New NiW/Bauxite	0	2.8
Aged NiW/Bauxite	11.4	4.6

Sample information

Standard: BBOT* 72.53 C%, 7.44 S%
Standard weight: 3.0 - 5.0 mg
Sample weight: 10 - 25 mg

Note

Vanadium pentoxide (V₂O₅) (p/n 338 37510) has been added to sample (10 mg).

Comment

The poisoning of catalysts is a very important phenomenon in catalysis science and technology. These examples (hydrotreating catalyst) show that C and S are the most important elements to investigate on poisoning effects.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Catalysts

CHNS determination

CATALYSTS (POISONED)

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Catalyst 1	0.0113		1.4570		2.9898		0	
	0.0107	4.0916	1.4568	0.1585	2.9608	0.4876	0	0
	0.0116		1.4609		2.9745		0	
Catalyst 2	0.0070		0.1653		1.1645		0.4076	
	0.0067	4.4776	0.1663	1.7158	1.1542	0.5522	0.4089	1.2526
	0.0064		0.1707		1.1528		0.4171	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 15 - 20 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Catalysts

CHNS determination

CATALYSTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
A	0.0269		0.4230		0.3240		0.0621	
	0.0269		0.4294		0.3307		0.0631	
	0.0263		0.4262		0.3186		0.0631	
	0.0274	3.6598	0.4347	1.0459	0.3171	2.7223	0.0635	4.2372
	0.0290		0.4272		0.3365		0.0603	
	0.0269		0.4298		0.3179		0.0585	
	0.0259		0.4214		0.3377		0.0669	
B	0.0644		0.3715		0.8346		28.3499	
	0.0631		0.3712		0.8332		28.3335	
	0.0638		0.3713		0.8336		28.3843	
	0.0649	2.9700	0.3719	1.5579	0.8322	0.7969	28.3625	0.1908
	0.0675		0.3868		0.8314		28.3649	
	0.0612		0.3707		0.8155		28.2395	
	0.0643		0.3759		0.8313		28.4094	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Cystine 11.66 N%, 29.99 C%, 5.03 H%, 26.69 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 8.0 - 10 mg for sample A
 2.0 - 2.5 mg for sample B

Note

Samples were homogenized by a ball mill.
 Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Catalysts

Carbon determination

CATALYSTS

Sample	C%	RSD%
A	3.8252	0.1720
	3.8126	
	3.8157	
B	0.0329	1.9384
	0.0342	
	0.0336	

Sample information

Standard: Aspartic acid 36.04 C%
Standard weight: 4.0 - 5.0 mg
Sample weight: 50 - 60 mg

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Catalysts

CH/O determination

CATALYSTS

Sample	C%	RSD%	H%	RSD%	O%	RSD%
1	22.52		1.31		26.33	
	22.55	0.25	1.32	1.15	26.33	0.04
	22.44		1.34		26.35	
2	22.68		1.46		25.37	
	22.69	0.04	1.46	0.39	25.29	0.17
	22.70		1.47		25.30	
3	22.62		1.33		26.44	
	22.59	0.13	1.32	0.76	26.43	0.10
	22.65		1.31		26.48	

Sample information for CHN determination

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
 Standard weight: 3.0 - 4.0 mg
 Sample weight: 3.0 - 4.0 mg

Sample information for Oxygen determination

Standard: Benzoic acid 26.20 O%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

Set the Oxygen Injection Time at 4 seconds.



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Catalysts

CHNS/O determination

CATALYSTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	22.52		1.31		26.33		22.52		22.52	
	22.55	0.25	1.32	1.15	26.33	0.04	22.55	0.25	22.55	0.25
	22.44		1.34		26.35		22.44		22.44	

Sample information for CHNS determination

Standard:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
	Aspartic acid	10.52 N%, 36.09 C%, 5.30 H%
Standard weight:	BBOT	3.0 - 4.0 mg
	Aspartic acid	2.0 - 3.0 mg
Sample weight:	9.0 - 10 mg	

Sample information for Oxygen determination

Standard:	BBOT	7.43 O%
	Aspartic acid	48.08 O%
Standard weight:	1.0 - 2.0 mg	
Sample weight:	1.0 - 2.0 mg	

Note

Set the Oxygen Injection Time at 4 seconds. Sample was homogenized by a ball mill and analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Catalysts

CHN/O determination

CATALYSTS

N%	RSD%	C%	RSD%	H%	RSD%	O%	RSD%
-		3.78		0.54		3.34	
	-	3.78	0.15	0.54	0.00	3.29	0.76
		3.77		0.54		3.32	

Sample information for CHN determination

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
Standard weight: 3.0 - 4.0 mg
Sample weight: 9.0 - 10 mg

Sample information for Oxygen determination

Standard: BBOT* 7.43 O%
Standard weight: 1.0 - 2.0 mg
Sample weight: 1.0 - 2.0 mg

Note

For CHN determination, set the Oxygen Flow at 250 ml/min and Oxygen Injection Time at 4 seconds.
Sample was homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Catalysts

CHNS determination

CATALYSTS - USED HYDROTREATMENT CATALYST

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
0.0321	1.01	2,85	0.16	0.368	0.81	10.76	0.19
0.0317		2,85		0.364		10.78	
0.0322		2.84		0.361		10.73	
0.0321		2.85		0.368		10.77	
0.0314		2.85		0.366		10.74	

Sample information for CHNS determination

Standard: Sulfanilic acid 8.09 N%, 41.61 C%, 4.07 H%, 18.51 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510). The sample containing aluminium oxide, molybdenum and nickel was homogenized by a ball mill.

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Cement - Shale

Sulfur determination

CEMENT - SHALE

Sample	S%		
Cement	1.82	1.85	1.81
Shale	0.93	0.95	0.95

Sample information

Standard: BBOT* 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 6.0 mg

Note

BBOT and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Ceramics

CHN determination

CERAMICS

Sample	N%		C%		H%	
A	5.51	5.49	0.15	0.13	0.02	0.02
B	32.57	32.71	0.34	0.31	0.04	0.05
C	54.80	55.18	0.37	0.33	0.07	0.06
D	37.49	37.68	0.15	0.19	0.04	0.05

Sample information

Standard:	Acetanilide	10.36 N%, 71.09 C%, 6.71 H%
Standard weight:	1.0 - 2.0 mg	
Sample weight:	10 - 15 mg	
Additive:	Pb ₃ O ₄	
Additive weight:	10 - 15 mg	

Note

Considering refractoriness of these materials, additives such as Pb₃O₄ (Oxygen donors) (p/n 338 37540) are highly recommended.



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DYES (SULPHONATED COPPER PHTHALOCYANINE DYES)

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	11.444		36.095		2.457		10.947	
	11.450	0.0754	36.010	0.1386	2.418	0.8006	10.993	0.2221
	11.433		36.007		2.439		10.984	
2	14.130		34.403		2.651		11.684	
	14.130	0.0490	34.435	0.0465	2.685	0.6508	11.629	0.2375
	14.118		34.419		2.662		11.662	
3	14.103		40.045		3.474		11.112	
	14.119	0.0929	40.045	0.0274	3.427	0.9887	11.093	0.1015
	14.129		40.064		3.408		11.113	

Sample information

Standard: Sulfanilamide 16.27 N%, 41.84 C%, 4.68 H%, 18.62 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

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Dyes and Pigments

CHNS determination

DYES - RUTHENIUM POLYPYRIDYL COMPLEXES

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
8.478 8.856	0.681	56.354 56.517	0.204	7.462 7.447	0.142	4.601 4.725	1.880

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 1.0 - 1.5 mg
 Sample weight: about 1.0 mg

Note

Set the Oxygen Injection Time at 4 seconds.
 Standard and sample were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

The sample is used as sensitizer dyes.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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PIGMENTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%
1	9.32		68.98		3.76	
	9.31	0.2845	68.98	0.1839	3.76	0
	9.27		69.20		3.76	
2	8.68		67.29		3.55	
	8.64	0.3533	67.29	0.0944	3.52	0.4907
	8.62		67.18		3.52	

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

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Fiber

Nitrogen determination

FIBER

N%	RSD%
0.259	
0.254	
0.258	0.8050
0.258	
0.259	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	30 - 35 mg	
Sample weight:	40 - 50 mg	

Note

Configuration used is FlashSmart™ EA N/Protein, Oxygen Injection Time 20 seconds.



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Fiber

Nitrogen determination

ABSORBENT FIBERS

Sample	N%	RSD%	Sample	N%	RSD%
1	0.389	0.51	3	0.548	0.11
	0.387			0.549	
	0.391			0.548	
2	0.571	0.35	4	0.289	0.34
	0.569			0.290	
	0.567			0.291	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 200 - 250 mg

Note

Set Oxygen Flow 300 ml/min and Oxygen Injection Time 30 seconds for standard and samples.
The 1 m GC column (p/n 260 70004) was used for the analysis.
Large tin containers (p/n 252 08000) were used to weigh the samples.

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Flame Retardants

CHNS determination

FLAME RETARDANTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.0209		33.6773		6.9306		0.0728	
	0.0201		33.5769		6.9723		0.0731	
	0.0207	1.9653	33.5769	0.1389	6.9739	0.2707	0.0738	0.5058
	0.0207		33.5596		6.9724		0.0731	
	0.0200		33.6065		6.9524		0.0731	
2	0.0206		35.3056		7.3965		0.2253	
	0.0204		35.2701		7.4714		0.2257	
	0.0194	4.4672	35.0210	0.3299	7.4224	0.4136	0.2584	6.3367
	0.0201		35.1292		7.4529		0.2246	
	0.0219		35.1303		7.4609		0.2266	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Foam

CHNS determination

FOAM

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1.6204		46.7941		6.6563		0.4715	
1.6586		46.6162		6.6861		0.4807	
1.6475	0.9280	46.6347	0.2274	6.6641	0.1822	0.4793	0.9205
1.6455		46.6436		6.6639		0.4798	
1.6568		46.4962		6.6785		0.4725	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Fungicides

CHNS determination

FUNGICIDES

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Thiram Analytical	11.67		30.45		5.02		54.23	
	11.81		30.38		5.08		54.10	
	11.65	0.704	30.40	0.122	5.06	0.551	54.09	0.141
	11.82		30.47		5.09		54.22	
	11.80		30.44		5.08		54.25	
Thiram Technical	11.53		30.74		5.03		53.28	
	11.54		30.82		5.10		53.10	
	11.54	0.339	30.79	0.096	5.10	0.666	53.35	0.198
	11.48		30.77		5.11		53.33	
	11.59		30.77		5.11		53.35	
Thiram WG	9.71		31.96		4.83		44.23	
	9.74		31.95		4.92		44.22	
	9.69	0.573	31.98	0.173	4.88	0.999	44.24	0.178
	9.81		31.91		4.81		44.20	
	9.81		31.84		4.81		44.05	

Sample information

Standard: Cystine 11.66 N%, 29.99 C%, 5.03 H%, 26.69 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).



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Glass Fiber

CHS determination

GLASS FIBER

Sample	C%	H%	S%
Glass Fiber	0.4045	0.0383	0.0766
	0.4033	0.0414	0.0952
	0.4161	0.0468	0.0875
	0.4078	0.0382	0.0808

Sample information

Standard: BBOT* 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 1.0 - 1.5 mg

Sample weight: 3.0 - 4.0 mg

Note

BBOT and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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High Carbon Contents

CHNS determination

GRAPHITE CATHODES

Sample	N%	C%	H%	S%
1095	1.081	79.148	0.658	0.666
	1.040	78.590	0.566	0.725
	1.056	78.703	0.591	0.712
PL 90	1.083	76.020	2.032	0.658
	1.087	75.856	2.071	0.659
Electrode	0.077	80.159		0.131
	0.102	80.310		0.153
	0.092	80.379		0.100
Graphite Alpha		97.395		
		97.477		
		97.708		

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

Samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Set the analytical conditions for CHNS: Oxygen Flow 300 l/min, Oxygen Injection Time 10 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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High Carbon Contents

Carbon determination

GRAPHITE SAMPLES

Sample	A	B	C	D	E	F	G	H
C%	99.85	98.67	92.06	92.99	95.99	94.78	92.94	97.40
	99.77	98.85	92.31	92.92	95.99	95.03	93.65	97.48
	99.72	98.78	92.48	92.91	96.07	95.51	93.69	97.71

Sample information

Standard: Anthracene 94.34 C%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Set Oxygen Flow to 300 ml/min and Oxygen Injection Time to 10 seconds.

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High Carbon Contents

CHN determination

GRAPHITE

Sample	N%	RSD%	C%	RSD%	H%	RSD%
1	0.0483	0.43	99.24	0.07	< 100 ppm	-
	0.0482		99.08			
	0.0482		99.17			
	0.0487		99.11			
	0.0483		99.10			
2	0.0407	0.36	99.40	0.05	< 100 ppm	-
	0.0405		99.51			
	0.0409		99.45			
	0.0408		99.43			
	0.0407		99.53			

Sample information for CHN determination

Standard: Tocopherol nicotinate 2,61 N%, 78.46 C%, 9.97 H%
Standard weight: 1.8 - 2.2 mg
Sample weight: 1.5 - 2.0 mg

Note

Set the Oxygen Flow at 300 ml/min and Oxygen Injection Time at 10 seconds.

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High Carbon Contents

Carbon determination

GRAPHENE

Sample	C%	Average C %	RSD%
1	99.88	99.89	0.10
	99.91		
	99.72		
	99.99		
	99.96		
2	99.94	99.89	0.13
	99.97		
	99.66		
	99.96		
	99.90		

Sample information

Standard: Acetanilide 71.09 C%
Standard weight: 2.0 - 3.0 mg
Sample weight: 1.0 mg

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 15 sec.

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High Carbon Contents

CHN determination

GRAPHENE

Sample	N%	RSD%	C%	RSD%	H%	RSD%
1	0.827	0.53	95.347	0.03	0.250	1.07
	0.819		95.289		0.246	
	0.820		95.332		0.245	
2	0.191	0.53	96.643	0.10	0.960	0.39
	0.190		96.777		0.953	
	0.189		96.826		0.959	

Sample information for CHN determination

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 0.9 - 1.0 mg

Note

Set Oxygen Flow at 300 ml/min and Oxygen Injection Time at 15 seconds.
 Sample was homogenized by a ball mill.



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High Carbon Contents

Oxygen determination

GRAPHENE

Sample	O%	RSD%
1	1.24	0.80
	1.25	
	1.26	
2	1.40	0.41
	1.40	
	1.39	

Sample information

Standard: BBOT* 7.43 O%

Standard weight: 0.5 - 0.6 mg

Sample weight: 0.5 - 0.6 mg

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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High Carbon Contents

CHN determination

GRAPHENE

N%	RSD%	C%	RSD%	H%	RSD%
0.112	1.35	99.29	0.11	0.0226	1.58
0.113		99.22		0.0219	
0.115		99.07		0.0213	

Sample information for CHN determination

Standard:	Polystyrene	91.95 C%, 7.84 H%
	Thermo Scientific Soil Reference Material	0.21 N%, 2.29 C%
Standard weight:	Polystyrene	2.0 - 3.0 mg
	Thermo Scientific Soil Reference Material	10 - 15 mg
Sample weight:	1.5 - 1.8 mg	

Note

Sample was dried at 110°C. Set Oxygen flow at 300 ml/min and Oxygen Injection Time at 10 seconds.

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High Carbon Contents

CHN determination

POROUS CARBON

Sample	N%	RSD%	C%	RSD%	H%	RSD%
1	0.177	0.33	97.34	0.08	0.114	0.87
	0.177		97.20		0.116	
	0.178		97.22		0.115	
2	0.0929	0.76	85.32	0.12	1.43	0.40
	0.0935		85.52		1.44	
	0.0921		85.42		1.43	

Sample information

Standard: Tocopherol nicotinate 2,61 N%, 78.46 C%, 9.97 H%
Standard weight: 1.8 - 2.2 mg
Sample weight: 1.0 - 2.5 mg

Note

Set the Oxygen Flow at 300 ml/min and Oxygen Injection Time at 10 seconds.

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High Carbon Contents

CHNS/O determination

CARBON FIBERS

	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
A	1.22		93.16		4.07		0.13		1.30	
	1.23	0.472	93.20	0.101	4.06	0.377	0.14	7.692	1.33	1.322
	1.22		93.34		4.04		0.12		1.30	
B	1.20		91.50		3.93		0.17		2.80	
	1.18	0.968	91.49	0.110	3.97	0.527	0.16	3.535	2.84	1.088
	1.20		91.67		3.94		0.16		2.78	
C	1.18		89.85		3.60		0.15		5.38	
	1.18	0.491	89.86	0.049	3.58	0.855	0.14	3.936	5.34	0.388
	1.17		89.78		3.54		0.15		5.37	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%, 7.43 O%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

In order to get more precise data for C%, it is recommended to calibrate with a high C content substance, such as anthracene (94.3 C%).
Samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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High Carbon Contents

NCS determination

CARBON FIBERS

Sample	N%			C%			S%		
1	1.14	1.13	1.13	86.71	86.74	86.63	0.17	0.18	0.17
2	1.22	1.24	1.25	92.24	92.07	92.33	0.19	0.20	0.21

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

Vanadium pentoxide (V_2O_5) (p/n 338 37510) has been added to sample (10 - 15 mg).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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High Carbon Contents

CHN determination

CARBON FIBERS

Sample	N%	RSD%	C%	RSD%	H%	RSD%
1	20.746		60.077		3.611	
	21.236	1.282	60.103	0.134	3.422	2.532
	21.288		60.020		3.473	
	21.326		59.921		3.427	
2	6.254		91.426		0.362	
	6.376	1.024	91.946	0.291	0.335	4.155
	6.353		91.584		0.340	

Sample information

Standard:

Nicotinamide
Anthracene22.94 N%, 59.01 C%, 4.95 H%
94.34 C%, 5.66 H%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg



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High Carbon Contents

CHNS/O determination

CARBON FIBERS

	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	0.2642		89.7354		0.8072		0.1483		7.3561	
	0.2682	0.8992	90.4785	0.4139	0.7961	0.7032	0.1418	2.2773	7.3995	0.3502
	0.2685		90.1653		0.8034		0.1441		7.3536	
2	0.5011		90.8000		0.2884		0.2817		4.5824	
	0.5034	0.5902	91.3435	0.3477	0.2924	0.8518	0.2780	1.1888	4.5087	0.8298
	0.5070		90.7914		0.2879		0.2751		4.5598	
3	0.0299		98.4037		0.0267		0.0641		0.2654	
	0.0311	2.7602	98.9710	0.2967	0.0279	4.4944	0.0611	2.3962	0.2679	1.0382
	0.0295		98.8140		0.0255		0.0626		0.2624	

Sample information

Standard for CHNS analysis:	Nicotinamide	22.94 N%, 59.01 C%, 4.95 H%
	Anthracene	94.34 C%, 5.66 H%
Standard for Oxygen analysis:	Acetanilide	11.84 O%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	2.0 - 3.0 mg	

Note

CHNS analysis, samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

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High Carbon Contents

CHNS determination

CARBON FIBERS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.0436		99.4227					
	0.0456	2.2943	99.0317	0.1970	< 100 ppm	-	-	-
	0.0450		99.2227					
2	3.7880		93.6306		0.3133		0.0324	
	3.7667	1.0406	93.2411	0.2324	0.3290	2.9233	0.0359	5.1544
	3.8433		93.6027		0.3125		0.0339	

Sample information

Standard: BBOT* 6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 1.8 - 2.2 mg

Note

Set the Oxygen Flow to 280 ml/min and the Oxygen Injection Time to 13 sec.
Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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High Carbon Contents

CHNS/O determination

CARBON FIBERS

Sample	N%	RSD%	C%	RSD%	O%	RSD%
1	0.0411		97.94		0.0652	
	0.0417	0.67	97.72	0.14	0.0672	2.40
	0.0413		97.84		0.0641	
2	0.0394		98.93		0.0402	
	0.0395	0.82	98.71	0.08	0.0396	1.23
	0.0389		98.67		0.0393	
3	0.0424		98.76		0.0475	
	0.0425	0.62	98.71	0.06	0.0490	1.73
	0.0429		98.83		0.0490	
4	0.0429		99.75		0.0706	
	0.0456	3.06	99.86	0.08	0.0708	1.39
	0.0441		99.71		0.0690	

Sample information for NC determination

Standard: BBOT* 6.51 N%, 72.53 C%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%
Standard weight: 1.0 - 2.0 mg
Sample weight: 1.0 mg

Note

Set Oxygen Flow at 300 ml/min and Oxygen Injection Time at 13 seconds.
NCS configuration was used for NC determination

*BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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High Carbon Contents

Sulfur determination

CARBON NANOTUBES

Sample	ppm S	Average ppm S	RSD%
1	609	625	3.620
	641		
2	652	641	2.539
	629		
3	3391		
	3221	3342	3.144
	3413		
4	1263	1282	2.096
	1301		

Sample information

Standard:

Thermo Scientific Soil Reference Material

320 ppm S

Standard weight:

0.5 - 6.0 mg

Sample weight:

0.2 - 1.5 mg

Note

The samples have been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

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IONIC LIQUIDS

Sample	S%	RSD%
Ionic liquid 1	13.663	0.845
	13.536	
	13.385	
	13.431	
	13.416	
Ionic liquid 2	11.004	0.467
	10.968	
	11.062	
	11.061	
	10.951	

Sample information

Standard: Sulfanilamide 18.62 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 1.5 - 3.0 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510). Ionic liquid samples were weighed in the double tin container (p/n 240 06400).



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Latex

CHN determination

LATEX

Sample	N%	RSD%	C%	RSD%	H%	RSD%
1	0.425		52.018		11.382	
	0.438	3.081	52.392	0.920	11.696	1.438
	0.452		52.976		11.448	
2	0.213		50.793		11.367	
	0.219	1.764	51.356	0.867	11.358	0.285
	0.212		51.670		11.307	
3	0.222		55.965		11.293	
	0.215	1.654	55.480	0.491	11.471	0.898
	0.217		55.504		11.470	
4	0.237		58.853		11.411	
	0.221	3.987	58.317	0.592	11.122	1.649
	0.237		58.634		11.472	

Sample information

Standard: Atropine 4.84 N%, 70.56 C%, 8.01 H%
Standard weight: 2.0 - 3.0 mg
Sample weight: 1.0 - 2.0 mg

Note

Samples were shaken and weighed in the double tin container.

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Latex

Nitrogen determination

LATEX

N%	RSD%
1.74	0.71
1.75	
1.76	
1.76	
1.76	
1.76	
1.77	
1.77	
1.78	
1.78	

Sample information

Standard: Acetanilide 10.36 N%
Standard weight: 20 - 25 mg
Sample weight: 100 - 150 mg
adsorbed on about 40 mg of Chromosorb WAW (30 - 60 mesh)
(p/n 338 37530)

Note

Set Oxygen Flow at 300 ml/min and Oxygen Injection Time at 20 seconds.
Samples were cut in small pieces.

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Monomers and Polymers

Total Carbon (TC) and Total Organic Carbon determination (TOC)

POLYMERS - POLYOLEFINES WITH CALCIUM CARBONATE

TC%	RSD%	TOC%	RSD%
50.4572	0.0343	49.54	0.2309
50.4817		49.52	
		49.79	
		49.61	
		49.71	

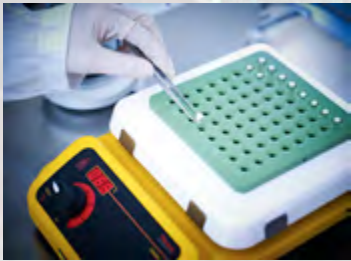
Sample information

Standard:	Acetanilide	71.09 C%
Standard weight:	2.0 - 3.0 mg	
Sample weight:	2.0 - 4.0 mg	

Note

Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 5 seconds.
TOC determination was performed with the dedicated kit (p/n 190 04120).
TOC % values are determined by FlashSmart™ EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

Analytical - Classical

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Monomers and Polymers

Nitrogen determination

POLYMERS - NITROGEN CONTAINING COMPOUNDS IN POLYETHYLENE

Sample	N%	RSD%
1	0.9237	0.3774
	0.9297	
	0.9236	
2	0.7248	0.2434
	0.7251	
	0.7280	
3	0.5414	0.3898
	0.5426	
	0.5385	
4	0.3477	0.5709
	0.3504	
	0.3516	
5	0.0272	0.2125
	0.0272	
	0.0271	
6	0.0187	2.9425
	0.0187	
	0.0187	
	0.0188	
	0.0186	
	0.0183	
	0.0174	
	0.0176	
	0.0183	
	0.0176	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 4.0 - 5.0 mg
Sample weight: 10 - 12 mg

Note

Set Oxygen Flow to 300 ml/min and Oxygen Injection Time to 10 seconds.



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Monomers and Polymers

Nitrogen determination

POLYMERS

Sample	N%	RSD%
Polymer 1	3.5060	0.0897
	3.5020	
	3.4998	
Polymer 2	0.0434	4.3647
	0.0421	
	0.0398	
Polymer 3	3.8895	0.5330
	3.8549	
	3.8918	
Polymer 4	0.0439	2.3000
	0.0427	
	0.0447	
Polymer 5	0.0967	0.2064
	0.0971	
	0.0969	
Polymer 6	0.0091	1.1111
	0.0089	
	0.0090	
Polymer 7	0.0527	3.9346
	0.0570	
	0.0546	
Polymer 8	1.4714	0.3685
	1.4617	
	1.4707	
Raw Material 1	18.1409	0.0224
	18.1357	
	18.1437	
Raw Material 2	19.6389	0.0870
	19.6307	
	19.6061	
Raw Material 3	13.4139	0.0387
	13.4068	
	13.4169	
Raw Material 4	2.2418	0.5692
	2.2406	
	2.2192	

Sample information

Standard:	Atropine	4.84 N%
	Acetanilide	10.36 N%
	Nicotinamide	22.94N%
Standard weight:	5.0 - 6.0 mg Atropine	
	10 - 15 mg Acetanilide	
	30 - 32 mg Nicotinamide	
Sample weight:	30 - 40 mg	



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POLYMERS - CAOUTCHOUC

Sample 1		Sample 2		Sample 3	
N%	RSD%	N%	RSD%	N%	RSD%
8.60	0.10	8.29	0.14	10.55	0.12
8.60		8.31		10.56	
8.60		8.27		10.54	
8.61		8.28		10.53	
8.62		8.27		10.54	
8.60		8.29		10.53	
8.61		8.28		10.53	
8.61		8.28		10.56	
8.62		8.28		10.54	
8.62		8.29		10.56	

Sample information

Standard: Acetanilide 0.36 N%
Standard weight: 50 - 60 mg
Sample weight: 50 - 60 mg

Note

Set Oxygen Flow at 300 ml/min and Oxygen Injection Time at 40 seconds.
Samples were cut in small pieces.

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Monomers and Polymers

Nitrogen determination

POLYMERS

Sample	N%	RSD%
1	0.1103	0.87
	0.1087	
	0.1104	
2	0.2082	1.10
	0.2114	
	0.2127	
3	0.2440	0.77
	0.2476	
	0.2468	
4	0.0482	1.75
	0.0499	
	0.0493	
5	0.2391	0.31
	0.2402	
	0.2405	

Sample information

Standard: Atropine 4.84 N%

Standard weight: 25 - 30 mg
120 - 130 mg samples 1, 2, 3

Sample weight: 90 - 100 mg samples 4, 5

Note

Set the Oxygen Flow at 300 ml/min and the Oxygen Injection Time at 40 seconds for samples 1, 2 and 3, and 50 seconds for samples 4 and 5.

Use 1 meter GC column (p/n 260 70004) installed outside the oven.



Analytical - Classical

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Monomers and Polymers

CHN/O determination

POLYMERS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	O%	RSD%
1	21.69	0.14	45.35	0.08	5.86	0.26	25.70	0.24
	21.66		45.28		5.84		25.81	
	21.72		45.31		5.87		25.80	
2	10.34	0.46	59.92	0.07	6.85	0.30	22.67	0.19
	10.25		59.85		6.82		22.59	
	10.32		59.85		6.81		22.60	
3	21.64	0.20	43.67	0.16	6.34	0.00	21.96	0.26
	21.58		43.57		6.34		21.88	

Sample information for CHN determination

Standard: Nicotinamide 22.94 N%, 59.01 C%, 4.95 H%
Standard weight: 1.0 - 2.0 mg
Sample weight: 1.0 - 2.0 mg

Sample information for Oxygen determination

Standard: Benzoic acid 26.20 O%
Standard weight: 0.4 - 0.7 mg
Sample weight: 0.4 - 0.6 mg

Note

For CHN determination, set the Oxygen Flow at 250 ml/min and Oxygen Injection Time at 4 seconds.

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Monomers and Polymers

CHNS determination

POLYMERS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	0.0471	0.54	52.56	0.13	7.30	0.21	1.33	0.37
	0.0469		52.67		7.31		1.34	
	0.0466		52.55		7.28		1.34	
2	0.0331	0.80	52.53	0.13	7.31	0.08	1.30	0.62
	0.0327		52.58		7.30		1.32	
	0.0332		52.67		7.30		1.32	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 3.5 mg

Note

Set the Oxygen Flow at 300 ml/min and Oxygen Injection Time at 8 seconds.
Standard and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Monomers and Polymers

CHN determination

POLYMERS - BORON CONTAINING POLYMER

N%	RSD%	C%	RSD%	H%	RSD%
10.67	0.09	55.69	0.06	8.73	0.35
10.66		55.67		8.75	
10.65		55.74		8.79	

Sample information

Standard: CEDFNI* 0.36 N%

Standard weight: 1.0 mg

Sample weight: 1.0 mg

Note

Set Oxygen Injection Time at 5 seconds.

The polymer was cut in small pieces and weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510) as follows:

- Tara of the tin container on the balance
- Addition of about 5 mg V_2O_5 , tara again on the balance
- Addition of about 0.5 mg of boron carbide sample, take the proper weight in the balance
- Addition of about 5 mg V_2O_5
- Close the tin container

*CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone

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Monomers and Polymers

CHNS/O determination

POLYMERS - LIGNIN (plant complex organic polymer)

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.113	1.80	63.75	0.12	5.71	0.18	1.59	0.82	26.64	0.22
0.111		63.90		5.70		1.60		26.66	
0.109		63.81		5.69		1.61		26.75	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Cystine 26.63 O%
Standard weight: 1.0 - 1.5 mg
Sample weight: 1.0 - 1.5 mg

Note

For CHNS, sample was weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Monomers and Polymers

CHNS/O determination

POLYMERS - LIGNIN (plant complex organic polymer)

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.132	0.75	61.37	0.12	5.52	0.36	3.43	0.44	25.45	0.19
0.134		61.55		5.50		3.44		25.36	
0.133		61.69		5.48		3.46		25.43	

Sample information for CHNS determination
Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination
Standard: Sulfanilic acid 27.71 O%
Standard weight: 1.0 - 1.5 mg
Sample weight: 1.0 - 1.5 mg

Note
CHNS determination, standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Monomers and Polymers

CH determination

FLUORINATED LIQUID CRYSTALLINE ACRYL MONOMERS

C%	RSD%	H%	RSD%
73.268	0.0125	6.361	0.323
73.281		6.332	

Sample information

Standard: BBOT* 72.53 C%, 6.09 H%

Standard weight: 1.0 - 1.5 mg

Sample weight: about 1.0 mg

Note

Set the Oxygen Injection Time at 4 seconds.
Due to the content of fluorine, the sample was weighed in silver container (p/n 240 05405).

Comment

The sample is used for LC displays.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Liquid Soap

Nitrogen determination

LIQUID SOAP (used as lubricant in powder coating production)

Sample	N%	RSD%
1	0.0252	5.9343
	0.0251	
	0.0283	
	0.0264	
	0.0283	
2	0.1030	1.9420
	0.1052	
	0.1069	
	0.1068	
	0.1026	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 3.0 - 4.0 mg
Sample weight: 80 - 100 mg

Note

The liquids samples were adsorbed on about 30 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530). Set the Oxygen Flow at 300 ml/min and the Oxygen Injection Time at 8 seconds.



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Lubricants

N Lubricant determination

LUBRICANTS

N%	RSD%
0.748	0.67
0.758	
0.759	
0.761	
0.751	
0.751	
0.749	
0.760	
0.759	
0.759	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 4.0 - 5.0 mg
Sample weight: 80 - 10 mg

Note

Set the Oxygen Flow at 300 ml/min and Oxygen Injection Time at 8 seconds.
The expected nitrogen data is 0.755, with an accepted range of 0.748 - 0.762 N%.

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Lubricants

N Lubricant determination

LUBRICANTS

Sample	N%	RSD%	Sample	N%	RSD%
1	0.464	1.12	6	0.771	0.52
	0.454			0.779	
	0.461			0.776	
2	1.40	0.71	7	0.160	0.96
	1.42			0.158	
	1.41			0.157	
3	1.12	0.51	8	1.19	0.81
	1.13			1.19	
	1.12			1.17	
4	0.936	1.14	9	1.58	0.84
	0.928			1.56	
	0.915			1.55	
5	0.340	1.09	10	1.11	0.52
	0.339			1.10	
	0.352			1.11	

Sample information for N determination

Standard: Atropine 4.84 N%
Standard weight: 4.0 - 5.0 mg
Sample weight: 8.0 - 10 mg

Note

Set Oxygen Flow 300 ml/min and Oxygen Injection Time 8 seconds.
Large tin containers (p/n 252 08000) were used to weigh the samples.

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Nitrile Gloves

NCS determination

NITRILE GLOVE

N%	RSD%	C%	RSD%	S%	RSD%
6.511		76.531		1.217	
6.533		76.499		1.256	
6.632	0.931	76.400	0.092	1.236	1.312
6.653		76.403		1.256	
6.590		76.548		1.238	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Paper

CHNS determination

PAPER

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
0.2360		43.8517		5.9666		0.0772	
0.2357	4.0207	43.6566	0.5319	5.9599	0.5269	0.0772	0.2997
0.2198		43.1214		5.9093		0.0768	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

Sample was cut into small pieces, collected in a container, mixed and then weighed in the tin container (p/n 240 06400). Standard was weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510)

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Paper

Nitrogen determination

PAPER

Sample	N%	RSD%
1	0.3282	1.2932
	0.3368	
	0.3326	
2	0.3334	0.5880
	0.3372	
	0.3344	
3	0.2513	0.9119
	0.2501	
	0.2469	
4	0.2959	0.8179
	0.3003	
	0.2963	
5	0.2880	0.9263
	0.2930	
	0.2888	

Sample information

Standard: Aspartic acid 10.52 N%
 Sample weight: 70 - 80 mg

Note

Sample was cut into small pieces collected in a container, mixed and then weighed in the tin container (p/n 252 08000). The configuration used is N/Protein setting Oxygen Injection Time 20 seconds.



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Paper

NCS determination

PAPER

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	1.8279		42.0787		0.0437	
	1.8310	1.2421	42.1599	0.1086	0.0439	0.9556
	1.8690		42.1559		0.0431	
2	0.0282		42.3373		0.0394	
	0.0298	3.0270	42.3655	0.0467	0.0422	4.3372
	0.0284		42.3274		0.0390	
3	0.9866		42.4505		0.0422	
	1.0042	1.1261	42.4331	0.0517	0.0425	0.9592
	0.9835		42.4767		0.0417	
4	1.2053		42.3358		0.0360	
	1.2293	1.0200	42.3647	0.0600	0.0356	0.5587
	1.2119		42.3141		0.0358	
5	1.2529		42.1291		0.0374	
	1.2521	0.1195	42.2987	0.2729	0.0363	1.5851
	1.2550		42.3493		0.0372	

Sample information for NCS determination

Standard: BBOT* 6.51 N%, 72.56 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). The samples were cut in small pieces.

The *Gain x10* option was used for the sulfur peak to amplify ten Times the area due to the low level.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Paper

Nitrogen determination

PAPER

Sample	N%	RSD%
1	0.0037	3.985
	0.0040	
	0.0038	
2	0.0039	6.614
	0.0038	
	0.0043	
3	0.0351	2.958
	0.0331	
	0.0339	
4	0.9802	0.4222
	0.9735	
	0.9727	
5	1.1196	0.3147
	1.1251	
	1.1262	
6	1.1963	0.0871
	1.1943	
	1.1948	
7	1.2400	0.6032
	1.2338	
	1.2487	
8	1.5926	0.7178
	1.5813	
	1.5699	
9	1.7291	0.4206
	1.7271	
	1.7406	

Sample information

Standard: Aspartic acid 10.52 N%
 Standard weight: 30 - 100 mg
 Sample weight: 200 - 250 mg for paper samples 1
 250 - 150 mg for other paper samples

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 20 sec.
 The samples were cut in small pieces.



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ELECTROSTATIC PAPER

Sample	N%	RSD%
1	0.4695	4.5960
	0.4298	
	0.4616	
	0.4867	
	0.4170	
2	1.2198	1.7210
	1.2360	
	1.2747	
	1.2264	
	1.2364	
3	1.4424	1.9450
	1.4345	
	1.3912	
	1.4644	
	1.4525	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 100 - 150 mg

Note

Set the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 20 sec.
The samples were cut in small pieces.

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PAPER - SAUSAGES CASINGS

Sample Code	Sample Nature	N%	RSD%
1	Paper - cellulose (coating 1)	0.0635	1.21
		0.0623	
		0.0621	
2	Paper - cellulose (coating 2)	0.116	0.87
		0.115	
		0.114	
3	Cellulose	0.219	1.44
		0.224	
		0.225	
4	Paper	0.0060	6.33
		0.0058	
		0.0053	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 70 mg
Sample weight: 140 - 200 mg sample 1
190 - 100 mg sample 2
70 - 100 mg sample 3
140 - 150 mg sample 4

Note

N/Protein configuration was used for the analysis.
Set the Oxygen Flow at 300 ml/min, @ 30 seconds for blank and standards, and OxyTune® Category A for samples were used.
Samples were cut in small pieces and mixed before weighing.

Comment

Samples contain halogens, chlorine at about 0 - 0.5 wt%.
Wear safety glasses and gloves when working with samples.

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Paper

Sulfur determination

PAPER - SAUSAGES CASINGS

Sample Code	Sample Nature	S%	RSD%
1	Paper - cellulose (coating 1)	0.0389	0.54
		0.0390	
		0.0386	
2	Paper - cellulose (coating 2)	0.0392	1.34
		0.0390	
		0.0400	
3	Cellulose	0.0532	0.78
		0.0538	
		0.0530	
4	Paper	0.0760	1.22
		0.0748	
		0.0742	

Sample information

Standard: BBOT* 7.44 S%

Standard weight: 2.0 - 2.5 mg

Sample weight: 2.0 - 3.0 mg

Note

Samples were cut in small pieces and mixed before weighing.

Comment

Samples contain halogens, chlorine at about 0 - 0.5 wt%.

Wear safety glasses and gloves when working with samples.

Standard was weighed with about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510)



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Plaster

Sulfur determination

PLASTER

S%	RSD%
18.059	
17.983	0.221
18.000	

Sample information

Standard: BBOT* 7.43 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 1.0 - 2.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Plastic Beads

CH determination

PLASTIC BEADS

Sample	C%	RSD%	H%	RSD%
Natural fiber	40.780		6.489	
	40.568	0.3057	6.334	1.3536
	40.787		6.345	
Bead reference	65.418		5.484	
	65.438	0.0157	5.495	0.3155
	65.432		5.518	
Bead & about 5% natural fiber	63.767		5.536	
	63.671	0.0756	5.542	0.1174
	63.712		5.549	
Bead & about 10% natural fiber	62.132		5.553	
	62.034	0.2627	5.587	0.4891
	61.814		5.607	
Bead & about 20% natural fiber	59.621		5.642	
	59.567	0.0468	5.649	1.9714
	59.606		5.455	
Stick & about 10% natural fiber	62.248		5.573	
	62.124	0.1737	5.562	0.1548
	62.033		5.579	

Sample information

Standard: Acetanilide 71.09 C%, 6.71 H%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

Samples are plastic beads mixed with natural fiber.

Samples were homogenized by a ball mill while the stick sample was cut in small pieces by scissors.



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Powders

Nitrogen determination

ROCKWOOL POWDERS

Sample	N%	RSD%
1	0.0012	16.4342
	0.0015	
	0.0011	
2	0.0008	7.873
	0.0007	
	0.0007	
3	0.0066	6.6436
	0.0058	
	0.0064	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 10 - 12 mg
Sample weight: 250 - 300 mg

Note

For this application the N/Protein configuration was used setting the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 20 seconds for the standard and blanks, while for samples use the Category C.

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Powders

Nitrogen determination

WHITE COATING POWDER

N%	RSD%
7.0068	
6.9024	
6.9572	0.5563
6.9609	
6.9317	

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:	3.0 - 4.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

Set the Oxygen Flow at 300 ml/min and the Oxygen Injection Time at 8 seconds.

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Powders

CHNS/O determination

TONER POWDERS

Toner is a powder mixture used in laser printers and photocopiers to form the printed text and images on the paper, in general through a toner cartridge. The mixture contains granulated plastic, carbon powder, iron oxide, polypropylene, fumed silica, and various minerals.

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
Black 1	0.321		66.76		5.71		0.125		17.25	
	0.328	1.24	66.88	0.12	5.73	0.17	0.127	1.29	17.17	0.27
	0.328		66.73		5.72		0.128		17.17	
Black 2	0.363		72.17		6.18		0.150		17.86	
	0.368	1.52	72.27	0.08	6.20	0.19	0.155	1.64	17.81	0.25
	0.357		72.17		6.18		0.150		17.77	
Magenta 1	0.572		66.95		6.17		0.0530		18.79	
	0.572	0.30	66.89	0.08	6.14	0.25	0.0532	0.73	18.88	0.26
	0.569		67.00		6.15		0.0525		18.80	
Magenta 2	0.611		70.26		6.50		0.0540		19.07	
	0.614	0.34	70.52	0.19	6.51	0.15	0.0559	2.30	19.16	0.24
	0.610		70.37		6.49		0.0565		19.11	
Black 6305	0.339		70.40		6.01		0.148		17.79	
	0.339	0.17	70.49	0.10	6.04	0.25	0.147	0.26	17.77	0.11
	0.340		70.54		6.02		0.148		17.81	
Black 6705	0.329		67.58		5.79		0.123		17.50	
	0.322	1.08	67.35	0.17	5.75	0.35	0.126	1.33	17.61	0.33
	0.325		67.42		5.77		0.125		17.52	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Methionine 21.45 O%
Standard weight: 1.0 - 2.0 mg
Sample weight: 1.0 - 2.0 mg

Note

For CHNS, samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Refractory Materials

CHNS determination

REFRACTORY MATERIALS

Sample	N%	C%	H%	S%
A		54.401	1.819	28.977
		54.217	1.864	29.048
B		43.523		
		43.665		
		43.550		
C		82.834	5.749	
		82.560	5.772	
		82.728	5.765	
D		72.917	5.082	
		73.076	5.084	
E	11.200	47.812	4.717	
	11.354	48.045	4.562	
	11.361	47.652	4.467	
F	1.571	59.981	11.091	
	1.580	59.895	11.289	
	1.574	60.293	11.415	

Sample information

Standard:	Sample B	Trifluoroacetanilide	38.06 C%
	others	Cystine	11.66 N%, 29.99 C%, 5.03 H%, 26.69 S%
Standard weight:	Sample B	0.5 mg	
	others	2.0 mg	
Sample weight:	Sample B	0.5 - 1.0 mg	
	others	2.0 - 3.0 mg	

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REFRACTORY MATERIALS

Sample	N%		C%	
	Found	Theoretical	Found	Theoretical
SiC			29.90	
			29.84	
			29.87	29.93
			29.95	
			29.86	
WC			6.10	
			6.14	6.13
			6.12	
Si ₃ N ₄	29.95			
	29.90	29.96		
	29.93			

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%
Standard weight: 5.0 - 10 mg
Sample weight: 2.0 - 3.0 mg
Additive: Pb₃O₄
Additive weight: 20 mg

Note

Considering the refractoriness of these materials, additives as Pb₃O₄ (Oxygen donors) (p/n 338 37540) are highly recommended.

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Refractory Materials

Carbon determination

REFRACTORY MATERIALS

BCR-CRM 352/1 Reference Material (6.1536 C%)		Tungsten Carbide Reference Material (6.11 C%)	
Experimental data	6.1484	Experimental data	6.1243
	6.1342		6.1111
	6.1559		6.1151
	6.1575		6.1171
	6.1668		6.1069
	6.1628		6.1173
	6.1673		6.1123
	6.1712		6.1145
	6.1387		6.1129
	6.1609		6.1070
Average C%	6.1564	Average C%	6.1138
RSD%	0.2011	RSD%	0.0844

Sample information

Standard: BCS-CRM 352/1 6.1536 C%, mean of intralaboratory means
 Standard weight: 7.0 - 8.0 mg
 Sample weight: 7.0 - 8.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of lead oxide (p/n 338 37540).
 Set the Oxygen Injection Time to 10 seconds.



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Resins

NC determination

RESINS

Sample	N%	RSD%	C%	RSD%
1	21.51		21.81	
	21.69		22.02	
	21.47	0.4577	21.84	0.4658
	21.45		21.75	
	21.59		21.89	
2	22.21		21.46	
	22.19	0.1133	21.51	0.1171
	22.24		21.48	
3	18.10		17.18	
	18.38	0.7785	17.04	0.4311
	18.20		17.07	
4	18.43		17.14	
	18.48	0.3272	17.16	0.5401
	18.36		17.31	

Sample information

Standard:	Nicotinamide	22.94 N%, 59.01 C%
	Aspartic acid	10.52 N%, 36.04 C%
Standard weight:	18 - 20 mg	
Sample weight:	20 - 25 mg	

Note

Set the Oxygen Flow at 250 ml/min and the Oxygen Injection Time at 10 seconds.
 Suggestion: use the 3 meter GC column (p/n 260 08205).
 Samples were weighed in the tin container (p/n 252 08000).



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Resins

Nitrogen determination

FORMALDEHYDE RESINS

Sample	N%	N ppm
Formaldehyde resin	14.66	
	14.70	
	14.68	
Formalin		260
		254
		250

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:		10 - 15 mg
Sample weight:	Formaldehyde resins	10 - 15 mg
	Formalin	50 - 100 mg

Note

Samples have been sealed in tin containers using the sealing device for liquids (p/n 205 03002).



Sealing device (p/n 205 03002)

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Resins

CHNS determination

ASPHALTENE RESINS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1 (high viscosity)	0.644		85.344		10.496		2.569	
	0.645	0.0896	85.630	0.2482	10.495	0.0635	2.553	0.7218
	0.645		85.216		10.484		2.590	
2 (low viscosity)	0.475		84.799		11.144		0.976	
	0.469	2.9536	84.343	0.3216	11.092	0.2933	0.963	0.6760
	0.496		84.315		11.084		0.971	
3 (low viscosity)	1.265		87.023		5.628		3.751	
	1.265	0.0912	87.207	0.1073	5.675	0.4292	3.800	0.6849
	1.267		87.144		5.662		3.790	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 2.5 mg

Note

Sample 1 was heated before weighing.
Samples 1 and 2 were analyzed without the addition of vanadium pentoxide (V₂O₅) (p/n 338 37510).
Standard and sample 3 were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Resins

CHNS/O determination

MELAMINE RESINS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
Melamine Resin 1	45.523		34.353		5.345				14.722	
	45.761	0.342	34.405	0.109	5.348	0.096	-	-	14.624	0.346
	45.468		34.332		5.338				14.650	
Melamine Resin 2	47.638		31.341		5.092		0.710		13.592	
	47.466	0.232	31.337	0.054	5.082	0.101	0.742	2.204	13.512	0.703
	47.433		31.310		5.089		0.727		13.403	
Liquid Additive	0.168		45.755		10.912		0.413		42.591	
	0.176	3.113	45.718	0.198	10.863	0.225	0.392	2.677	42.655	0.103
	0.166		45.583		10.889		0.407		42.571	

Sample information for CHNS determination

Standard:	BBOT*	6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
	Imidazole	41.15 N%, 52.93 C%, 5.92 H%
	Urea	46.65 N%, 20 C%
Standard weight:	2.0 - 3.0 mg BBOT*, 3.0 - 4.0 mg Imidazole or Urea	
Sample weight:	3.0 - 4.0 mg for melamine resins 2.0 - 3.0 mg for liquid additive	

Sample information for Oxygen determination

Standard:	Aspartic acid	48.08 O%
	Atropine	16.59 O%
Standard weight:	1.0 - 2.0 mg	
Sample weight:	1.0 - 2.0 mg	

Note

For CHNS Standard and sample were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510). The liquid additive sample was weighed in double tin container.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Resins

NCS determination

RESINS FOR HPLC COLUMNS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1			7.01		0.101	
	-	-	7.00	0.54	0.104	1.09
			7.07		0.101	
2			7.29		0.130	
	-	-	7.27	0.21	0.133	0.97
			7.30		0.131	
3	0.244		5.98		0.0885	
	0.242	0.47	5.96	0.42	0.0898	0.73
	0.244		6.01		0.0891	
4	0.123		8.93		0.0908	
	0.121	0.95	8.90	0.17	0.0915	0.66
	0.121		8.92		0.0920	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Thermo Scientific Pasta Reference Material	0.136 S%
Standard weight:	3.0 - 4.0 mg	
Sample weight:	6.0 - 7.0 mg	

Note

Standards and samples were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

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Rubbers and Tires

Oxygen determination

RUBBERS

Sample	O%	RSD%
1	2.1763	0.1850
	2.1806	
	2.1740	
	2.1715	
	2.1806	
2	1.8246	0.6215
	1.8194	
	1.8368	
	1.8097	
	1.8099	
3	2.1221	0.3032
	2.1154	
	2.1173	
	2.1296	
	2.1136	

Sample information

Standard: BBOT* 7.43 O%
Standard weight: 1.0 - 2.0 mg
Sample weight: 2.0 - 3.0 mg

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Rubbers and Tires

Nitrogen determination

RUBBERS

Sample	N%		
Nytrilbutadiene A	10.60	10.58	10.56
Nytrilbutadiene B	9.01	9.04	9.02
Rubber	1.84	1.82	1.82

Sample information

Standard: Acetanilide 10.36 N%
Standard weight: 10 - 15 mg
Sample weight: 50 - 100 mg

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Rubbers and Tires

CHNS/O determination

RUBBERS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	0.477		86.118		7.922		0.881		2.023	
	0.481	0.521	86.735	0.223	7.916	0.165	0.899	2.043	1.999	0.823
	0.481		85.951		7.941		0.863			
2	0.336		86.560		7.719		0.639		1.932	
	0.321	2.420	86.233	0.195	7.674	0.303	0.634	1.967	1.904	1.010
	0.325		86.329		7.707		0.658			
3	0.337		86.250		7.210		0.260		2.218	
	0.324	2.287	86.210	0.247	7.271	0.706	0.254	3.317	2.245	0.862
	0.338		86.597		7.312		0.271			

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%, 7.43 O%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Rubber samples were analyzed without any pre-treatment, only cut into small pieces.
BBOT* was analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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RUBBERS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.2769	0.7367	85.8024	0.2468	0.9266	0.7515
	0.2798		85.5034		0.9365	
2	0.2897	2.4466	85.1296	0.0684	1.5459	1.7795
	0.2999		85.0473		1.5853	
3	0.2934	2.4768	84.8806	0.1078	1.9690	1.2682
	0.2933		84.7513		1.9340	
4	0.2830	1.0909	83.2292	0.0008	3.7980	1.2812
	0.2874		83.2301		3.7298	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Samples were analyzed with the addition of about 10 mg vanadium pentoxide (V₂O₅) (p/n 338 37510). Rubber samples were analyzed without any pre-treatment, only cut into small pieces.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Rubbers and Tires

CHNS determination

RUBBERS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Rubber 4	0.628		82.447		11.279		0.797	
	0.636	0.666	82.272	0.208	11.300	0.1045	0.799	0.503
	0.633		82.104		11.298		0.792	
Rubber 5	0.625		82.210		11.263		1.095	
	0.616	0.790	82.661	0.576	11.114	1.123	1.015	3.989
	0.623		83.161		11.366		1.033	
Rubber 6	0.626		81.962		11.218		1.561	
	0.628	0.470	81.866	0.320	11.249	0.243	1.553	0.606
	0.622		82.361		11.272		1.572	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510). Samples were cut into small pieces.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Rubbers and Tires

Nitrogen determination

RUBBERS

Sample	N%	RSD%
1	7.009	0.1387
	7.003	
	6.990	
2	8.955	0.0573
	8.952	
	8.962	
3	10.657	0.1013
	10.637	
	10.654	

Sample information

Standard: Acetanilide 10.36 N%
Standard weight: 4.0 - 5.0 mg
Sample weight: 4.0 - 5.0 mg

Note

Samples were cut into small pieces.

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Rubbers and Tires

NCS determination

RUBBERS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	0.410	0.58	86.26	0.08	0.0294	0.39
	0.408		86.14		0.0293	
	0.413		86.27		0.0296	
	0.414		86.27		0.295	
	0.411		86.15		0.0294	
2	0.420	0.49	86.31	0.09	0.0206	1.28
	0.417		86.40		0.0204	
	0.422		86.35		0.0202	
	0.422		86.29		0.0208	
	0.421		86.48		0.0202	
3	0.430	0.56	86.26	0.09	0.0254	1.24
	0.425		86.27		0.0262	
	0.431		86.10		0.0261	
	0.430		86.11		0.0258	
	0.428		86.19		0.0257	
4	0.420	0.39	86.22	0.10	0.0293	1.08
	0.419		86.25		0.0291	
	0.420		86.21		0.0288	
	0.422		86.14		0.0286	
	0.423		86.03		0.0286	

Sample information for NCS determination

Standard: BBOT* 6.51 N%, 72.56 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
Samples were cut in small pieces.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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RUBBERS

C%	RSD%	H%	RSD%	S%	RSD%
25.95	0.86	3.31	0.98	68.89	0.33
25.11		3.36		69.52	
26.32		3.37		68.94	
25.72		3.32		69.27	
26.15		3.37		68.95	
26.11		3.38		69.07	
25.71		3.30		68.87	
26.23		3.36		69.22	

Sample information for NCS determination

Standard: Cystine 29.99 C%, 5.03 H%, 26.69 S%
Standard weight: 3.0 - 4.0 mg
Sample weight: 1.0 - 2.0 mg

Note

Set Oxygen Injection Time at 4 sec.
Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510)
Samples were cut in small pieces.



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Rubbers and Tires

CHNS/O determination

RUBBERS - ELASTOMERS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	3.01		59.63		7.00		2.05		28.31	
	3.02	0.19	59.49	0.15	7.00	0.00	2.08	0.84	28.37	0.12
	3.01		59.66		7.00		2.08		28.31	
2	2.97		59.52		7.02		2.02		28.59	
	2.97	0.00	59.61	0.15	7.03	0.08	2.04	0.49	28.51	0.20
	2.97		59.43		7.02		2.03		28.48	
3	3.01		59.44		6.98		2.12		28.54	
	3.03	0.50	59.41	0.03	6.99	0.14	2.12	0.27	28.61	0.14
	3.04		59.44		7.00		2.11		28.54	
4	2.88		63.74		7.91				25.56	
	2.87	0.35	63.74	0.02	7.90	0.07	-	-	25.53	0.12
	2.86		63.76		7.91				25.50	
5	4.17		67.53		8.67				19.67	
	4.14	0.37	67.54	0.03	8.63	0.27	-	-	19.76	0.24
	4.16		67.50		8.67				19.69	
6	1.59		66.19		10.16				21.96	
	1.59	0.36	66.27	0.12	10.20	0.20	-	-	21.95	0.17
	1.60		66.11		10.19				22.02	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Cystine 26.63 O%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 1.5 mg

Note

Sample was cut in small pieces.
 For CHNS, samples were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Rubbers and Tires

Sulfur determination

TIRES

Sample	S% theoretical (new Tires)	S% found (six months old Tires)		
Tire A	2.60	2.484	2.499	2.487
Tire B	5.89	5.415	5.302	5.250

Sample information

Standard: BBOT* 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 1.0 - 5.0 mg

Note

BBOT* was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510). Tire samples were analyzed without any pre-treatment, only cut into small pieces.

Comment

The sulfur content is the most important parameter in the quality control of the rubber products. It is possible to study the loss of S from the tire surface.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Rubbers and Tires

CHNS/O determination

TIRES

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	0.792		73.961		6.856		3.151		4.345	
	0.800	1.074	74.140	0.153	6.880	0.572	3.105	0.744	4.325	0.254
	0.783		74.171		6.933		3.122		4.327	
2	0.529		75.253		7.187		2.972		3.752	
	0.536	0.929	75.370	0.110	7.186	0.011	2.937	0.838	3.695	1.953
									3.609	
3	0.362	1.546	87.505	0.211	8.958	0.112	0.823	1.226	1.199	0.891
	0.370		87.767		8.973		0.837		1.178	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%, 7.43 O%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Tires samples were analyzed without any pre-treatment, only cut into small pieces.
For CHNS, BBOT* and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Rubbers and Tires

CHNS determination

TIRES

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
A	0.454	1.235	79.597	0.0701	6.945	0.0815	1.435	0.930
	0.462		79.676		6.937		1.454	
B	0.436	1.475	82.672	0.0932	7.137	0	1.666	0.0848
	0.427		82.781		7.137		0.668	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
Samples were cut into small pieces.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Silica

CHN determination

SILICA

Day	Day 1			Day 2		
Element%	N%	C%	H%	N%	C%	H%
	1.3870	6.5525	1.7462	1.3799	6.5263	1.7365
	1.3723	6.5728	1.7290	1.3770	6.5535	1.7387
	1.3731	6.5048	1.7317	1.3745	6.5110	1.7019
	1.3801	6.5232	1.7062	1.3860	6.5390	1.7120
	1.3871	6.5792	1.7264	1.3800	6.5140	1.7110
Average %	1.3799	6.5465	1.7279	1.3795	6.5288	1.7200
RSD %	0.5204	0.4878	0.8305	0.3116	0.2714	0.9617

Sample information

Standard: Atropine 4.84 N%, 70.56 C%, 8.01 H%
Standard weight: 1.0 - 1.5 mg
Sample weight: 1.0 - 1.5 mg



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Silica

Carbon determination

SILICA

Sample	C%	RSD%
Bonded Silica	17.6185	0.3559
	17.5653	
	17.6903	
Hybrid Silica	6.7989	1.1580
	6.7642	
	6.6498	

Sample information

Standard: Benzoic acid 68.85 C%

Sample weight: 3.0 - 4.0 mg

Sample weight: 4.0 - 5.0 mg

Note

Using NC configuration set Oxygen Flow 300 ml/min and Oxygen Injection Time to 10 seconds.



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Silicon

Carbon determination

SILICON (crystalline)

Sample	C%	RSD%
1	3.42	0.29
	3.44	
	3.43	
2	0.0207	0.73
	0.0210	
	0.0208	

Sample information

Standard: Aspartic acid 36.09 C%

Standard weight: 4.0 - 5.0 mg

Sample weight: 4.0 - 5.0 mg sample 1
50 - 60 mg sample 2

Note

Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 5 seconds.
Samples were homogenized by a ball mill.



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Silicon

Oxygen determination

SILICON (crystalline)

Sample	O%	RSD%
1	2.05	0.74
	2.08	
	2.07	
2	0.108	1.89
	0.112	
	0.111	

Sample information

Standard: BBOT* 7.43 O%

Standard weight: 1.0 - 1.5 mg

Sample weight: 1.0 - 1.5 mg

Note

Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 5 seconds.
Samples were homogenized by a ball mill.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Surfactant

CH determination

SURFACTANT

C%	RSD%	H%	RSD%
19.8970		0.3786	
19.8631		0.3955	
19.9099	0.2869	0.3756	2.0991
19.8284		0.3773	
19.9808		0.3825	

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%

Standard weight: 1.0 - 1.5 mg

Sample weight: 1.0 - 1.5 mg

Note

The sample was analyzed without any pre-treatment.
As the sample contains fluorine, a special reactor containing a fluorine adsorber was used.



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Synthetic Wax

Oxygen determination

SYNTHETIC WAX

Sample	O%	RSD%
1	0.398	0.521
	0.399	
	0.402	
2	0.617	1.545
	0.635	
	0.620	
3	0.527	0.824
	0.526	
	0.534	
4	0.425	1.195
	0.428	
	0.435	
5	0.505	1.166
	0.496	
	0.507	
6	0.581	1.988
	0.591	
	0.568	

Sample information

Standard: BBOT* 7.43 O%

Standard weight: 1.0 - 2.0 mg

Sample weight: 1.0 - 2.0 mg

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Cast Iron

NCS determination

CAST IRON

Sample	N%	C%	S%
1	0.0982	2.2003	0.0706
	0.1034	2.1940	0.701
	0.1082	2.2142	0.655
2	0.0190	2.3488	0.0670
	0.0162	2.3514	0.0643
	0.0169	2.3891	0.0629

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 10 - 30 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Copper Powders

Oxygen determination

COPPER POWDER

Sample	O%	RSD%
PC 18	0.32	2.64
PC 19	0.27	0.69
PC 20	0.40	1.59
PC 37	0.49	4.72
PC 38	0.73	0.87
PA 04	0.52	3.74
PA 02	0.46	0.45
EP 99	0.49	2.71

Sample information

Standard:	Acetanilide	11.84 O%
Standard weight:	1.0 - 2.0 mg	
Sample weight:	30 mg	

Note

Data are the average of duplicate analyses.



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Stainless Steels

Nitrogen determination

STAINLESS STEELS

Sample	N ppm		
A	117	112	110
B	96	91	93

Sample information

Standard: Atropine 4.84 N%
Standard weight: 5.0 - 10 mg
Sample weight: 100 - 200 mg

Note

Ultrapure tin container (p/n 240 07200) have been used.

Comment

The samples must be ground finely.



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Stainless Steels

NC and Oxygen determination

STAINLESS STEELS

Sample	N%	RSD%	C%	RSD%	O%	RSD%
1	0.0033		0.3764		0.0126	
	0.0033		0.3757		0.0124	
	0.0036	3.8124	0.3835	4.0418	0.0125	4.6456
	0.0035		0.3501		0.0137	
	0.0034		0.3900		0.0122	
2	0.0106		0.2814			
	0.0110	2.7033	0.2777	1.3674		
	0.0103		0.2752			
	0.0106		0.2838			

Sample information

Standard:	Atropine	4.84 N%, 70.56 C%
	BBOT*	7.43 O%
Standard weight:	1.0 - 2.0 mg	
Sample weight:	20 - 30 mg	

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Stainless Steels

Carbon determination

STAINLESS STEELS

C%	RSD%
0.0050	
0.0051	6.1425
0.0056	

Sample information

Standard: Aspartic Acid 36.09 C%

Standard weight: 1.0 - .02 mg

Sample weight: 20 - 30 mg

Note

CHN configuration was used.

To reduce possible contamination due to impurities present in the tin container, the analyses were performed using small tin container (p/n 240 05300).



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Cottons - Papers - Textile Fibers

Nitrogen determination

COTTONS, PAPERS AND TEXTILE FIBERS

Sample	N%			N ppm		
Cotton A	0.69	0.68	0.68			
Cotton B	0.46	0.46	0.45			
Cotton C	0.34	0.34	0.33			
Paper A				2555	2525	2534
Paper B				1666	1692	1709
Paper C				327	337	314
Paper D				154	169	151
Textile fiber A				550	560	565
Textile fiber B				510	524	521

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:		10 - 15 mg
Sample weight:	Cotton	20 - 30 mg
	Paper	5.0 - 10 mg
	Textile fiber	100 - 200 mg



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Detergents

Nitrogen determination

DETERGENTS

Sample	N%		
A	0.61	0.61	0.59
B	0.38	0.37	0.37
C	0.14	0.14	0.14

Sample information

Standard:	Atropine	4.84 N%
Standard weight:	5.0 - 10 mg	
Sample weight:	100 - 200 mg	



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Explosives

Nitrogen determination

EXPLOSIVE

Element	N%		
Cellulose nitrate A	12.59	12.54	12.56
Cellulose nitrate B	12.30	12.25	12.28
Guncotton A	13.57	13.58	13.61
Guncotton B	13.14	13.17	13.13

Sample information

Standard: KNO₃ 13.86 N%
Standard weight: 15 - 20 mg
Sample weight: 30 - 50 mg

Note

Samples have been adsorbed on Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) using microsyringe.
Tin containers (p/n 240 06400) have been used.



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Explosives

NC determination

EXPLOSIVE

Sample	N%	C%	CO ₂ /N ₂ area ratio
Nitrocellulose	13.47	25.19	5.30
	13.45	25.14	5.29
	13.49	25.25	5.30
Mix 227	13.06	25.55	5.54
	13.13	25.58	5.52
	13.04	25.52	5.54
34 lot 327	12.07	27.04	6.34
	12.04	26.72	6.28
	12.06	26.87	6.32
FL 593	13.59	25.00	5.20
	13.55	24.98	5.21
	13.57	24.97	5.19

Sample information

Standard:

CEDNFI (cyclohexanone-2,4 dinitrophenylhydrazone)

20.14 N%, 51.79 C%

Standard weight:

4.0 - 5.0 mg

Sample weight:

4.0 - 5.0 mg

Note

CO₂/N₂ area ratio is a useful index for QC users.

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Explosives

CHNS determination

EXPLOSIVE

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
TNT	18.4755		37.4174		2.2346		0	
	18.1904	0.8329	37.3513	0.2142	2.2074	0.8386	0	0
	18.4290		37.2582		2.2432		0	
Nitrocellulose	8.2963		17.2585		3.5368		0	
	8.3524	0.6044	17.0743	0.5737	3.3608	3.5514	0	0
	8.3970		17.2274		3.6008		0	
Sample A	12.0196		26.5217		2.9701		0.0098	
	11.9098	0.6777	26.5345	0.1451	2.9675	0.1374	0.0109	6.9307
	11.8619		26.5939		2.9755		0.0096	
Sample B	11.7585		26.5369		2.9541		0.0168	
	11.9547	0.8362	26.6208	0.1592	2.9759	0.4724	0.0187	6.2923
	11.8823		26.5884		2.9803		0.0168	

Sample information

Standard:

Acetanilide
BBOT*10.36 N%, 71.09 C%, 6.71 H%
6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

BBOT* and samples containing Sulfur were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Set the Oxygen Flow to 250 ml/min and the Oxygen Injection Time to 4 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Fatty - Rosin Acids

Oxygen determination

FATTY - ROSIN ACIDS

Sample	O%		
887A - 1	11.758	11.753	11.733
887A - 2	16.917	16.983	16.952
888A - 1	11.810	11.804	11.859
887A - 3	18.878	18.903	18.890
887A - 4	19.860	19.831	19.876
888A - 2	19.833	19.824	19.821

Sample information

Standard: Benzoic acid 26.20 O%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Comment

Fatty-Rosin Acids, known as Tall oils, are used in the manufacturing of rubber, paper, soaps and detergents, printing inks, metalworking fluids, corrosion inhibitors and plasticizers.



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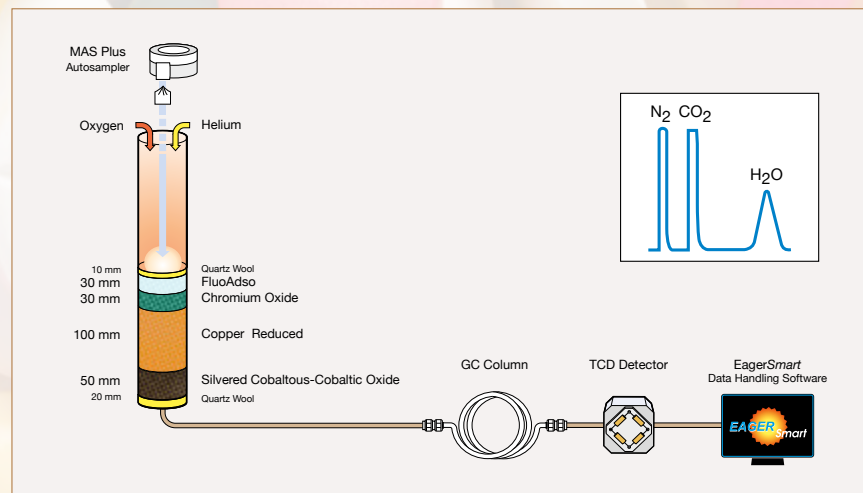
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Fluorine - Containing Compounds

CHN determination

FLUORINE - CONTAINING COMPOUNDS



Analytical conditions

Temperature reactor:	950°C (see layout)
Oven:	75°C
Helium Flow:	Carrier 140 ml/min, reference 100 ml/min
Oxygen Flow:	250 ml/min, Oxygen Injection Time 5 sec
Sample Delay:	12 sec

Sample information

Standard:	Acetanilide	10.36 N%, 71.09 C%, 6.71 H%
Standard weight:	0.8 - 1.2 mg	
Sample weight:	0.8 - 1.2 mg	

Comment

Among the halogens only fluorine has a certain influence on CHN analysis as it causes tailing or splitting of the hydrogen peak. The use of fluorine adsorber mix (p/n 338 40030) allows the quantitative determination of these elements with excellent accuracy and precision.

Other halogen atoms (Cl, Br and I) do not influence CHN determinations, no specific precautions need to be taken.



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Fluorine - Containing Compounds

CHN determination

FLUORINE - CONTAINING COMPOUNDS

Day to day reproducibility - CHN determination of BCR 73 Reference Material*							
Day	N° runs	N%	RSD%	C%	RSD%	H%	RSD%
1	40	8.78	0.34	50.81	0.38	3.84	1.21
2	15	8.81	0.42	50.84	0.38	3.82	0.80
3	35	8.83	0.40	50.96	0.30	3.87	0.89
Theoretical %		8.89	-	50.81	-	3.84	-

*BCR 73: 1-[1-(4-bromophenylmethyl)-4-piperidinyl]-5-chloro-2-(trifluoromethyl)-1H-benzimidazole 12.06 F%



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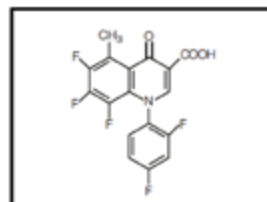
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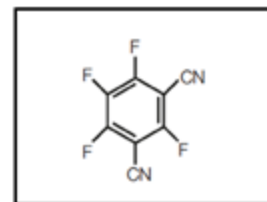
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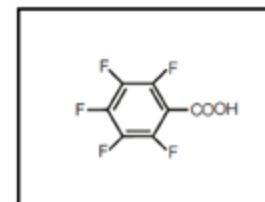
FLUORINE - CONTAINING COMPOUNDS



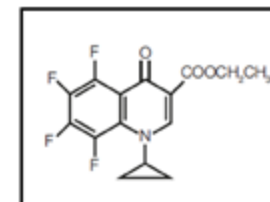
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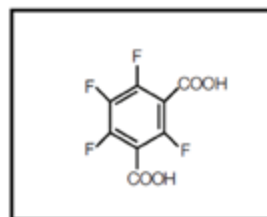
3: NACC008



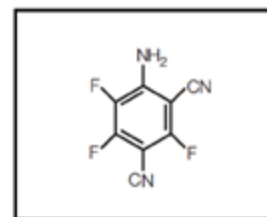
5: NACC007



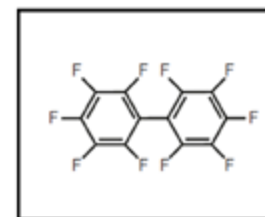
7: NACC002



2: NACC005



4: NACC011



6: NACC012

Sample	Theoretical value				Experimental data					
	F%	N%	C%	H%	N%	RSD%	C%	RSD%	H%	RSD%
1	25.73	3.79	55.30	2.18	3.77	0.153	55.40	0.100	2.20	0.262
2	31.92	0	40.36	0.85	0	0	40.59	0.384	0.84	0.690
3	37.98	14.00	48.02	0	13.95	0.504	47.88	0.588	0	0
4	28.91	21.32	48.75	1.02	21.01	0.595	48.99	0.470	0.98	0.591
5	44.79	0	39.64	0.48	0	0	39.28	0.291	0.52	0.794
6	56.86	0	43.14	0	0	0	43.08	0.039	0	0
7	23.08	4.25	54.72	3.37	4.24	0.136	54.90	0.038	3.34	0.173

Comment

Samples were analyzed in triplicate.

No effect on the results was observed related to chemical structure of the sample and its fluorine content.



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Fluorine - Containing Compounds

CHNS determination

FLUORINE - CONTAINING COMPOUNDS

CHNS determination of p-toluensulfonyl fluoride ($\text{CH}_3\text{C}_6\text{H}_4\text{SO}_2\text{F}$)				
Element%	N%	C%	H%	S%
	0	48.53	4.06	18.53
	0	48.26	4.08	18.35
	0	48.20	4.09	18.32
Average	0	48.33	4.08	18.40
RSD%	0	0.36	0.37	0.62
Theoretical values	0	48.27	4.05	18.41

Analytical conditions

Typical for CHNS configuration

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 0.4 - 0.6 mg

Sample weight: 0.4 - 0.6 mg

Note

If splitting in the Hydrogen peak appears, run a series of by-passes with a high content Hydrogen compound such as parafilm or hydrocarbon.

Comment

In CHNS configuration, where it is not possible to use the fluorine adsorbing reagent, silver containers (p/n 240 05405) were used to reduce the influence of fluorine on the hydrogen peak.

In fact, silver traps fluorine, producing AgF, which remains in the ashes on top of the combustion reactor.

BBOT* and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Organic - Organometallic Halogenated Compounds

CHN determination

ORGANIC - ORGANOMETALLIC - HALOGENATED COMPOUNDS

Sample	Theoretical values			Experimental data		
	N%	C%	H%	N%	C%	H%
$C_{61}H_{90}Si$	-	86.05	10.65	-	85.76	10.54
					85.67	10.54
$C_{38}H_{61}BO_2Si$	-	77.52	10.44	-	77.50	10.33
					77.23	10.32
$C_{16}H_{18}FN_3O_3C_6H_5NO_2$	12.66	59.67	5.20	12.73	59.68	5.30
				12.69	59.80	5.34

Sample information

Standard:

Acetanilide

10.36 N%, 71.09 C%, 6.71 H%

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg



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Organic - Organometallic Halogenated Compounds

CHNS determination

ORGANIC - ORGANOMETALLIC - HALOGENATED COMPOUNDS

Sample	N%	C%	H%	S%
Tetramethylammonium Tetrphenylborate	3.56	85.39	8.20	0
Mercurysuccinamide	7.06	24.22	2.03	0
Ag-Diethylthiocarbamate	5.46	23.44	3.93	25.03
Nr-(2-chloro-4-nitrophenyl)-N-(4-iodophenyl)thiourea	9.69	36.01	2.09	7.39
4-Fluorophenyl-3-thiosemicarbazide	9.97	49.53	2.87	10.16
Bis(triphenylphosphine)-Coppertrifluoromethane-Sulfonate		60.28	4.10	4.35

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 1.0 - 3.0 mg

Note

The samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 36510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Organic - Organometallic Halogenated Compounds

CHNS determination

ORGANIC COMPOUNDS

Theoretical CHNS data of organic compounds and technical specification range ($\pm$)								
Organic compound	Theoretical values and acceptable range ($\pm$)							
	N%	Range ($\pm$)	C%	Range ($\pm$)	H%	Range ($\pm$)	S%	Range ($\pm$)
4-(2-hidroxyethyl)-piperazine-1-propanesulfonic acid (>99% purity)	11.04	0.11	42.58	0.30	7.89	0.10	12.61	0.13
4-Amine-N-tiazolylbenzenesulfonamide (Sulfatazol, $\geq 98\%$ purity)	16.28	0.16	41.87	0.30	3.48	0.05	24.81	0.24
DL-homocystine ($\geq 99\%$ purity)	10.38	0.10	35.60	0.28	5.93	0.09	23.73	0.23
Taurine ($\geq 99\%$ purity)	11.13	0.11	19.08	0.20	5.57	0.08	25.44	0.24
N-acetiltiourea (99% purity)	23.58	0.23	30.31	0.28	5.05	0.08	26.95	0.25



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CHNS determination

ORGANIC COMPOUNDS

Organic compound	Experimental data							
	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
4-(2-hidroxyethyl)-piperazine-1-propanesulfonic acid (> 99% purity)	11.09	0.09	42.79	0.12	7.95	0.38	12.73	0.24
	11.07		42.87		7.89		12.71	
	11.08		42.89		7.93		12.67	
4-Amine-N-tiazolilbencenesulfonamide (Sulfatiazol, $\geq 98\%$ purity)	16.33	0.13	42.01	0.05	3.53	0.16	25.03	0.10
	16.30		41.99		3.52		24.98	
	16.29		42.03		3.52		25.01	
DL-homocystine ($\geq 99\%$ purity)	10.34	0.24	35.73	0.24	6.01	0.10	23.86	0.15
	10.39		35.56		6.01		23.79	
	10.36		35.64		6.00		23.81	
Taurine ($\geq 99\%$ purity)	11.13	0.05	19.22	0.03	5.62	0.10	25.61	0.04
	11.14		19.21		5.63		25.59	
	11.13		19.21		5.63		25.60	
N-acetiltiourea (99% purity)	23.68	0.06	30.47	0.05	5.09	0.01	27.05	0.11
	23.66		30.50		5.08		26.99	
	23.69		30.49		5.09		27.01	

Sample information

Standard:

Cystine 11.66 N%, 29.99 C%; 5.03 H%, 26.69 S%
 Sulfanilamide 16.27 N%, 41.84 C%, 4.68 H%, 18.62 S%
 Nicotinamide 22.94 N%, 59.01 C%; 4.95 H%

Standard weight:

3.0 - 4.0 mg Cystine
 3.0 - 4.0 mg Sulfanilamide
 2.0 - 3.0 mg Nicotinamide

Sample weight:

3.0 - 4.0 mg



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CHN determination

PURE ORGANIC COMPOUNDS (1/4)

Table 1. CHN determination of poly-nuclear aromatics hydrocarbon compounds

Organic compound	Anthracene (C ₁₄ H ₁₀)			Fluorene (C ₁₂ H ₁₀)			Naphthalene (C ₁₀ H ₈)		
Element	N%	C%	H%	N%	C%	H%	N%	C%	H%
Theoretical	-	94.34	5.66	-	93.94	6.06	-	93.71	6.29
Experimental		94.29	5.68		93.94	6.04		93.80	6.31
		94.35	5.68		94.02	6.05		93.68	6.30
	-	94.41	5.67	-	93.95	6.05	-	93.78	6.29
		94.30	5.67		93.98	6.05		93.70	6.29
		94.28	5.68		93.97	6.06		93.66	6.29
Std. Dev.	-	0.054	0.005	-	0.031	0.007	-	0.062	0.009
RSD%	-	0.06	0.10	-	0.03	0.11	-	0.07	0.14

Table 2. CHN determination of cholesterol (steroid) and nitro-compounds

Organic compound	Cholesterol(C ₂₇ H ₄₆ O)			1-Chloro-2,4-dinitrobenzene (C ₆ H ₃ ClN ₂ O ₄)			CEDFNI (C ₁₂ H ₁₄ N ₄ O ₄)		
Element	N%	C%	H%	N%	C%	H%	N%	C%	H%
Theoretical	-	83.87	11.99	13.83	35.59	1.49	20.14	51.79	5.07
Experimental		83.86	11.99	13.83	35.54	1.47	20.18	51.80	5.06
		83.84	11.95	13.83	35.59	1.48	20.11	51.85	5.05
	-	83.92	11.97	13.86	35.57	1.47	20.14	51.72	5.07
		83.95	11.95	13.84	35.55	1.48	20.16	51.84	5.05
		83.83	11.99	13.84	35.53	1.48	20.10	51.83	5.04
Std. Dev.	-	0.052	0.020	0.012	0.024	0.005	0.033	0.053	0.011
RSD%	-	0.06	0.17	0.09	0.07	0.37	0.17	0.10	0.23



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CHN determination

PURE ORGANIC COMPOUNDS (2/4)

Table 3. CHN determination of heterocyclic nitrogen containing compounds

Organic compound	Antipyrine (C ₁₁ H ₁₂ N ₂ O)			Caffeine (C ₈ H ₁₀ N ₄ O ₂)			Imidazole (C ₃ H ₄ N ₂)		
	N%	C%	H%	N%	C%	H%	N%	C%	H%
Theoretical	14.88	70.19	6.43	28.85	49.48	5.19	41.15	52.93	5.92
Experimental	14.88	70.25	6.43	28.84	49.45	5.16	41.09	53.01	5.94
	14.89	70.17	6.44	28.86	49.43	5.17	41.10	52.99	5.93
	14.88	70.22	6.43	28.89	49.45	5.20	41.05	52.89	5.94
	14.90	70.14	6.42	28.88	49.37	5.19	41.12	52.89	5.95
	14.89	70.21	6.42	28.84	49.45	5.18	41.10	52.95	5.95
Std. Dev.	0.008	0.043	0.008	0.022	0.034	0.015	0.026	0.056	0.008
RSD%	0.06	0.06	0.13	0.08	0.07	0.31	0.06	0.10	0.14

Table 4. CHN determination of heterocyclic nitrogen containing compounds

Organic compound	Melamine (C ₃ H ₆ N ₆)			Nicotinamide (C ₆ H ₆ N ₂ O)			Nicotinic acid (C ₆ H ₅ NO ₂)		
	N%	C%	H%	N%	C%	H%	N%	C%	H%
Theoretical	66.63	28.56	4.81	22.94	59.01	4.95	11.38	58.54	4.09
Experimental	66.71	28.56	4.81	22.89	58.89	4.93	11.37	58.52	4.06
	66.51	28.52	4.80	22.88	58.95	4.92	11.38	58.43	4.07
	66.63	28.50	4.80	22.93	59.02	4.93	11.39	58.53	4.07
	66.55	28.45	4.81	22.91	58.95	4.94	11.37	58.47	4.05
	66.61	28.50	4.81	22.89	58.99	4.93	11.38	58.47	4.07
Std. Dev.	0.076	0.039	0.005	0.020	0.049	0.007	0.008	0.057	0.009
RSD%	0.12	0.14	0.11	0.09	0.08	0.14	0.07	0.09	0.22



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CHN determination

PURE ORGANIC COMPOUNDS (3/4)

Table 5. CHN determination of tocopherol nicotinate and urea compounds

Organic compound	Tocopherol nicotinate (C ₃₅ H ₅₃ NO ₃)			Urea (CH ₄ N ₂ O)		
Element	N%	C%	H%	N%	C%	H%
Theoretical	2.61	78.46	9.97	46.65	20.00	6.71
Experimental	2.61	78.34	10.01	46.58	20.07	6.68
	2.60	78.44	10.00	46.55	20.08	6.69
	2.60	78.47	9.99	46.66	20.10	6.69
	2.62	78.38	9.99	46.67	20.01	6.70
	2.62	78.55	10.00	46.63	20.03	6.70
Std. Dev.	0.010	0.081	0.008	0.052	0.037	0.008
RSD%	0.38	0.10	0.08	0.11	0.18	0.13

Table 6. CHN determination of polymers and triphenylphosphine compounds

Organic compound	Polyethylene			Polystyrene			Triphenylphosphine (C ₁₈ H ₁₅ P)		
Element	N%	C%	H%	N%	C%	H%	N%	C%	H%
Theoretical	-	85.71	14.47	-	91.95	7.84	-	82.42	5.76
Experimental		85.65	14.44		91.38	7.83		82.50	5.78
		85.68	14.45		91.89	7.81		82.41	7.79
	-	85.75	14.48	-	91.99	7.81	-	82.48	5.78
		85.77	14.42		91.92	7.80		82.41	5.79
		85.81	14.44		91.94	7.82		82.42	5.77
Std. Dev.	-	0.067	0.022	-	0.059	0.011	-	0.043	0.008
RSD%	-	0.08	0.15	-	0.06	0.15	-	0.05	0.14

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Organic - Organometallic Halogenated Compounds

CHN determination

PURE ORGANIC COMPOUNDS (4/4)

Sample information for CHN determination

Sample Name	Sample weight (mg)	Standard used for calibration	
		Type	Weight (mg)
Anthracene, Fluorene, Naphthalene	2.0 - 3.0	Fluorene	2.0 - 3.0
Cholesterol	1.8 - 2.2	Polyethylene	1.8 - 2.2
1-chloro-2,4-dinitrobenzene	3.5 - 4.0	CEDFNI	2.5 - 3.0
CEDFNI*	2.5 - 3.0	CEDFNI	2.5 - 3.0
Antypirine	2.0 - 3.0	Acetanilide	2.0 - 3.0
Caffeine, Imidazole	2.0 - 3.0	Imidazole	2.0 - 3.0
Melamine, Urea	3.0 - 4.0	Urea	3.0 - 4.0
Nicotinamide	2.0 - 3.0	Acetanilide	2.0 - 3.0
Nicotinic acid	2.0 - 3.0	Aspartic acid	3.0 - 4.0
Tocopherol nicotinate	2.0 - 2.2	Atropine	2.5 - 3.0
Polyethylene, Polystyrene	1.8 - 2.2	Atropine	2.5 - 3.0
Triphenylphosphine	2.0 - 3.0	Fluorene	2.0 - 3.0

*CEDFNI: Cyclohexanone-2,4-dinitrophenylhydrazone



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CHNS determination

PURE ORGANIC AND INORGANIC COMPOUNDS (1/3)

Theoretical CHNS values

No.	Sample	N%	C%	H%	S%
1	2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene (BBOT)	6.51	72.53	6.09	7.44
2	4-(2-Hidroxyethyl)-piperazine-1-propanesulfonic acid	11.04	42.58	7.89	12.61
3	4-amino-N-(1,3-thiazol-2-yl)benzenesulfonamide (Sulfatiazol)	16.28	41.87	3.48	24.81
4	Cystine	11.66	29.99	5.03	26.69
5	DL-Homocystine	10.38	35.60	5.93	23.73
6	Methionine	9.39	40.25	7.43	21.49
7	N-Acetilthiourea	23.58	30.31	5.05	26.95
8	Sulphanilamide	16.27	41.84	4.68	18.62
9	Sulphamethazine	20.12	51.78	5.07	11.52
10	Sulphanilic acid	8.09	41.61	4.07	18.51
11	2-Aminoethanesulfonic acid (Taurine)	11.13	19.08	5.57	25.44
12	Ammonium sulfate $(\text{NH}_4)_2\text{SO}_4$	21.14	-	6.10	24.27
13	Sulfur powder	-	-	-	99.98



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CHNS determination

PURE ORGANIC AND INORGANIC COMPOUNDS (2/3)

Experimental CHNS data

No.	Organic compound	Experimental data							
		N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene (BBOT)	6.49		72.49		6.10		7.44	
		6.48	0.24	72.50	0.04	6.10	0.19	7.42	0.16
		6.51		72.55		6.08		7.42	
2	4-(2-Hidroxyethyl)-piperazine-1-propanesulfonic acid	11.09		42.79		7.95		12.73	
		11.07	0.09	42.87	0.12	7.89	0.38	12.71	0.24
		11.08		42.89		7.93		12.67	
3	4-Amino-N-(1,3-thiazol-2-yl)benzenesulfonamide (Sulfatiazol)	16.33		42.01		3.53		25.03	
		16.30	0.13	41.99	0.05	3.52	0.16	24.98	0.10
		16.29		42.03		3.52		25.01	
4	Cystine	11.65		29.97		5.01		26.66	
		11.64	0.13	29.98	0.07	5.01	0.12	26.64	0.06
		11.67		30.01		5.02		26.63	
5	DL-Homocystine	10.34		35.73		6.01		23.86	
		10.39	0.24	35.56	0.24	6.01	0.10	23.79	0.15
		10.36		35.64		6.00		23.81	
6	Methionine	9.38		40.22		7.40		21.48	
		9.35	0.22	40.23	0.07	70.40	0.16	21.49	0.12
		9.39		40.27		7.42		21.44	
7	N-Acetiltiourea	23.68		30.47		5.09		27.05	
		23.66	0.06	30.50	0.05	5.08	0.01	26.99	0.11
		23.69		30.49		5.09		27.01	
8	Sulphanilamide	16.27		41.80		4.68		18.61	
		16.25	0.09	41.82	0.04	4.67	0.11	18.63	0.13
		16.24		41.79		4.67		18.62	
9	Sulphamethazine	20.10		51.81		5.05		11.51	
		20.13	0.10	51.80	0.04	5.05	0.11	11.52	0.13
		20.14		51.77		5.06		11.49	
10	Sulphanilic acid	8.08		41.58		4.08		18.54	
		8.08	0.07	41.57	0.06	4.06	0.27	18.50	0.11
		8.07		41.62		4.06		18.53	
11	Taurine	11.13		19.22		5.62		25.61	
		11.14	0.05	19.21	0.03	5.63	0.10	25.59	0.04
		11.13		19.21		5.63		25.60	
12	Ammonium sulfate	21.15		-		6.05		24.26	
		21.15	0.07	-	-	6.05	0.10	24.23	0.11
		21.18		-		6.03		24.21	
13	Sulfur powder	-		-		-		99.93	
		-	-	-	-	-	-	99.98	0.09
		-		-		-		99.99	



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CHNS determination

PURE ORGANIC AND INORGANIC COMPOUNDS (3/3)

Sample information for CHNS determination

Standard:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
	Cystine	11.66 N%, 29.99 C%, 5.03 H%, 26.69 S%
	Sulfanilamide	16.27 N%, 41.84 C%, 4.68 H%, 18.62 S%
	Nicotinamide	22.94 N%, 59.01 C%, 4.95 H%,
Standard weight:	2.0 - 3.0 mg BBOT*	
	3.0 - 4.0 mg Cystine	
	3.0 - 4.0 mg Sulfanilamide	
	2.0 - 3.0 mg Nicotinamide	
Sample weight:	2.0 - 3.0 mg for sample 1	
	3.0 - 4.0 mg for samples 2 to 11	
	1.0 - 2.0 mg for sample 12	
	0.5 - 0.6 mg for sample 13	

Note

For CHNS determination, standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Set Oxygen Injection Time 2 seconds for samples 12 and 13.



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Organic - Organometallic Halogenated Compounds

Oxygen determination

PURE ORGANIC COMPOUNDS (1/2)

Theoretical Oxygen values

Organic compound	O%	Organic compound	O%
Acetanilide	11.84	Cyclohexanone 2-4 dinitrophenylhydrazone	23.00
Antipyrine	8.50	Cystine	26.63
Aspartic acid	48.08	2-Iodobenzoic acid	12.90
Atropine	16.59	Methionine	21.45
2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene (BBOT)	7.43	Nicotinamide	13.10
Benzoic acid	26.20	Sulphanilamide	18.58
4-Bromobenzoic acid	15.92	Sulphamethazine	11.49
Caffeine	16.48	Sulphanilic acid	27.71
1-Chloro 2-4 dinitrobenzene	31.60	Tocopherol nicotinate	8.96
Cholesterol	4.14	Urea	26.64

*Cyclohexanone-2,4-dinitrophenylhydrazone



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Organic - Organometallic Halogenated Compounds

Oxygen determination

PURE ORGANIC COMPOUNDS (2/2)

Experimental Oxygen data

Organic compound	O%	RSD%	Organic compound	O%	RSD%
Acetanilide	11.87	0.13	Cyclohexanone 2-4 dinitrophenylhydrazone	22.95	0.13
	11.84			22.96	
	11.86			23.02	
	11.85			23.01	
	11.88			22.99	
	8.54			26.69	
Antipyrine	8.51	0.15	Cystine	26.66	0.08
	8.51			26.65	
	8.52			26.68	
	8.53			26.64	
	48.00			12.86	
	48.01			12.87	
Aspartic acid	48.11	0.12	2-Iodobenzoic acid	12.85	0.15
	48.12			12.90	
	48.05			12.86	
	16.61			21.39	
	16.57			21.40	
	16.63			21.46	
Atropine	16.62	0.14	Methionine	21.44	0.13
	16.62			21.43	
	7.45			13.05	
	7.44			13.11	
	7.41			13.06	
	7.43			13.08	
BBOT	7.44	0.20	Nicotinamide	13.10	0.19
	26.15			18.63	
	26.21			18.62	
	26.18			18.60	
	26.17			18.54	
	26.22			18.60	
4-Bromobenzoic acid	15.97	0.25	Sulphamethazine	11.52	0.21
	15.87			11.54	
	15.90			11.50	
	15.95			11.48	
	15.93			11.49	
	16.47			27.77	
Caffeine	16.40	0.27	Sulphanilic acid	27.74	0.09
	16.49			27.70	
	16.41			27.74	
	16.39			27.75	
	31.53			8.99	
	31.57			8.96	
1-Chloro 2-4 dinitrobenzene	31.60	0.10	Tocopherol nicotinate	8.95	0.18
	31.58			8.96	
	31.53			8.98	
	4.10			26.68	
	4.10			26.62	
	4.14			26.66	
Cholesterol	4.14	0.49	Urea	26.63	0.11
	4.12			26.61	

Sample information

Standard weight:

1.0 - 1.2 mg

Sample weight:

1.0 - 1.2 mg



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CHNS determination

HALOGEN CONTAINING COMPOUNDS

Standard	Halogen	Nitrogen			Carbon			Hydrogen			Sulfur		
Name	%	Av. %	RSD%	T.V.	Av. %	RSD%	T.V.	Av. %	RSD%	T.V.	Av. %	RSD%	T.V.
BCR 71*	9.18 Cl 20.68 Br	10.70	0.35	10.80	40.18	0.26	40.40	2.37	0.65	2.37	8.36	0.39	8.30
		10.63			39.98			2.35			8.31		
		10.64			40.02			2.34			8.30		
BCR 72**	9.18 Cl 20.68 Br	9.64	10.70	10.70	36.12	0.03	36.10	2.11	0.03	2.10	7.41	0.16	7.35
		9.58			36.14			2.10			7.43		
		9.57			36.13			2.11			7.43		

T.V.: theoretical values

BCR 71:** N-(4-bromophenyl)-N'-(2-chloro-4-nitrophenyl)thiourea*BCR 72:** N-(2-chloro-4-phenyl)-N'-(4-iodophenyl)thiourea

Sample information

Standard: BBOT*** 6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

For CHNS Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

*** BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CHN determination

PURE ORGANIC HALOGEN CONTAINING COMPOUNDS

Compound	1-Chloro-2,4-dinitrobenzene (C ₆ H ₃ ClN ₂ O ₄)			4-Bromobenzoic acid (C ₇ H ₅ BrO ₂)			Hexachlorobenzene (C ₆ Cl ₆)			2-Iodobenzoic acid (C ₇ H ₅ IO ₂)		
	N%	C%	H%	N%	C%	H%	N%	C%	H%	N%	C%	H%
Theoretical	13.83	35.58	1.49	-	41.82	2.51	-	25.30	-	-	33.90	2.03
Experimental	13.83	35.54	1.47		41.85	2.49		25.28			33.90	2.01
	13.83	35.59	1.48		41.80	2.49		25.30			33.90	2.02
	13.86	35.57	1.47	-	41.80	2.50	-	25.28	-	-	33.93	2.02
	13.84	35.55	1.48		41.89	2.51		25.29			33.96	2.03
	13.84	35.53	1.48		41.87	2.50		25.29			33.86	2.02
Std. Dev.	0.012	0.024	0.005	-	0.038	0.008	-	0.008	-	-	0.037	0.007
RSD%	0.09	0.07	0.37	-	0.09	0.33	-	0.03	-	-	0.11	0.35

Sample information for CHN determination

Compound	Halogen content	Sample weight (mg)	Standard used for calibration	
			Type	Weight (mg)
1-Chloro-2,4-dinitrobenzene	17.50 Cl%	2.5 - 3.0	Cyclohexanone-2,4-dinitrophenylhydrazone	2.5 - 3.0
Hexachlorobenzene	74.70 Cl%			
4-Bromobenzoic acid	39.75 Br%			
2-Iodobenzoic acid	51.17 I%			

Note
Set Oxygen Injection Time 4 seconds.



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Organic - Organometallic Halogenated Compounds

CH determination

HEXAFLUOROACETONE TRIHYDRATE (C₃F₆O.3H₂O)

Organic compound	Hexafluoroacetone trihydrate (C ₃ F ₆ O.3H ₂ O)	
Element	C%	H%
Theoretical	16.36	2.74
Experimental	16.44	2.75
	16.39	2.76
	16.34	2.74
	16.37	2.75
	16.33	2.77
	16.43	2.77
	16.33	2.78
	16.46	2.78
	16.38	2.74
	16.35	2.74
Std. Dev.	0.047	0.016
RSD%	0.29	0.59

Sample information

Standard: Aspartic acid 36.09 C%, 5.30 H%
 Standard weight: 1.0 - 1.5 mg
 Sample weight: 1.0 - 1.5 mg

Note

Set Oxygen Injection Time 4 seconds.
 The sample contains 51.81 F%.



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Carbon determination

POLY-NUCLEAR AROMATICS HYDROCARBON COMPOUNDS

Theoretical Carbon values

Sample	Polystyrene	Anthracene	Fluorene	Naphthalene
Theoretical C%	91.95	94.34	93.94	93.71

Experimental Carbon data

Compound	Anthracene (C ₁₄ H ₁₀)			Fluorene (C ₁₃ H ₁₀)			Naphthalene (C ₁₀ H ₈)		
Element	W (mg)	C (mg abs)	C%	W (mg)	C (mg abs)	C%	W (mg)	C (mg abs)	C%
Value	55.481	52.34	94.29	56.452	53.03	93.92	54.208	50.80	93.69
	54.438	51.36	94.32	54.115	50.84	93.94	52.292	49.28	93.76
	55.254	52.13	94.27	56.214	52.81	93.87	54.672	51.23	93.67
	54.207	51.14	94.36	56.485	53.06	93.89	56.361	52.81	93.76
	55.881	52.72	94.36	52.928	49.72	93.90	54.748	51.30	93.79
	55.504	52.36	94.29	56.695	53.26	93.88	55.778	52.27	93.72
	55.486	52.34	94.34	53.207	49.98	93.91	55.008	51.55	93.73
	53.521	50.49	94.27	54.498	51.19	93.95	55.945	52.43	93.69
	53.003	50.00	94.28	54.139	50.86	93.93	53.857	50.47	93.72
	54.491	51.41	94.32	55.888	52.50	93.88	56.825	53.25	93.71
Average	-	-	94.31	-	-	93.91	-	-	93.72
Std. Dev.	-	-	0.0350	-	-	0.0275	-	-	0.0372
RSD%	-	-	0.04	-	-	0.03	-	-	0.04

Sample information

Standard: Polystyrene 91.95 C%
Standard weight: 50 - 52 mg
Sample weight: 50 - 55 mg

Note

Set Oxygen Flow 250 ml/min and Oxygen Injection Time 30 seconds.
3 m GC column (p/n 260 07931) was installed into the oven at 45 °C.
Large tin containers (p/n 252 08000) were used to weigh the samples.



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CHN determination

NICOTINIC ACID

Theoretical CHN values

N%	C%	H%
11.38	58.54	4.09

Experimental CHN data

N%	RSD%	C%	RSD%	H%	RSD%
11.37	0.25	58.52	0.11	4.06	0.20
11.38		58.43		4.07	
11.43		58.55		4.08	
11.44		58.43		4.07	
11.39		58.53		4.07	
11.37		58.47		4.05	
11.42		58.46		4.07	
11.43		58.53		4.06	
11.40		58.37		4.07	
11.38		58.58		4.07	

Sample information

Standard:

Aspartic acid

10.52 N%, 36.09 C%, 5.30 H%

Standard weight:

3.0 - 4.0 mg

Sample weight:

2.0 - 3.0 mg



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CH determination

BENZOIC ACID

C%	RSD%	H%	RSD%	O%	RSD%	G.H.V.	RSD%	N.H.V.	RSD%
68.83	0.05	4.93	0.22	26.31	0.37	6211	0.07	5958	0.07
68.79		4.96		26.25		6219		5964	
68.79		4.95		26.22		6214		5960	
68.81		4.95		26.26		6217		5963	
68.89		4.97		26.04		6228		5973	
68.77		4.96		26.36		6216		5961	
68.80		4.95		26.32		6216		5962	
68.76		4.96		26.19		6214		5960	
68.78		4.96		26.31		6218		5963	
68.83		4.96		26.36		6222		5968	

G.H.V. (Gross Heat Value) and N.H.V. (Net Heat Value) determined by the Thermo Scientific EagerSmart Data Handling Software

Sample information for CHN determination

Standard: Acetanilide 71.09 C%, 6.71 H%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Cystine 26.63 O%
Standard weight: 1.0 - 2.0 mg
Sample weight: 1.0 - 2.0 mg

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CH determination

FLUORENE

C%	RSD%	H%	RSD%
94.07	0.03	6.01	0.15
94.14		6.03	
94.08		6.03	
94.10		6.03	
94.10		6.03	

Sample information for CHN determination

Standard: Acetanilide 71.09 C%, 6.71 H%
Standard weight: 2.5 - 3.0 mg
Sample weight: 1.8 - 2.2 mg

Note

The theoretical values are 93.94 C% and 6.06 H%.

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CHNS/O determination

SULFANILIC ACID

Element	N%	C%	H%	S%	O%
Theoretical %	8.09	41.61	4.07	18.51	27.71
Accepted range	±0.10	±0.30	±0.06	±0.20	±0.26

Experimental data									
N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
8.05	0.21	41.69	0.08	4.04	0.50	18.59	0.21	27.68	0.16
8.06		41.64		4.03		18.58		27.74	
8.08		41.58		4.07		18.55		27.71	
8.05		41.63		4.04		18.54		27.75	
8.08		41.68		4.03		18.53		27.66	
8.07		41.65		4.04		18.55		27.68	
8.07		41.70		4.05		18.57		27.68	
8.09		41.63		4.04		18.61		27.70	
8.09		41.67		4.09		18.49		27.73	
8.10		41.66		4.05		18.50		27.73	

Sample information for CHNS determination

Standard: Methionine 9.39 N%, 40.25 C%, 7.43 H%, 21.49 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Cystine 26.63 O%
 Standard weight: 1.0 - 1.2 mg
 Sample weight: 1.0 - 1.2 mg

Note

For CHNS, standard and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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CHNS/O determination

SULFAMETHAZINE

Element	N%	C%	H%	S%	O%
Theoretical %	20.12	51.78	5.07	11.52	11.49
Accepted range	±0.20	±0.30	±0.08	±0.12	±0.12

Experimental data									
N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
20.11	0.19	51.79	0.12	5.08	0.25	11.53	0.36	11.47	0.12
20.05		51.86		5.07		11.60		11.50	
20.02		51.77		5.06		11.55		11.52	
20.14		51.76		5.07		11.53		11.49	
20.10		51.87		5.07		11.58		11.49	
20.09		51.85		5.06		11.63		11.48	
20.11		51.75		5.04		11.56		11.50	
20.10		51.72		5.08		11.59		11.50	
20.13		51.80		5.05		11.65		11.48	
20.06		51.69		5.05		11.56		11.49	

Sample information for CHNS determination

Standard: Methionine 9.39 N%, 40.25 C%, 7.43 H%, 21.49 S%
 CEDFNI* 20.14 N%, 51.79 C%, 5.07 H%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Acetanilide 11.84 O%
 Standard weight: 1.0 - 1.2 mg
 Sample weight: 1.0 - 1.2 mg

Note

For CHNS, standard and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

*CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone



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CHN/O determination

OLEIC ACID IN C₁₇H₃₆

N%	RSD%	C%	RSD%	H%	RSD%	O%	RSD%
≤ 100 ppm	-	84.27	0.03	14.81	0.08	0.411	0.42
		84.24		14.82		0.408	
		84.22		14.81		0.407	
		84.26		14.79		0.409	
		84.27		14.80		9.407	

Sample information for CHN determination

Standard: Polyethylene 85.71 C%, 14.47 H%
 Standard weight: 2.0 - 2.5 mg
 Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: BBOT* 7.43 O%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

For CHN determination, set the Oxygen Flow at 250 ml/min and Oxygen Injection Time at 5 seconds.
 Sample was shaken before weighing.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CHN determination

BORON ORGANIC COMPOUNDS

Code	N%	RSD%	C%	RSD%	H%	RSD%
1	-	-	10.49	0.31	4.89	0.20
			10.50		4.91	
			10.55		4.90	
2	6.89	0.22	40.87	0.21	10.32	0.30
	6.86		40.70		10.36	
	6.87		40.79		10.38	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
 Standard weight: 1.0 mg
 Sample weight: 0.5 mg (sample 1)
 1.0 mg (sample 2)

Theoretical values							
Code	Formula	N%	C%	H%	B%	Co%	Cs%
1	B ₁₈ CoC ₄ H ₂₂ Cs	-	10.52	4.86	42.61	12.90	29.11
2	B ₈ C ₇ H ₂₁ N	6.80	40.86	10.31	42.03	-	-

Note

Set Oxygen Flow at 280 ml/min and the Oxygen Injection Time at 3 seconds for sample 1 and 4 seconds for sample 2. Samples were weighed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510) as follows:

- Tara of the tin container on the balance
- Addition of about 5 mg V₂O₅, tara again on the balance
- Addition of about 0.5 mg of boron carbide sample, take the proper weight in the balance
- Addition of about 5 mg V₂O₅
- Close the tin container



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CHNS determination

ORGANIC LIQUID SAMPLES

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	1.7626		81.4186		15.2550		4.0705	
	1.7618	0.3315	81.3920	0.1743	15.2572	0.3055	4.0726	1.9060
	1.7663		81.5967		15.3175		4.0876	
	1.7746		81.6875		15.2035		3.9237	
2	0.9629	0.2354	89.0842	0.0518	9.3855	0.0354	2.1651	0.0229
	0.9597		89.0190		9.3902		2.1644	
3	0.3752	0.1887	87.2782	0.1967	12.2319	0.2032	0.6728	2.1012
	0.3742		87.0358		12.1968		0.6531	
4	1.4274	0.1190	83.8642	0.3879	15.8155	0.3847	0	0
	1.4250		83.4054		15.7297		0	

Sample information

Standard:

Liquid solution (organic compounds containing N and/or S dissolved in hydrocarbon such as iso-octane, n-hexane)

Standard weight:

2 - 3 µl

Sample weight:

2 - 3 µl

Note

The density can be entered into the sample table. Set the Oxygen Injection Time at 3 seconds.
The injection of the sample must be at 8 seconds after the start of the analysis.

Comment

In general for CHNS analysis, the liquid samples are weighed in tin containers or double tin containers. Volatile samples must be sealed in hard tin containers (p/n 240 08820) using the sealing device for liquids (p/n 205 03002). Under these conditions the standard is BBOT* (2 - 3 mg) and the sample weight is 2 - 3 mg. Depending on the sample nature and the density of the sample, the analysis can be performed by manual or automatic liquid injection.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CH determination

ORGANIC LIQUID SAMPLES

Element%	C%	H%
	83.8406	16.3563
	83.5938	16.3192
	83.3147	16.2556
	83.4546	16.2796
	83.3947	16.2726
	83.4778	16.2773
	83.6000	16.3083
	83.4830	16.2795
	83.5321	16.2851
	83.3985	16.2632
Average %	83.509	16.2897
RSD %	0.1756	0.1852

Sample information

Standard: n-Hexane 83.63 C%, 16.38 H%

Standard volume: 2 - 3 µl

Sample volume: 2 - 3 µl

Note

The sample can be injected manually or by automatic liquid injection.
 The density can be entered into the sample table.
 Set the Oxygen Injection Time at 3 seconds.
 The injection of the sample must be at 8 seconds after the start of the analysis.



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Organic Liquid Samples

CHS determination

LIQUID ORGANIC SOLUTIONS (DIMETHYL SULFOXIDE IN ETHANOL)

Solvents and solutions theoretical values

Sample	C%	H%	S%
Ethanol (density 0.789 g/ml)	52.14	13.12	0
DMSO (density 1.1 g/ml)	65.68	15.15	41.02
DMSO/Ethanol solution A	52.10	13.11	0.0860
DMSO/Ethanol solution B	51.92	13.06	0.428
DMSO/Ethanol solution C	51.73	13.02	0.796
DMSO/Ethanol solution D	52.06	13.08	0.143

Experimental CHS data

Sample	C%	RSD%	H%	RSD%	S%	RSD%
DMSO/Ethanol solution A	52.10	0.10	13.11	0.64	0.0879	1.68
	52.14		13.19		0.0842	
	52.06		13.00		0.0873	
	52.08		13.13		0.0873	
	52.00		13.00		0.0869	
DMSO/Ethanol solution B	52.05	0.10	13.00	0.70	0.428	1.77
	52.00		13.20		0.446	
	52.00		13.03		0.428	
	51.98		12.96		0.434	
	51.91		13.03		0.439	
DMSO/Ethanol solution C	51.89	0.16	13.06	0.36	0.790	0.63
	51.81		13.04		0.796	
	51.94		12.99		0.795	
	51.78		12.98		0.790	
	51.98		13.09		0.802	
DMSO/Ethanol solution D	52.12	0.17	13.08	0.31	0.143	1.55
	51.99		13.03		0.134	
	52.00		13.07		0.144	
	51.88		13.00		0.139	
	52.07		13.10		0.136	

Sample information

Standard: DMSO/Ethanol solutions A, B, C, D
Standard volume: 2 µl
Sample volume: 2 µl

Note

Samples were solutions of dimethyl sulfoxide (DMSO) in ethanol at different concentrations. Ethanol was used as solvent to clean the syringe before and after the injection of each sample. Samples were analyzed by direct injection through the AS 1310 Liquid Autosampler. Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 3 seconds. Samples are injected at 8 seconds after the start.



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LIQUID ORGANIC SOLUTIONS (DIMETHYL SULFOXIDE IN ETHANOL)

Solvents and solutions theoretical values

Sample	C%	S%
Ethanol (density 0.789 g/ml)	52.14	0
DMSO (density 1.1 g/ml)	65.68	41.02
DMSO/Ethanol solution 1	52.10	0.0860
DMSO/Ethanol solution 2	52.08	0.0501

Experimental CS data

Sample	C%	RSD%	S%	RSD%
DMSO/Ethanol solution A	52.82	0.39	0.0486	1.61
	52.05		0.0493	
	52.16		0.0510	
	51.83		0.0508	
	52.22		0.0504	
	52.37		0.0508	
	51.80		0.0494	
	52.26		0.0497	
	52.24		0.0506	
	52.34		0.0496	

Sample information

Standard: DMSO/Ethanol solutions A
Standard volume: 2 µl
Sample volume: 2 µl

Note

Samples were solutions of dimethyl sulfoxide (DMSO) in ethanol. Ethanol was used as solvent to clean the syringe before and after the injection of each sample. Samples were analyzed by direct injection through the AS 1310 Liquid Autosampler. Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 3 seconds. Samples are injected at 8 seconds after the start. the small filter filled with Anydorne (Magensium perchloride) was installed as near as possible to the bottom of the reactor.

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CHN determination

LIQUID ORGANIC SOLUTIONS

Solvents used to prepare the solutions, theoretical values and density

SOLVENT	N%	C%	H%	DENSITY (g/ml)
Heptane	0	83.89	16.11	0.684
Ethanol	0	52.14	13.12	0.789
Di-ethylamine	19.15	65.68	15.15	0.707
Acetonitrile	34.12	58.51	7.37	0.786

Experimental CHN data

Sample	N%	RSD%	C%	RSD%	H%	RSD%	Expected values		
							N%	C%	H%
A	2.95	0.19	81.00	0.08	15.98	0.11	2.96	81.09	16.05
B	1.96	0.28	82.13	0.60	16.02	0.12	1.98	82.02	16.00
C	0.98	0.56	82.96	0.08	16.03	0.17	0.99	82.96	15.98
D	3.39	0.34	52.13	0.26	12.52	0.12	3.40	52.18	12.55
E	2.03	0.27	52.59	0.25	12.81	0.10	2.04	52.53	12.79
F	1.18	0.38	52.78	0.13	12.94	0.19	1.19	52.73	12.93
G	0.833	0.85	52.28	0.08	12.99	0.17	0.852	52.32	12.98
H	0.516	0.80	52.16	0.09	13.03	0.16	0.511	52.25	13.04
I	0.167	0.78	52.07	0.09	13.06	0.13	0.170	52.18	13.09
J	0.786	0.44	83.12	0.14	16.04	0.08	0.791	83.15	16.06
K	0.395	0.58	83.54	0.08	16.09	0.08	0.396	83.52	16.08
L	0.116	1.12	83.76	0.07	16.10	0.07	0.179	83.78	16.10
M	0.393	0.38	83.48	0.13	16.09	0.05	0.396	83.52	16.08
N	0.195	0.67	83.72	0.22	16.08	0.05	0.198	83.71	16.09
O	0.0545	1.50	83.85	0.05	16.09	0.12	0.0530	83.84	16.10
p	0.116	0.72	83.79	0.11	16.08	0.07	0.0119	83.78	16.10
Q	15.32	0.29	69.29	0.12	15.29	0.13	15.35	69.33	15.34
R	9.73	0.41	74.64	0.10	15.63	0.23	9.74	74.64	15.62
S	5.86	0.49	78.38	0.20	15.78	0.32	5.88	78.31	15.81
T	6.61	0.44	77.95	0.14	15.58	0.45	6.60	78.01	15.60

Sample information

Standard:

Standard volume:

Sample volume:

Di-ethylamine in heptane and acetonitrile in ethanol solutions

2 µl

2 µl

Note

Samples were solutions of di-ethylamine in heptane and acetonitrile in ethanol.

Heptane was used as solvent to clean the syringe before and after the injection of each sample. Samples were analyzed 5 Times by direct injection through the AS 1310 Liquid Autosampler. Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 3 seconds.

Samples are injected at 8 seconds after the start. Linear Fit calibration method was used.



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CHNS determination

LIQUID ORGANIC SOLUTIONS (DIMETHYL SULFOXIDE - ACETONITRILE IN ETHANOL)

Solutions theoretical values

Sample	N%	C%	H%	S%
A	0.239	52.24	13.13	0.287
B	0.112	52.19	13.13	0.143
C	0.0620	52.16	13.12	0.0860

Experimental CHS data

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
A	0.236	1.04	52.14	0.14	13.10	0.16	0.285	0.65
	0.235		52.08		13.11		0.285	
	0.239		52.23		13.10		0.284	
	0.239		52.33		13.09		0.281	
	0.235		52.22		13.09		0.288	
	0.236		52.28		13.09		0.286	
	0.231		52.27		13.11		0.284	
	0.235		52.24		13.12		0.285	
	0.233		52.23		13.14		0.284	
	0.237		52.21		13.15		0.283	
	0.111		52.14		13.10		0.139	
	0.109		52.22		13.11		0.137	
B	0.108	1.45	52.18	0.05	13.17	0.19	0.139	1.08
	0.108		52.21		13.16		0.139	
	0.111		52.13		13.15		0.139	
	0.110		52.18		13.14		0.138	
	0.107		52.16		13.14		0.141	
	0.108		52.19		13.15		0.142	
	0.107		52.18		13.12		0.141	
	0.107		52.17		13.10		0.140	
	0.0599		52.11	0.16	13.10	0.14	0.0888	1.43
	0.0584		52.09		13.09		0.0874	
	0.0603		52.08		13.11		0.0865	
	0.0605		52.09		13.15		0.0863	
C	0.0595	1.32	52.07		13.12		0.0862	
	0.0599		52.22		13.13		0.0890	
	0.0593		52.29		13.11		0.0891	
	0.0604		52.10		13.10		0.0889	
	0.0608		52.08		13.09		0.0886	
	0.0587		52.25		13.10		0.0871	

Sample information

Standard: DMSO/Acetonitrile in Ethanol solutions A, B, C
Standard volume: 2 µl
Sample volume: 2 µl

Note

Samples were solutions of dimethyl sulfoxide (DMSO) and acetonitrile in ethanol at different concentrations. Solution A was used to calibrate the system with K factor as calibration method. Ethanol was used as solvent to clean the syringe before and after the injection of each sample. Samples were analyzed by direct injection through the AS 1310 Liquid Autosampler. Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 3 seconds. Samples are injected at 8 seconds after the start.



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Organic Liquid Samples

CHNS determination

LIQUID ORGANIC SOLUTIONS (Lubricant Reference Material in iso-Octane)

Solutions theoretical values

Sample	N%	C%	H%	S%
A	0.143	83.89	15.62	0.325
B	0.103	83.95	15.63	0.239
C	0.0540	84.03	15.78	0.122

Experimental CHS data

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
A	0.142	1.11	84.16	0.28	15.66	0.31	0.325	1.08
	0.142		84.04		15.72		0.319	
	0.145		84.08		15.66		0.326	
	0.142		84.16		15.66		0.325	
	0.142		83.55		15.57		0.324	
	0.145		84.08		15.66		0.326	
	0.142		84.16		15.66		0.325	
	0.142		83.55		15.57		0.324	
	0.144		83.85		15.68		0.332	
	0.140		83.87		15.70		0.330	
B	0.0977	1.14	83.86	0.07	15.69	0.07	0.231	1.16
	0.0978		83.96		15.67		0.237	
	0.0973		83.91		15.70		0.239	
	0.0963		83.96		15.71		0.236	
	0.0960		83.95		15.69		0.231	
	0.0983		84.00		15.70		0.233	
	0.1001		83.86		15.68		0.236	
	0.1003		84.04		15.70		0.233	
	0.1000		83.97		15.69		0.239	
	0.0977		83.86		15.69		0.231	
C	0.0556	1.49	84.29	0.09	15.78	0.07	0.121	1.34
	0.0575		84.21		15.75		0.119	
	0.0586		84.23		15.76		0.122	
	0.0585		84.14		15.76		0.119	
	0.0585		84.19		15.78		0.120	
	0.0561		84.10		15.76		0.117	
	0.0560		84.29		15.78		0.119	
	0.0565		84.07		15.75		0.118	
	0.0556		84.10		15.76		0.117	
	0.0585		84.14		15.76		0.119	

Sample information

Standard: Thermo Scientific Lubricant Reference Material in iso-Octane solutions A, B, C
Standard volume: 2 µl
Sample volume: 2 µl

Note

Samples were solutions of Thermo Scientific Lubricant Reference Material at different concentrations. Solution A was used to calibrate the system with K factor as calibration method. Iso-Octane was used as solvent to clean the syringe before and after the injection of each sample. Samples were analyzed by direct injection through the AS 1310 Liquid Autosampler. Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 3 seconds. Samples are injected at 8 seconds after the start.



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Organic Liquid Samples

Oxygen determination

ETHANOL (34.71 O%)

Element	O%
	34.6566
	34.5361
	34.5543
	34.6131
	34.5548
	34.6094
	34.5087
	34.5223
	34.5203
	34.5090
Average	34.5585
RSD%	0.1476

Sample information

Sample volume: Atropine 2 - 3 µl

Note

The analyses can be performed using the Manual Injection Device (p/n 190 04138) or liquid autosampler. The injection is at 8 seconds after the start.



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Organic Liquid Samples

CH determination

HEXADECANE (C₁₆H₃₄)

C%	RSD%	H%	RSD%
84.6669	0.0709	15.0912	0.1966
84.5102		15.1145	
84.5996		15.1118	
84.5798		15.1243	
84.5075		15.0670	
84.5780		15.1395	
84.5663		15.1327	
84.6526		15.1079	
84.5807		15.1421	
84.6808		15.1713	
84.6351		15.1626	
84.6703		15.1486	
84.6464		15.1624	
84.6589		15.1471	
84.6967		15.1649	

Sample information

Standard: Iso-Octane
 Standard weight: 2.0 - 2.5 mg
 Sample weight: 2.0 - 2.5 mg

Note

About 2 µl of standard and sample were introduced by a syringe in a hard tin container (p/n 240 08820) closed by the sealing device (p/n 252 03002).

Comment

The theoretical percentages of hexadecane are 84.87 C%, 15.13 H% and the density is 0.77 g/l.



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Organic Liquid Samples

CHN/O determination

TOCOPHEROL NICOTINATE

N%	RSD%	C%	RSD%	H%	RSD%	O%	RSD%
2.61	0.44	78.59	0.15	10.01	0.15	8.96	0.61
2.62		78.51		10.01		8.89	
2.61		78.52		10.02		9.03	
2.64		78.78		10.05		8.87	
2.63		78.85		10.04		9.02	
2.64		78.70		10.04		8.95	
2.62		78.57		10.02		8.97	
2.63		78.52		10.02		8.96	
2.61		78.60		10.01		8.93	
2.62		78.72		10.04		9.03	

Sample information for CHN determination

Standard: Atropine
Standard weight: 2.5 - 3 mg
Sample weight: 2.0 - 2.2. mg
4.84 N%, 70.56 C%, 8.01 H%

Sample information for Oxygen determination

Standard: Acetanilide
Standard weight: 1.0 - 2.0 mg
Sample weight: 1.0 - 2.0 mg
11.84 O%

Note

The theoretical values are 2.61 N%, 78.46 C%, 9.97 H% and 8.96 O%.

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Organic Liquid Samples

Nitrogen determination

HIGH CONTAINING UREA WATER SOLUTIONS (ISO 22241-2:2006 Annex B)

Solution A (15.61 N%)			Solution B (15.10 N%)			Solution C (14.40 N%)		
N%	Av. N%	RSD%	N%	Av. N%	RSD%	N%	Av. N%	RSD%
15.59	15.74	0.51	15.10	15.21	0.52	14.28	14.40	0.44
15.71			15.15			14.39		
15.76			15.25			14.38		
15.76			15.16			14.34		
15.85			15.19			14.47		
15.80			15.24			14.38		
15.75			15.10			14.41		
15.74			15.29			14.48		
15.80			15.33			14.47		
15.62			15.26			14.42		

Sample information

Standard: Urea water solution 15.61 N%

Standard weight: 50 ul

Sample weight: 50 ul

Note

- N/Protein configuration was used for the analysis using a one meter GC column (p/n 260 70004). Set the Oxygen Flow at 300 ml/min and the Oxygen Injection Time at 10 seconds.
- The solutions were prepared according to the sample preparation method.
- Standard and samples were injected by the AS 1310 Liquid Autosampler at 8 seconds after the start of the analysis, as blank bidistilled water was used. The AS 1310 method was:

Sample Volume: 50 ul	Air Volume: 0 ul
Plunger Strokes: 3	Viscous Sample: YES
Sampling Depth in Vial: Bottom	Washes: bidistilled water
- It is suggested to prepare the solutions and fill the vials as close as possible to the analysis Time, and inject one Time per vial to avoid influence in the data due to the urea crystallization. Some blanks between the solutions is also suggested.

Sample preparation method (32.5% w/w urea in water)

- Place a 20 ml vial onto the balance and tare to zero.
- Use a small spatula to weigh approx. 7.085 g certified urea.
- Record the exactly weight of urea to 5 decimal places.
- Multiply the weight of urea by 2.0769 to give a required weight of water.
- Use a syringe or pipettor to inject the amount of water.
- Record the exactly weight of water to 5 decimal places.
- Place the lid securely on the vial and shake to homogenize.
- Place vial in ultrasound bath for several hours until the solution is clear of haze.
- Calculate the % of urea in the solution by dividing the weight of urea by the weight of urea plus weight of water; and multiply that figure x 100.
- Calculate the N% in the solution by multiplying the % of urea by the certified N% in the urea.

Comment:

- The FlashSmart EA fulfills the requirements of the Official Method ISO 22241-2:2006 Annex B, Determination of urea content by total nitrogen.



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Paint Leads

Nitrogen determination

PAINT LEADS

Sample	N%		
A	1.07	1.09	1.09
B	0.65	0.63	0.63
C	0.60	0.60	0.61

Sample information

Standard:	Atropine	4.84 N%
Standard weight:	5.0 - 10 mg	
Sample weight:	50 - 100 mg	



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Pesticides

CHNS determination

PESTICIDES

Sample	N%	C%	H%	S%
Ziram	7.921	24.30	3.94	35.62
	7.949	24.36	3.96	36.01
	7.921	24.27	3.94	36.08
Zineb B	9.705	17.39	2.267	46.264
	9.751	17.44	2.273	46.432
	9.676	17.31	2.249	46.072
Mancozeb	9.40	19.06	2.52	42.63
	9.37	19.29	2.52	42.07
	9.39	19.13	2.52	42.44

Sample information

Standard: Cystine 11.66 N%, 29.99 C%, 5.03 H%, 26.69 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Comment

The samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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CHNS determination

TABLETS

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
0.2891		28.9027		5.1564		0.1685	
0.2845	1.2316	29.0092	0.2654	5.1544	0.2145	0.1677	0.2405
0.2822		29.0521		5.1745		0.1680	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

The sample was homogenized by a ball mill.
 Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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NCS determination

CHONDROITINE SULFATE

N%	RDS%	C%	RSD%	S%	RSD%
3.10	0.432	32.32	0.461	5.29	0.546
3.10		32.64		5.31	
3.10		32.53		5.31	
3.07		32.26		5.27	
3.11		32.42		5.25	
3.09		32.35		5.30	
3.07		32.31		5.27	
3.09		32.22		5.24	
3.10		32.16		5.25	
3.10		32.49		5.32	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

Comment

The sample is extracted from animal cartilage from domestic animal slaughtered in veterinary approved slaughter houses.

*BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CHN determination

MOXIFLOXACIN HYDROCHLORIDE (57.60 C%, 5.75 H%, 9.60 N%)

N%	RSD%	C%	RSD%	H%	RSD%
9.607	0.256	57.648	0.109	5.702	0.296
9.561		57.611		5.721	
9.624		57.621		5.705	
9.617		57.710		5.700	
9.605		57.536		5.740	

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 0.5 - 0.8 mg

Note

The sample ($C_{21}H_{25}FN_3O_4$) is an effective antibiotic against many strains of both gram negative and gram positive bacteria. It is used to treat adults with infections of the lungs, sinuses, skin and abdominal cavity.



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CH determination

ORGANIC - BETAMETHASONE VALERATE (C₂₇H₃₇FO₆)

C%	RSD%	H%	RSD%
68.4536		7.8217	
68.0902		7.7968	
68.1083		7.7911	
68.2668		7.7995	
68.1268	0.1803	7.8200	0.4272
68.3935		7.8743	
68.2587		7.8537	
68.1530		7.8382	
68.1644		7.8586	
68.2754		7.8858	

Sample information

Standard:	Acetanilide	71.09 C%, 6.71 H%
Standard weight:	1.0 - 1.5 mg	
Sample weight:	1.0 - 1.5 mg	
Theoretical values:		68 C%, 7.77 H%

Note

In the CHN configuration the fluorine adsorber mix was used (p/n 338 40030).



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Nitrogen determination

INSULIN

Sample	N%	RSD%
1	14.5500	0.1172
	14.5836	
	14.5857	
	14.5633	
2	14.3800	0.0605
	14.3677	
3	14.0100	0.1276
	14.0353	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 60 mg
Sample weight: 40 - 50 mg

Comment

Set Oxygen Injection Time 20 seconds, Sample Delay 10 seconds.



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CHNS determination

CHINESE MEDICAL HERBS EXTRACT (viscous)

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
3.15	0.16	65.44	0.09	7.42	0.11	0.506	0.47
3.15		65.47		7.41		0.502	
3.15		65.51		7.40		0.507	
3.16		65.58		7.41		0.503	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 0.5 - 0.8 mg

Sample weight: 0.4 - 0.6 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
 Sample was weighed without V_2O_5 by the Ultramicro Balance Mettler XPR2U, (p/n 432 30087), due to the low amount of sample.
 The Oxygen Injection Time was 3 seconds.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CHNS determination

LYOPHILIZED PHARMACEUTICAL PRODUCTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1 (solid)	0.862	0.31	0.862	0.15	5.56	0.54	0.605	0.66
	0.857		0.857		5.50		0.612	
	0.858		0.858		5.53		0.611	
2 (liquid)	0.0168	1.52	0.0168	0.55	11.05	0.29		-
	0.0165		0.0165		11.10		-	
	0.0163		0.0163		11.04			
3 (solid)	13.45	0.19	13.45	0.09	6.28	0.16	1.52	0.63
	13.48		13.48		6.27		1.53	
	13.43		13.43		6.26		1.54	

Sample information

Standard: BBOT* for sample 1 and 3 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
CEDFNI** for sample 3 20.14 N%, 51.79 C%, 5.07 H%
Tocopherol nicotinate for sample 2 2.61 N%, 78.46 C%, 9.97 H%

Standard weight: 2.0 - 2.5 mg

Sample weight: 2.5 - 3.0 mg samples 1 and 3
4.0 - 5.0 mg sample 2

Note

Set the Oxygen Injection Time at 4 seconds.
Standard and solid samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
Sample 2 was solubilized in 500 ul distilled water and weighed in double tin containers.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene
** CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone

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CHN determination

TERIFLUNOMIDE

Code	N%	RSD%	C%	RSD%	H%	RSD%
Batch 1	10.32	0.22	53.28	0.15	3.33	0.16
	10.36		53.29		3.33	
	10.30		53.26		3.33	
	10.35		53.37		3.34	
	10.35		53.30		3.34	
	10.33		53.16		3.34	
Batch 2	10.34	0.13	53.34	0.05	3.34	0.24
	10.33		53.33		3.33	
	10.33		53.34		3.32	
	10.36		53.27		3.33	
	10.34		53.31		3.34	
	10.36		53.34		3.34	

Sample information

Standard:

Nicotinamide

22.94 N%, 59.01 C%, 4.95 H%

Standard weight:

1.0 - 1.2 mg

Sample weight:

1.0 - 1.2 mg

Medical use and theoretical values

Medical use	Formula	N%	C%	H%	O%	F%
Multiple sclerosis	$C_{12}H_{19}F_3N_2O_2$	10.37	53.34	3.36	11.84	21.09

Note

As sample contains fluorine, the CHN reactor was filled with the fluorine adsorber (p/n 338 40030).



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CHNS/O determination

RIVAROXABAN

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
Batch 1	9.67	0.18	52.43	0.01	4.15	0.28	7.33	0.28	18.31	0.03
	9.67		52.42		4.17		7.36		18.32	
	9.64		52.43		4.15		7.37		18.31	
Batch 2	9.66	0.18	52.44	0.03	4.15	0.24	7.37	0.31	18.37	0.05
	9.66		52.41		4.13		7.33		18.36	
	9.63		52.42		4.14		7.37		18.35	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Sulfanilamide 18.58 O%
 Standard weight: 1.0 - 1.5 mg
 Sample weight: 1.0 - 1.5 mg

Medical use and theoretical values

Medical use	Formula	N%	C%	H%	S%	O%
Anticoagulant	$C_{19}H_{18}ClN_3O_5S$	9.64	52.35	4.16	7.36	18.35

Note

For CHNS, standard and sample were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Pharmaceutical Products

CHN/O determination

PHARMACEUTICAL PRODUCTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	O%	RSD%
Ivabradine hydrochloride	5.50	0.10	63.97	0.04	7.39	0.14	15.80	0.15
	5.51		64.02		7.38		15.84	
	5.50		64.00		7.40		15.80	
Perampanel	11.98	0.13	79.12	0.06	4.29	0.13	4.58	0.13
	12.01		79.03		4.28		4.58	
	11.99		79.08		4.28		4.57	
Fesoterodine fumarate	2.64	0.22	68.27	0.00	7.84	0.07	21.25	0.05
	2.65		68.27		7.85		21.25	
	2.65		68.28		7.85		21.27	

Sample information for CHN determination

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Atropine 16.59 O%
Nicotinamide 13.10 O%
Methionine 21.45 O%
Standard weight: 1.0 - 1.5 mg
Sample weight: 1.0 - 1.5 mg

Medical use and theoretical values						
Sample	Medical use	Formula	N%	C%	H%	O%
Ivabradine hydrochloride	For stable angine pectoris	C ₂₇ H ₃₇ ClN ₂ O ₅	5.55	64.21	7.38	15.84
Perampanel	Antiepileptic	C ₂₃ H ₁₅ N ₃ O	12.03	79.07	4.33	4.58
Fesoterodine fumarate	Antimuscarinic	C ₃₀ H ₄₁ NO ₇	2.65	68.29	7.83	21.22

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Pharmaceutical Products

CHN determination

PHARMACEUTICAL PRODUCTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%
Agomelatine	5.75	0.17	73.95	0.07	7.04	0.08
	5.74		74.03		7.05	
	5.76		73.93		7.05	
Apixaban Batch 1	15.25	0.07	65.35	0.08	5.46	0.28
	15.23		65.45		5.47	
	15.24		65.43		5.49	
Apixaban Batch 2	15.27	0.10	65.39	0.06	5.47	0.18
	15.25		65.46		5.46	
	15.28		65.41		5.48	

Sample information for CHN determination

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Medical use and theoretical values						
Sample	Medical use	Formula	N%	C%	H%	O%
Agomelatine	Melatonergic antidepressant	C ₁₅ H ₁₇ NO ₂	5.76	74.05	7.04	13.15
Apixaban	Anticoagulant	C ₂₅ H ₂₅ N ₅ O ₄	15.24	65.35	5.48	13.93

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Pharmaceutical Products

CHNS determination

DOFETILIDE

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
Batch 1	9.51	0.24	51.71	0.08	6.14	0.16	14.54	0.07
	9.51		51.76		6.13		14.53	
	9.47		51.79		6.12		14.55	
Batch 2	9.44	0.06	51.77	0.06	6.13	0.25	14.58	0.04
	9.44		51.73		6.10		14.59	
	9.45		51.79		6.11		14.58	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Medical use and theoretical values						
Medical use	Formula	N%	C%	H%	S%	O%
Antiarrhythmic agent	$C_{19}H_{27}N_3O_5S_2$	9.52	51.70	6.12	14.51	18.15

Note

For CHNS, standard and sample were weighed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Sugars

CHN determination

SUGARS

Sample	N%	C%	H%
A	14.384	2.903	16.051
	14.357	2.977	15.982
B	9.503	1.976	17.647
	9.591	1.661	17.726
C	5.087	31.601	4.445
	5.065	31.512	4.163
D	5.386	36.962	6.392
	5.268	36.856	6.608

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 1.0 - 1.5 mg

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Urea Formaldehyde

NC determination

UREA FORMALDEHYDE

Sample	N%	RSD%	C%	RSD%
1	24.73		22.66	
	24.64		22.26	
	24.99	0.627	22.53	0.991
	24.65		22.26	
	24.61		22.12	
2	20.89		22.04	
	20.66		22.28	
	20.89	0.615	22.27	0.542
	20.66		22.23	
	20.90		22.33	
3	19.72		22.80	
	19.51		22.97	
	19.47	1.124	22.87	0.667
	19.90		23.16	
	19.96		23.11	
4	25.73		21.75	
	25.51		21.83	
	25.55	0.462	21.79	0.139
	25.78		21.77	
	25.71		21.77	

Sample information

Standard: Nicotinamide 22.94 N%, 59.01 C%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 4.0 mg

Note

Use Oxygen Flow 250 ml/min and Oxygen Injection Time 4 seconds.
 The volatile samples were weighed in hard tin container (p/n 240 08820) closed with the sealing device (p/n 205 03002).



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Urea Formaldehyde

NCS determination

UREA FORMALDEHYDE

Sample	N%	RSD%	C%	RSD%	S%	RSD%
Urea formaldehyde	16.0656		17.8400		0.3507	
	16.9611		17.9240		0.3482	
	16.0371	0.3264	17.0591	0.5151	0.3354	1.8593
	15.9990		17.8361		0.3435	
	16.0927		17.9566		0.3505	
Melamine-urea-formaldehyde	24.9754		21.7912		0	
	24.9892		21.8417		0	
	24.8378	0.4049	21.8740	0.2018	0	0
	24.9543		21.7680		0	
	24.7577		21.8513		0	
Urea-melamine-phenolic-formaldehyde	26.6121		24.7282		0.0741	
	26.2952		24.6661		0.0748	
	26.3821	0.4895	24.5534	0.4021	0.0766	2.1439
	26.4466		24.6109		0.0730	
	26.5628		24.8076		0.0726	

Sample information

Standard:

BBOT*

Nicotinamide

2.0 - 3.0 mg

Standard weight:

Sample weight:

2.0 - 4.0 mg

6.51 N%, 72.53 C%, 7.44 S%

22.94 N%, 59.01 C%

Note

Sample was weighed in double tin container.

Comment

Samples are an irritant to eyes.

BBOT and samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Vaccines

Nitrogen determination

VACCINES (LIQUIDS)

Sample 1		Sample 2		Sample 3	
N%	RSD%	N%	RSD%	N%	RSD%
0.0446	1.20	0.2095	0.75	0.3003	0.72
0.0436		0.2064		0.2987	
0.0444		0.2076		0.3030	

Sample information for CHN determination

Standard: Urea water solution 0.2 N%

Standard weight: 200 mg

Sample weight: 200 mg

adsorbed on about 40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530)



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Plastics - Additives

Nitrogen determination

PLASTICS AND ADDITIVES

Sample	N%	RSD%
Raw Material (Dimeric benzotriazole)	12.7990	
	12.8081	0.0572
	12.8135	
Polycarbonate + Dimeric benzotriazole	0.6419	
	0.6453	0.4835
	0.6391	
Raw Material (Hindered amine light stabilizer)	5.7666	
	5.7530	0.2312
	5.7400	
White polystyrene granules contains hindered amine light stabilizer	0.5063	
	0.5013	0.8082
	0.5094	

Sample information

Standard:	Acetanilide	10.36 N%
	Atropine	4.84 N%
Standard weight:	25 - 30 mg	
Sample weight:	25 - 30 mg	



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Polyethylene Films

Nitrogen determination

POLYETHYLENE FILMS

Sample	N%	RSD%
1	0.2410	0.3120
	0.2410	
	0.2397	
2	0.1569	1.2122
	0.1590	
	0.1552	
3	0.1072	1.5730
	0.1040	
	0.1064	
4	0.0781	0.6038
	0.0779	
	0.0788	
5	0.0492	0.8405
	0.0500	
	0.0494	
6	0.0266	5.5556
	0.0252	
	0.0238	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 3.0 - 4.0 mg
Sample weight: 20 - 25 mg

Note

For this application the N/Protein configuration was used, setting the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 20 seconds.



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Polycarbonate Polymers (Pellets)

Nitrogen determination

POLYCARBONATE POLYMERS (PELLETS)

Sample	1	2	3	4	5
N%	0.675	0.656	0.617	0.113	0.110
	0.678	0.651	0.622	0.111	0.111
RSD%	0.314	0.541	0.571	1.263	0.640

Sample information

Standard: Atropine 4.84 N%
 Standard weight: 25 - 30 mg
 Sample weight: 150 - 170 mg

Note

For this application the N/Protein configuration was used, setting the Oxygen Flow to 300 ml/min and the Oxygen Injection Time to 50 seconds for the standard, blanks and samples.



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NCS determination

POLYMERS POWDERS

Sample	N%	RSD%	C%	RSD%	S%	RSD%
1	15.8294		45.9830		0.2207	
	15.7396	0.3034	54.9498	0.1582	0.2227	0.5478
	15.7558		54.8187		0.2229	
2	13.7750		49.0137		3.2660	
	13.7633	0.0537	48.8889	0.1295	3.2817	0.2703
	13.7770		48.9706		3.2668	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%

Standard weight: 1.0 - 1.5 mg

Sample weight: 1.0 - 1.5 mg

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Nitrogen determination

POLYMERS

Element	N%				
A	0.189	0.190	0.191	0.190	0.189
B	3.594	3.573	3.585		
C	0.030	0.030	0.031	0.028	0.032

Sample information

Standard:	Atropine	4.84 N%
Standard weight:	5.0 - 10 mg	
Sample weight:	15 - 20 mg	

Note

The nitrogen content is correlated with the quality and properties of polymers. N-containing compounds are used in the production process as initialization or termination agents and as additives to provide specific properties to the final product.



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Nitrogen determination

POLYMERS

Sample	N%	N ppm
Polyacrylonitrile	26.44	
	26.51	
	26.41	
Polypropylene		220
		213
		218
Polyethylene A		1044
		1027
		1071
Polyethylene B		114
		103
		107

Sample information

Standard:	CEDFNI (Cyclohexanone-2,4-dinitrophenylhydrazone)	20.14 N%
Standard weight:	10 - 15 mg	
Sample weight:	10 - 15 mg	

Comment

The nitrogen content indicates the quality and properties of polymers. N-containing compounds are used in the polymerization reactions, as initiation or termination agents, and as additives to provide specific properties to the final product.



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Oxygen determination

POLYMERS

Element	O%	
A	0.272	0.266
B	0.245	0.242
C	0.171	0.169
D	0.160	0.162
E	0.159	0.160
F	0.158	0.153

Sample information

Standard:	Acetanilide	11.84 O%
Standard weight:	1.0 - 1.5 mg	
Sample weight:	4.0 - 5.0 mg	

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Nitrogen determination

POLYMERS (PELLETS)

Sample	N%	RSD%
1	0.0985	1.5888
	0.0998	
	0. 0982	
	0.1002	
	0.1029	
	0.0999	
	0.1005	
	0.1001	
	0.1008	
	0.1031	
2	0.0331	2.2360
	0.0322	
	0.0324	
	0.0328	
	0.0326	
	0.0334	
	0.0346	
	0.0335	
	0.0327	
	0.0339	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 10 - 12 mg
Sample weight: 200 - 250 mg

Note

Configuration used was FlashSmart™ EA N/Protein with fixed amount of oxygen of 50 seconds (Thermo Scientific OxyTune®).

Comment

These two samples were analyzed directly as pellets.
If the pellets are not homogenous, samples must be homogenized or cut into small pieces.



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CHN/O determination

POLYSACCARIDE

Sample	N%	C%	H%	O%
1	0.2340	36.1026	5.5922	50.6966
	0.2376	36.0018	5.7482	50.4187
2	0.1498	34.7311	5.4678	51.0589
	0.1524	34.9482	5.6513	50.8573
3	0.1583	36.3348	5.9859	47.7339
	0.1650	36.3123	5.6644	48.1444
4	0.1761	34.5637	5.5253	48.0143
	0.1816	34.6324	5.7206	47.3465
5	0.1975	37.0801	5.8705	48.3638
	0.1871	37.0596	5.5945	48.3224
6	0.2621	35.1802	5.6854	47.8829
	0.2568	35.3110	5.5690	46.8917
7	0.1649	35.5733	5.7797	46.3274
	0.1682	35.7007	5.7728	46.5683

Sample information

Standard:

Atropine
Benzoic acid
1.0 - 2.0 mg
1.0 - 2.0 mg

4.84 N%, 70.56 C%, 8.01 H%
26.20 O%

Standard weight:

Sample weight:



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CHNS/O determination

POLYSACCARIDE

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	2.06	0.69	33.92	0.40	6.05	0	0.0866	0.41	49.69	0.38
	2.04		33.73		6.05		0.0871		49.42	
2	2.19	0.32	35.06	0.38	5.39	0.26	0.1816	0.50	43.85	0.81
	2.18		35.25		5.37		0.1829		43.35	
3	2.36	0.30	35.44	0.81	5.66	0.50	0.2093	0.54	42.64	0.59
	2.37		35.85		5.70		0.2109		43.00	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.56 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 2.0 - 3.0 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%
 Standard weight: 0.5 - 1.0 mg
 Sample weight: 0.5 - 1.0 mg

Note

Set Oxygen Injection Time at 4 seconds.
 For CHNS Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CHN/O determination

POLYACRYLONITRILES

Sample	N%	C%	H%	O%
A	23.17	64.26	5.73	4.79
	23.35	64.35	5.76	4.59
	23.17	64.42	5.68	4.63
B	22.77	64.65	5.73	5.31
	22.54	64.23	5.66	5.37
	22.44	64.41	5.62	5.30
C	24.97	64.88	5.67	2.99
	24.88	65.20	5.66	3.01
	24.88	65.23	5.70	2.98

Sample information

Standard: Acetanilide 10.36 N%, 71.09 C%, 6.71 H%, 11.84 O%

Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Comment

The acrylonitrile (monomer) is the base of many types of compounds (polyacrylonitriles) such as fibers, plastics, surface coatings and adhesives.



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CHNS/O determination

POLYIMIDE

Element	N%	C%	H%	S%	O%
	3.483	61.108	2.642	3.950	20.304
	3.494	61.092	2.629	3.910	20.213
	3.478	61.168	2.620	3.943	20.236
Average %	3.485	61.123	2.630	3.934	20.251
RSD %	0.2349	0.0656	0.4205	0.543	0.2337

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
26.20 O%

Standard weight: 1.0 - 2.0 mg

Sample weight: 1.0 - 2.0 mg

Note

For CHNS determination, the sample was analyzed with the addition of about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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CH determination

POLYSTYRENE

C%	RSD%	H%	RSD%
92.35	0.10	7.75	0.30
92.08		7.69	
92.16		7.74	
92.10		7.71	
92.22		7.76	
92.23		7.76	
92.17		7.75	
92.23		7.74	
92.29		7.76	
92.08		7.75	

Sample information for CHN determination

Standard:	Atropine	70.56 C%, 8.01 H%
	Acetanilide	71.09 C%, 6.71 H%
Standard weight:	2.5 - 3.0 mg	
Sample weight:	1.8 - 2.2. mg	

Note

The theoretical values are 92.3 C% and 7.6 H%.
Linear Fit can be used as calibration method.



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Polymers Powders

CH determination

POLYETHYLENE

C%	RSD%	H%	RSD%
85.81	0.07	14.25	0.36
85.81		14.39	
85.79		14.41	
85.82		14.41	
85.75		14.39	
85.86		14.44	
85.82		14.43	
85.68		14.39	
85.69		14.39	
85.72		14.40	

Sample information for CHN determination

Standard:	Atropine	70.56 C%, 8.01 H%
	Acetanilide	71.09 C%, 6.71 H%
Standard weight:	2.5 - 3.0 mg	
Sample weight:	1.8 - 2.2. mg	

Note

The theoretical values are 85.70 C% and 14.30 H%.
Linear Fit can be used as calibration method.



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Agave

CHNS/O determination

AGAVE

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
0.9503		42.3880		5.9434		0.0667		39.5014	
0.9527	0.25	42.4072	0.07	5.9098	0.41	0.0643	1.91	39.6814	0.26
0.9550		42.4435		5.9577		0.0649		39.5037	

Heat Values and CO₂ Emission Trade calculation

G.H.V.	RSD%	N.H.V.	RSD%	CO ₂ E.T.	RSD%
3733.53		3428.91		108.29	
3739.40	0.09	3434.77	0.09	108.10	0.09
3738.97		3434.34		108.11	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 3.0 - 4.0 mg

Sample information for Oxygen determination

Standard: Cystine 26.63 O%
 Standard weight: 1.0 - 2.0 mg
 Sample weight: 1.0 - 2.0 mg

Note

For CHNS Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
 Samples were homogenized by a ball mill.

*BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Alfalfa Reference Material

CHN determination

ALFALFA REFERENCE MATERIAL

Weight (mg)	N%	RSD%	C%	RSD%	H %	RSD%
3.099	2.135		48.110		6.483	
2.652	2.136	0.31	48.350	0.56	6.489	0.09
2.303	2.124		47.860		6.492	
2.716	2.308		50.210		6.203	
3.118	2.292	0.44	50.143	0.09	6.199	0.15
2.868	2.289		50.129		6.205	
2.806	2.962		43.342		5.959	
2.837	3.009	0.88	43.470	0.18	5.926	0.73
2.762	3.006		43.480		6.011	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%

Standard weight: 3.0 - 4.0 mg

Sample weight: 3.0 - 4.0 mg

Note

The certified N% is 3.01 (uncertainty ± 0.2).
Carbon and Hydrogen content are not certify.
The percentages varies from batch to batch.



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Cellulose Foil

Total Carbon (TC) and Total Organic Carbon determination (TOC)

CELLULOSE FOIL

TC%	RSD%	TOC%	RSD%
42.8685	0.0188	41.79	0.4525
42.8571		41.91	
		41.71	
		41.69	
		41.40	

Sample information

Standard: Acetanilide 71.09 C%

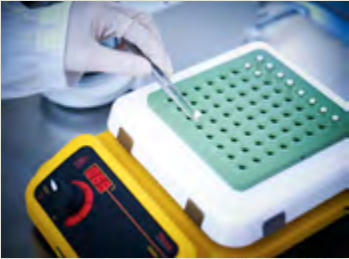
Standard weight: 2.0 - 3.0 mg

Sample weight: 2.0 - 4.0 mg

Note

Set Oxygen Flow at 250 ml/min and Oxygen Injection Time at 5 seconds.
TOC determination was performed with the dedicated kit (p/n 190 04120).
TOC % values are determined by FlashSmart™ EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

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Cereals

Sulfur determination

CEREALS

Sample	S%					
Soy 1	0.356	0.336	0.338	0.350	0.343	0.341
Soy 2	0.351	0.344	0.343			
Soy 3	0.372	0.373	0.363			
Soy 4	0.366	0.363	0.364			
Maize 1	0.115	0.114	0.116	0.113	0.113	0.106
Maize 2	0.119	0.111				
Maize 3	0.104	0.104				
Maize 4	0.112	0.102				
Maize 5	0.102	0.100				

Sample information

Standard: BBOT* 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 2.0 - 3.0 mg

Note

The samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Cottons - Papers - Textile Fibers

Nitrogen determination

COTTONS, PAPERS & TEXTILE FIBERS

Sample	N%			N ppm		
Cotton A	0.69	0.68	0.68			
Cotton B	0.46	0.46	0.45			
Cotton C	0.34	0.34	0.33			
Paper A				2555	2525	2534
Paper B				1666	1692	1709
Paper C				327	337	314
Paper D				154	169	151
Textile fiber A				550	560	565
Textile fiber B				510	524	521

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:		10 - 15 mg
Sample weight:	Cotton	20 - 30 mg
	Paper	5.0 - 10 mg
	Textile fiber	100 - 200 mg



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Leaves - Pine Needles

NCS determination

LEAVES, PINE NEEDLES

Sample	N%	RSD%	C%	RSD%	S%	RSD%
Pine Needles 1	1.167	1.433	49.138	0.225	0.117	2.469
Pine Needles 2	1.172	0.876	43.485	0.479	0.174	3.581
Pine Needles 3	1.182	1.034	48.156	0.315	0.0317	2.629
Pine Needles 4	2.436	1.494	46.789	0.665	0.0323	2.168
Citrus Leaves	2.637	1.346	41.612	0.500	0.393	1.215
Spruce Leaves	1.144	1.260	49.079	0.194	0.0634	1.378
Blackberry Leaves	1.334	1.994	47.853	0.082	0.0622	1.829
Birch Leaves	1.197	0.805	46.896	0.132	0.245	1.245

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
Standard weight: 2.0 - .03 mg
Sample weight: 2.0 - 3.0 mg

Note

Each value is the average of 5 runs.
The samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Leaves - Pine Needles

NCS determination

LEAVES

Sample	N%	C%	S%
A	3.15	48.34	0.24
	3.17	48.30	0.23
	3.19	48.51	0.23
B	2.84	46.32	0.12
	2.87	46.40	0.12
	2.88	46.50	0.13

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
 Standard weight: 2.0 - 3.0 mg
 Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Leaves - Pine Needles

CHN determination

LEAVES REFERENCES MATERIALS

Expected values of Leaves Reference Materials						
Reference Material Description	Specification					
	N%	Uncertainty (±)	C%	Uncertainty (±)	H%	Uncertainty (±)
Birch Leaves	2.12	0.06	48.09	0.51	6.55	0.30
Orchard Leaves	2.28	0.04	50.40	0.40	6.22	0.03

Note
The percentages varies from batch to batch.
Hydrogen content is not certify.
Orchard leaves was dried at 105°C for 2 hours.

Reference Material	W (mg)	N%	RSD%	C%	RSD%	H %	RSD%
Birch Leaves	3.099	2.135		48.110		6.483	
	2.652	2.136	0.31	48.350	0.56	6.489	0.09
	2.303	2.124		47.860		6.492	
Orchard Leaves	2.716	2.308		50.210		6.203	
	3.118	2.292	0.44	50.143	0.09	6.199	0.15
	2.868	2.289		50.129		6.205	

Sample information
Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
Standard weight: 3.0 - 4.0 mg
Sample weight: 3.0 - 4.0 mg

Analytical - Classical

Vegetation

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Leaves - Pine Needles

NC determination

LEAVES

NC Determination by Single Combustion/Reduction Reactor - Method C			
N%	RSD%	C%	RSD%
2.4584		42.0264	
2.4316	0.94	42.0234	0.07
2.4128		42.0760	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Acetanilide	10.36 N%; 71.09 C%
Standard weight:	2.0 - 7.0 mg Aspartic acid	
	6.0 - 7.0 mg Benzoic acid	
	4.0 - 12 mg Acetanilide	
Sample weight:	14 - 15 mg	

Note

The analytical parameters of method C are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.

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Leaves - Pine Needles

NCS determination

LEAVES

N%	RSD%	C%	RSD%	S%	RSD%
2.4196		42.0603		0.3192	
2.4575	0.78	42.0924	0.04	0.3144	1.45
2.4358		42.0854		0.3101	

Sample information for NCS determination

Standard: BBOT* 6.51 N%, 72.56 C%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Note

Standard was analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Plants

NC determination

PLANTS

Sample	N%	RSD%	C%	RSD%
Plant 1	0.9162		37.3620	
	0.9161	0.6166	37.5457	0.2490
	0.9064		37.4261	
Plant 2	2.4892		47.0817	
	2.4787	0.2149	47.3519	0.3691
	2.4823		47.0267	
Barley	1.6988		41.9268	
	1.6833	0.4914	41.9220	0.0288
	1.6859		41.9039	
Hay	1.1948		41.8792	
	1.2057	0.6076	41.9459	0.1055
	1.1919		41.9629	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Standard weight: 10 - 12 mg
Sample weight: 10 - 12 mg

Note

Use Oxygen Flow 300 ml/min, Oxygen Injection Time 10 seconds and the 3 metres GC column (p/n 260 08205).

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Plants

CHNS determination

PLANTS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%
1	2.0130	1.6045	39.0654	0.0739	5.3679	0.5080	0.4891	0.9753
	2.0592		39.0246		5.4066		0.4824	
2	3.4983	0.0243	41.1127	0.0853	5.6277	0.1431	0.1619	1.8534
	3.4995		41.1623		5.6391		0.1662	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Plants

NC determination

PLANT

N%	RSD%	C%	RSD%
2.51		41.24	
2.50	0.398	41.13	0.179
2.52		41.10	

Sample information

Standard: Atropine 4.84 N%, 70.56 C%
Standard weight: 18 - 19 mg
Sample weight: 15 - 16 mg

Note

It is suggested to use the 3 meters GC column (p/n 260 079 31) installed into the oven at 50 °C.

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Plants

NC determination

PLANTS REFERENCES MATERIALS

Expected values of Plants Reference Materials				
Reference Material Description	N%	Uncertainty (±)	C%	Uncertainty (±)
Birch Leaves	2.12	0.06	48.09	0.51
Orchard Leaves	2.28	0.04	50.40	0.40
Alfalfa	3.01	0.20	n.a.	-

Note

The percentages varies from batch to batch. Orchard leaves was dried at 105°C for 2 hours.

NC data of Plants Reference Materials					
Reference Material Description	W (mg)	N%	RSD%	C%	RSD%
Birch Leaves		2.09		48.06	
	4 - 5	2.09	0.27	48.13	0.20
		2.10		48.25	
Orchard Leaves		2.27		50.53	
	4 - 5	2.28	0.75	50.50	0.12
		2.30		50.41	
Alfalfa		2.91		43.65	
	4 - 5	2.89	0.53	43.57	0.13
		2.88		43.68	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%
Standard weight: 4.0 - 5.0 mg
Sample weight: 4.0 - 5.0 mg

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Plants

NC determination

PLANTS REFERENCES MATERIALS

Certified Nitrogen and Carbon of Reference Materials				
Reference Material Description	N%	Uncertainty (±)	C%	Uncertainty (±)
Birch Leaves	2.12	0.06	48.09	0.51
Orchard Leaves	2.28	0.04	50.40	0.40
Alfalfa	3.01	0.20	na	-

NC Determination by Single Combustion/Reduction Reactor - Method A									
Reference Material Description	W (mg)	N%	RSD%	C%	RSD%	N%	RSD%	C%	RSD%
Birch Leaves	6.788	2.14		47.93		2.11		48.04	
	7.249	2.17	1.17	47.92	0.13	2.13	0.72	47.99	0.22
	6.065	2.12		48.03		2.10		48.19	
Orchard Leaves	6.445	2.30		50.00		2.27		50.12	
	6.615	2.31	0.25	50.21	0.26	2.27	0.25	50.31	0.29
	5.809	2.31		50.24		2.28		50.41	
Alfalfa	6.210	2.92		43.01		2.87		43.18	
	7.124	3.02	1.68	42.93	0.15	2.97	1.71	43.06	0.16
	6.133	2.97		42.88		2.92		43.06	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Thermo Scientific Soil Ref. Mat.	0.21 N%, 2.29 C%
Standard weight:	2.0 - 6.0 mg Aspartic acid	
	6.0 - 7.0 mg Benzoic acid	
	6.0 - 8.0 mg Thermo Scientific Soil Ref. Mat.	
Sample weight:	5.0 - 7.0 mg	

Note

The analytical parameters of method A are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.



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Plants

NC determination

PLANTS REFERENCES MATERIALS

NC Determination by Single Combustion/Reduction Reactor - Method B									
Reference Material Description	W (mg)	N%	RSD%	C%	RSD%	N%	RSD%	C%	RSD%
Birch Leaves	5.749	2.10		48.11		2.08		48.25	
	6.634	2.13	0.72	48.02	0.22	2.10	0.55	48.11	0.22
	5.854	2.12		47.90		2.10		48.04	
Orchard Leaves	5.845	2.28		50.63		2.26		50.72	
	5.849	2.28	0.25	50.59	0.25	2.26	0.26	50.72	0.25
	5.823	2.27		50.39		2.25		50.52	
Alfalfa	6.467	2.92		42.94		2.88		43.07	
	6.120	2.97	1.36	43.04	0.15	2.93	1.24	43.18	0.20
	7.337	3.00		42.92		2.95		43.01	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Thermo Scientific Soil Ref. Mat.	0.21 N%, 2.29 C%
Standard weight:	2.0 - 7.0 mg Aspartic acid	
	6.0 - 7.0 mg Benzoic acid	
	6.0 - 7.0 mg Thermo Scientific Soil Ref. Mat.	
Sample weight:	5.0 - 7.0 mg	

Note

The analytical parameters of method B are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.

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Vegetation

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- Cellulose Foil
- Cereals
- Cottons - Papers - Textile Fibers
- Leaves - Pine Needles
- Plants
- Potato Tuber
- Saw Powder
- Sunflower Seeds (Oil Seeds)
- Tobaccos
- Vegetals
- Vegetals Used as Biofuels
- Wood

Plants

NC determination

PLANTS REFERENCES MATERIALS

NC Determination by Single Combustion/Reduction Reactor - Method C									
Reference Material Description	W (mg)	N%	RSD%	C%	RSD%	N%	RSD%	C%	RSD%
Birch Leaves	16.185	2.17		48.45		2.19		48.47	
	15.952	2.16	0.27	48.37	0.08	2.19	0.26	48.39	0.08
	16.746	2.16		48.41		2.20		48.44	
Orchard Leaves	16.777	2.28		50.40		2.30		50.43	
	15.214	2.29	0.25	50.34	0.22	2.32	0.43	50.36	0.22
	15.878	2.29		50.19		2.31		50.21	
Alfalfa	18.079	3.03		43.06		3.01		43.07	
	20.441	3.03	0.19	43.06	0.12	3.01	0.19	43.06	0.11
	20.585	3.02		43.15		3.00		43.15	

Sample information

Standard:	Aspartic acid	10.52 N%, 36.09 C%
	Benzoic acid	68.85 C%
	Acetanilide	10.36 N%, 71.09 C%
Standard weight:	2.0 - 7.0 mg Aspartic acid	
	6.0 - 7.0 mg Benzoic acid	
	4.0 - 12 mg Acetanilide	
Sample weight:	15 - 20 mg	

Note

The analytical parameters of method C are included in the Overview Chapter, Analytical configurations. Linear Fit or Quadratic Fit are used as calibration method.

Analytical - Classical

Vegetation

- Agave
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Potato Tuber

NCS determination

POTATO TUBER

N%	RSD%	C%	RSD%	S%	RSD%
0.8744		39.5423		0.0709	
0.8929		39.5285		0.0698	
0.8958	1.330	39.3820	0.229	0.0716	1.221
0.8683		39.3890		0.0721	
0.8834		39.3482		0.0709	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Saw Powder

CHN/O determination

SAW POWDER

N%	RSD%	C%	RSD%	H%	RSD%	O%	RSD%
0.1385		45.7602		5.6496		43.7395	
0.1395		45.8526		5.7289		43.2058	
0.1370	2.7457	45.8621	0.4833	5.7009	0.8483	43.6751	0.5099
0.1317		46.1389		5.7792		43.4636	
0.141		45.5227		5.7427		43.3532	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%, 48.08 O%

Standard weight: 2.0 - 3.0 mg for CHN
1.0 - 2.0 mg for O

Sample weight: 3.0 - 4.0 mg for CHN
1.0 - 2.0 mg for O



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Sunflower Seeds (Oil Seeds)

NC determination

SUNFLOWER SEEDS (OIL SEEDS)

N%	RSD%	C%	RSD%
2.8265		59.4818	
2.7650		59.5597	
2.8047		59.7202	
2.7781		59.0374	
2.7428	2.6433	59.4762	0.5622
2.9241		59.8152	
2.9863		59.3076	
2.8434		59.6572	
2.8593		59.7048	
2.7977		58.7523	

Sample information

Standard: Atropine 4.84 N%, 70.56 C%
Standard weight: 18 - 20 mg
Sample weight: 15 - 20 mg

Note

Use Oxygen Flow 300 ml/min, Oxygen Injection Time 10 seconds and the 3 meters GC column (p/n 260 08205).



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Tobaccos

NCS determination

TOBACCOS

Sample	N%		C%		S%	
A	2.97	2.76	58.68	58.83	0.1796	0.1924
B	3.37	3.38	58.04	58.05	0.1763	0.1790
C	3.31	3.28	58.24	58.12	0.1914	0.1898
D	3.34	3.42	57.84	57.87	0.1947	0.1907
E	3.01	3.12	58.23	58.24	0.1782	0.1712
F	2.99	3.09	58.01	58.08	0.1678	0.1776
G	3.16	3.12	57.78	57.87	0.1739	0.1784
H	3.59	3.55	57.19	57.41	0.1863	0.1818
J	3.24	3.27	58.29	58.38	0.1735	0.1693
K	3.18	3.28	57.68	58.04	0.1664	0.1668

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

The samples have been analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Tobaccos

Nitrogen determination

TOBACCOS

Sample	N%	RSD%
1	1.7461	0.649
	1.7622	
2	3.5851	0.0533
	3.5824	
3	4.6146	0.5167
	4.5810	
4	2.2166	0.1885
	2.2107	
5	3.8406	0.2408
	3.8537	
6	4.4499	0.1113
	4.4429	
7	2.9923	0.2533
	2.9816	
8	2.6067	0.1111
	2.6108	
9	3.8070	0.4322
	3.7838	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 70 mg
Sample weight: 100 - 150 mg

Note

The analyses were performed using the N/Protein configuration setting Oxygen Flow 300 ml/min and Oxygen Injection Time 20 seconds.



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Vegetals

CHNS/O determination

VEGETALS

CHNS/O determination, Heat values and CO ₂ emission trade calculation										
Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	5.521		47.119		6.010		0.265		34.3115	
	5.790	3.133	47.276	0.3882	5.821	1.6489	0.277	2.6467	34.0453	0.4445
	5.861		47.485		5.959		0.278		34.3059	
2	3.534		46.467		5.876		0.182		37.1834	
	3.528	2.8161	46.489	0.1533	5.946	0.6095	0.176	2.7757	37.4212	0.3572
	3.706		46.600		5.926		0.186		37.1986	

Sample	G.H.V.	RSD%	N.H.V.	RSD%	CO ₂ E.T.	RSD%
1	4449		4145		99.883	
	4461	0.1495	4157	0.1670	99.608	0.1574
	4450		4145		99.877	
2	4255		3952		103.056	
	4245	0.1358	3942	0.1395	103.323	0.1449
	4255		3951		103.073	

G.H.V. (Gross Heat Value) and N.H.V. (Net Heat Value) determined by the Thermo Scientific EagerSmart Data Handling Software

Sample information

Standard for CHNS determination:	BBOT*	6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard for O determination:	Benzoic acid	26.20 O%
Standard weight:	CHNS	2.0 - 3.0 mg
	Oxygen	1.0 - 2.0 mg
Sample weight:	CHNS	3.0 - 4.0 mg
	Oxygen	1.0 - 2.0 mg

Note

For CHNS, standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
Heat Values and CO₂ emission trade are calculated automatically by the Thermo Scientific EagerSmart Data Handling Software.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Vegetals

CHNS/O determination

BROCCOLI POWDER

N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
3.51		35.94		5.23		1.38		38.72	
3.49	0.44	35.93	0.15	5.21	0.29	1.38	0.83	38.63	0.20
3.48		36.03		5.24		1.40		38.78	

Sample information for CHNS determination

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%

Standard weight: 2.0 - 3.0 mg

Sample weight: 3.0 - 4.0 mg

Sample information for Oxygen determination

Standard: Aspartic acid 48.08 O%

Standard weight: 1.0 - 1.5 mg

Sample weight: 1.0 - 1.5 mg

Note

For CHNS determination, standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Vegetals Used as Biofuels

CHNS/O determination

VEGETALS USED AS BIOFUELS

Sample	N%	RSD%	C%	RSD%	H%	RSD%	S%	RSD%	O%	RSD%
1	5.521		47.119		6.010		0.265		34.311	
	5.790	3.133	47.276	0.388	5.821	1.649	0.277	2.647	34.045	0.444
	5.861		47.485		5.959		0.278		34.306	
2	3.534		46.467		5.876		0.182		37.183	
	3.528	2.816	46.489	0.153	5.946	0.609	0.176	2.776	37.421	0.357
	3.706		46.600		5.926		0.186		37.199	

Heat values / CO₂ emission trade calculation

Sample	G.H.V.	RSD%	N.H.V.	RSD%	CO ₂ E.T.	RSD%
1	4449		4145		99.883	
	4461	0.149	4157	0.167	99.608	0.157
	4450		4145		99.877	
2	4255		3952		103.056	
	4245	0.136	3942	0.139	103.323	0.145
	4255		3951		103.073	

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%, 7.43 O%

Standard weight: 2.0 - 3.0 mg for CHNS
1.0 - 2.0 mg for O

Sample weight: 3.0 - 4.0 mg for CHNS
1.0 - 2.0 mg for O

Note

For CHNS, standards and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Wood

CHN determination

WOOD

N%	RSD%	C%	RSD%	H%	RSD%
0.0882		47.1092		6.2197	
0.0910	1.5644	47.0881	0.0247	5.8837	2.8195
0.0895		47.1071		6.0046	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
Standard weight: 3.0 - 4.0 mg
Sample weight: 3.0 - 4.0 mg

Analytical - Classical

Vegetation

- Agave
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Wood

CHNS/O determination

WOOD

Sample	N%	C%	H%	S%	O%
1	0.0649	45.7746	6.1044	0.0288	42.7422
	0.0677	45.8869	6.2031	0.0274	42.7301
	0.0666	46.1076	6.1345	0.0285	42.4861
	0.0651	45.7568	6.1504	0.0275	42.5882
	0.0664	45.8578	6.0941	0.0279	42.4200
Av %	0.0661	45.8767	6.1373	0.0280	42.5933
RSD %	1.7463	0.3055	0.7035	2.1913	0.3370
2	0.0667	46.6378	5.9850	0.0246	42.4833
	0.0662	47.0700	5.9247	0.0249	42.4623
	0.0659	46.8560	5.9086	0.0260	42.6421
	0.0630	46.8802	5.9816	0.0254	42.5727
	0.0660	46.9996	6.0158	0.0259	42.3615
Av %	0.0656	46.8887	5.9631	0.0254	42.5044
RSD %	2.2329	0.3525	0.7520	2.6259	0.2530
3	0.0882	47.1092	6.1197	0.0312	43.2662
	0.0910	47.0881	6.1050	0.0324	43.1915
	0.0895	47.1071	6.1088	0.0315	43.1879
	0.0902	47.0995	6.1115	0.0331	43.3391
	0.0890	47.1042	6.1065	0.0319	43.2539
Av %	0.0896	47.1016	6.1103	0.0320	43.2477
RSD %	1.2034	0.0178	0.0949	2.3516	0.1438

Sample	G.H.V. (kcal/kg)	N.H.V. (kcal/kg)	CO ₂ emission trade
1	4042	3728	108
2	4069	3763	109
3	4105	3792	109

G.H.V. (Gross Heat Value) and N.H.V. (Net Heat Value) determined by the Thermo Scientific EagerSmart Data Handling Software

Sample information

Standard: BBOT* 6.51 N%, 72.53 C%, 6.09 H%, 7.44 S%
Standard weight: 2.0 - 3.0 mg
Sample weight: 3.0 - 4.0 mg

Note

The Standard and samples were analyzed with the addition of about 10 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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Wood

NC and TOC (Total Organic Carbon) determination

WOOD

N%	RSD%	C%	RSD%	TOC%	RSD%
2.172		40.389		38.324	
2.194	0.5581	40.245	0.2912	38.448	0.4374
2.174		40.478		38.657	

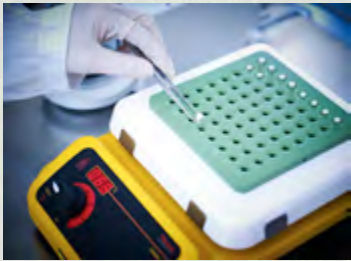
Sample information

Standard:	Aspartic acid	10.52 N%, 36.04 C%
Standard weight:	4.0 - 5.0 mg	
Sample weight for NC det.:	4.0 - 5.0 mg	
Sample weight for TOC det.:	3.0 - 4.0 mg	

Note

TOC determination was performed with the dedicated kit (p/n 190 04120).
TOC % values are determined by FlashSmart™ EA applying the following procedure: every sample is weighed in a silver container, and some drops of HCl 1:1 is added, then it is left to digest at correct temperature (50 - 80°C) according to the sample matrix. The TOC analysis is the last step.

For this application we suggest to use the **kit for Total Organic Carbon (TOC) in solid samples** (p/n 190 04128) which includes electric heater, syringe, sample holder plate and silver containers.



Kit for Total Organic Carbon (TOC)

Analytical - Classical

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CHN determination

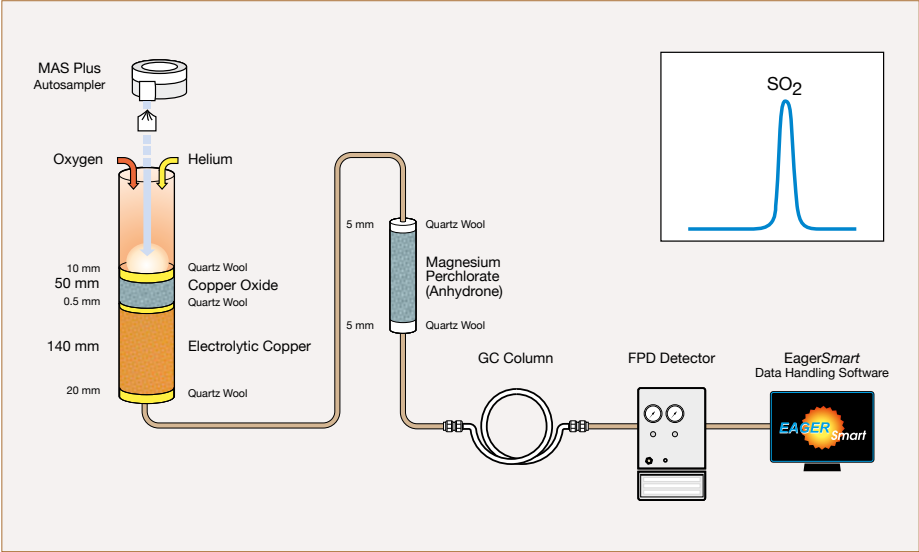
WOOD

Sample	N%	RS%	C%	RSD%	H%	RSD%
1	0.333	0.75	45.17	0.03	5.85	0.26
	0.338		45.19		5.82	
	0.335		45.20		5.83	
1	0.133	1.15	47.50	0.12	6.14	0.41
	0.134		47.41		6.17	
	0.131		47.40		6.12	

Sample information

Standard: Aspartic acid 10.52 N%, 36.09 C%, 5.30 H%
Standard weight: 3.0 - 4.0 mg
Sample weight: 3.0 - 4.0 mg

ANALYTICAL CONFIGURATIONS - SULFUR OEA/FPD ANALYSIS - OEA/FPD SYSTEM



The OEA/FPD system allows increasing the sensitivity in the Sulfur determination by using a Flame Photometric Detector (FPD) properly coupled with the Thermo Scientific FlashSmart™ Elemental Analyzer.

Analytical conditions		
Flow (ml/min)	He measurement	150
	He reference	0
	Oxygen	300
Temperature (°C)	Reactor	950
	Oven	0
Cycle (Run Time)	360 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	3 sec	
TCD detector Filaments:	OFF	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Electrolytic copper (70 g)	338 35313
Quartz wool (5 g)	338 22200
Magnesium perchlorate (100 g)	338 21900
Vanadium pentoxide (1 g)	338 37510
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Pre-packed quartz reactor for CHNS/NCS/S	468 02015
Separation column for Sulfur determination by OEA / FPD	260 07801

Note
For the FPD Detector parameters refer to the relative analytical test received together with the detector. More information is included in the Operating Manual. Quadratic Fit must be used as calibration method.



ANALYTICAL CONFIGURATIONS - APPLICATION GUIDELINES

The following table contains guidelines referring to the application of the Thermo Scientific FlashSmart™ Elemental Analyzer coupled with the FPD Detector.

Sample Nature	Range of Weight (mg)	Standard Suggested	Range of Standard Weight (mg)
Soil	2.0 - 3.0	Soil Reference Material	1.0 - 5.0
Plants	2.0 - 3.0	Pasta Reference Material	0.5 - 7.0
Leaves	2.0 - 3.0	Pasta Reference Material	0.5 - 7.0
Sediments	2.0 - 3.0	Soil Reference Material	1.0 - 5.0
Pasta	1.5 - 2.0	Pasta Reference Material	1.5 - 2.0
Diet Food	1.0 - 2.0	Pasta Reference Material	0.4 - 2.0
Steel	3.0 - 4.0	Soil Reference Material	1.0 - 8.0
Atmospheric particulate matter (filters)	0.5	Pasta Reference Material	0.8 - 3.5
Catalysts	2.0 - 3.0	Soil Reference Material	1.0 - 5.0
Polymers (250 - 500 ppm S)	2.0 - 3.0	Pasta Reference Material	0.4 - 2.0
Polymers (600 - 3000 ppm S)	0.6 - 1.0	Pasta Reference Material	0.5 - 1.4
Gasolines	2.0 - 3.0	Ref. Mat. Solutions Kit	2.0 - 3.0
Volatile liquids	2.0 - 3.0	Ref. Mat. Solutions Kit	2.0 - 3.0

Note

In principle, for samples with low organic content (e.g. soils, sediments, steel, catalysts, etc.) it is possible to avoid the use of the gas chromatographic column, reducing the analysis Time. For all the other samples, the use of the column is required. It is suggested to add 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510) to soils and sediments analysis. For samples containing less than 100 ppm of Sulfur a split of 10 - 15 ml/min is normally used, the FPD Detector range can be also changed.



PERFORMANCE TEST - SULFUR PERFORMANCE TEST

Sulfur determination in Pasta Reference Material (p/n 338 40027)

Analytical Sequence:

Run ID	Sample	Type	Weight (mg)	Theoretical S%	Experimental S%
1	Pasta Ref Mat.	Bypass			
2	Pasta Ref Mat.	Bypass			
3	Pasta Ref Mat.	Standard	3.074	0.135	
4	Pasta Ref Mat.	Standard	2.001	0.135	
5	Pasta Ref Mat.	Standard	1.090	0.135	
6	Pasta Ref Mat.	Standard	0.542	0.135	
7	Pasta Ref Mat.	Unknown	2.402		0.1356
8	Pasta Ref Mat.	Unknown	2.140		0.1349
9	Pasta Ref Mat.	Unknown	2.277		0.1386
10	Pasta Ref Mat.	Unknown	2.328		0.1386
11	Pasta Ref Mat.	Unknown	1.985		

Note
The average % was 0.1375 and the relative standard deviation RSD% obtained was 1.508 %.

Comment
The test indicates the accuracy and reproducibility of the system.

PERFORMANCE TEST - SULFUR PERFORMANCE TEST

Sulfur determination in soil samples

Sample	ppm S	Average ppm S	RSD%
Soil Ref. Mat.	336	341	1.67
	347		
	339		
Montana Soil (NIST)	412	404	1.65
	400		
	401		

Sample information

Standard for calibration:	Montana soil (NIST reference material, certified value 420 ppm S)
Standard weight:	2.0 - 9.0 mg
Samples analyzed as unknown:	Soil reference material (p/n 338 40026, certified value 320 ppm S)
	Montana soil (NIST reference material, certified value 420 ppm S)
Sample weight:	3.0 - 6.0 mg

Note

Samples were analyzed with the addition of 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510)

Comment

The test indicates the accuracy and reproducibility of the system.



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Analytical - Sulfur

Environmental

- Waste Water

Waste Water

Sulfur determination

WASTE WATER

Sample	S%	RSD%
1	0.0551	0.5152
	0.0547	
2	0.0083	3.3276
	0.0087	
3	0.0094	3.0744
	0.0090	
4	0.0046	3.0090
	0.0048	

Sample information

Standard: Thermo Scientific Soil Reference Material 0.0320 S%

Standard weight: 0.2 - 2.0 mg

Sample weight: 1.0 - 2.0 mg

Note

Samples were weighed in hard tin container (p/n 240 08820) closed with relative sealing device (p/n 205 03002).



Sealing device (p/n 205 03002)



Analytical - Sulfur

Fertilizers

- Soil

Soil

Sulfur determination

SOIL WEPAL

ppm S	RSD%
34	2.40
34	
35	
33	

Sample information

Standard:	Soil WEPAL	33 ppm S
Standard weight:	0.3 - 1.6 mg	
Sample weight:	0.8 - 1.0 mg	

Note

Set FPD Range zero and FPD split 15 ml/min.
Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.
Standard and sample were analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

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Analytical - Sulfur

Food

- Beverages
- Dried Fruit
- Food
- Pasta
- Rice

Beverages

Sulfur determination

BEER

Sample 1		Sample 2		Sample 3		Sample 4	
ppm S	RSD%	ppm S	RSD%	ppm S	RSD%	ppm S	RSD%
99	1.10	71	1.27	74	0.73	68	1.23
101		71		74		69	
101		69		75		67	
99		71		75		69	
99		70		75		68	

Sample information

Standard: Thermo Scientific Soil Reference Material 230 ppm S

Standard weight: 0.1 - 1.5 mg

Sample weight: 1.0 - 2.0 mg

Note

Set FPD Range zero and FPD split 15 ml/min.

Standard was analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

Beer samples were weighed in hard tin container (p/n 240 08820) closed by a sealing device (p/n 205 03002).

Analytical - Sulfur

Food

- Beverages
- Dried Fruit
- Food
- Pasta
- Rice

Beverages

Sulfur determination

ORANGE JUICE

S (ppm)	RSD%
32	5.35
32	
29	
33	
30	
33	
30	
30	
29	
33	

Sample information

Standard:	Thermo Scientific Soil Reference Materials	33 and 140 ppm S
Standard weight:	0.2 - 1.5 mg	
Sample weight:	1.0 - 2.0 mg	

Note

Standard was analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
Sample was mixed before weighing in double tin container.

Analytical - Sulfur

Food

- Beverages
- Dried Fruit
- Food
- Pasta
- Rice

Dried Fruit

Sulfur determination

DRIED FRUIT

S%	RSD%
0.0549	2.394
0.0524	
0.0548	
0.0547	
0.0525	

Sample information

Standard:	Soil Reference Material	0.0320 S%
Standard weight:	0.5 - 3.5 mg	
Sample weight:	1.0 - 2.0 mg	

Note

Standard and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



Analytical - Sulfur

Food

- Beverages
- Dried Fruit
- Food
- Pasta
- Rice

Food

Sulfur determination

FOOD

Sample	S%	Average S%	RSD%
Chocolate	0.3565		
	0.3648		
	0.3551	0.3585	1.14
	0.3551		
	0.3589		
Maize starch	0.0065		
	0.0063		
	0.0065	0.0065	2.28
	0.0064		
	0.0067		
Diet food	0.1535		
	0.1535	0.1520	1.67
	0.1491		
Spiked diet	0.3449		
	0.3362	0.3409	1.29
	0.3417		

Sample information

Chocolate, diet food and spiked diet:

Standard:	Thermo Scientific Pasta Reference Material	0.1350 S%
Standard weight:	0.5 - 2.0 mg	
Sample weight:	0.2 - 1.0 mg	

Starch

Standard:	Soil WEPAL	0.0030 S%
Standard weight:	1.0 - 7.0 mg	
Sample weight:	2.0 - 3.0 mg	

Note

Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test. Standard and sample were analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).



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Pasta

Sulfur determination

PASTA

Day to day reproducibility			
Sample	S%	Average S%	RSD%
1	0.1099		
	0.1131		
	0.1147	0.1143	2.76
	0.1154		
	0.1185		
2	0.1169		
	0.1160		
	0.1183	0.1162	1.34
	0.1141		
	0.1156		

Sample information

Standard:

Thermo Scientific Pasta
Reference Material

0.1350 S%

Standard weight:

0.5 - 2.5 mg

Sample weight:

1.0 - 2.0 mg



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Food

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- Rice

Rice

Sulfur determination

RICE

Sample	S%	Average S%	RSD%
1	0.1109	0.1129	2.5053
	0.1149		
2	0.0867	0.0864	0.5732
	0.0860		
3	0.0686	0.0676	2.0920
	0.0666		
4	0.0910	0.0912	0.3101
	0.0914		
5	0.0920	0.0908	1.7901
	0.0897		
6	0.1016	0.0978	5.4949
	0.0940		

Sample information

Standard: Thermo Scientific Pasta Reference Material 0.1350 S%

Standard weight: 0.5 - 2.0 mg

Sample weight: 1.5 - 2.5 mg

Note

Samples were homogenized by a ball mill and can be analyzed without the addition of vanadium pentoxide (V₂O₅) (p/n 338 37510).



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- Oils

Activated Carbon

Sulfur determination

ACTIVATED CARBON

ppm S	RSD%
72	1.41
71	
70	

Sample information

Standard: Thermo Scientific Soil Reference Material 230 ppm S

Standard weight: 0.1 - 1.0 mg

Sample weight: 0.8 - 1.0 mg

Note

Set FPD Range zero and FPD split 15 ml/min.
Standard and sample were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Biomass

Sulfur determination

BIOMASS

Sample	S%	RSD%
Switchgrass	0.0354	5.4753
	0.0395	
	0.0377	
Torrefied Corn Stover	0.0352	1.8686
	0.0364	
	0.0353	

Sample information

Standard:

Thermo Scientific Soil
Reference Material 0.0320 S%

Thermo Scientific Pasta
Reference Material 0.134 S%

Standard weight:

0.5 - 3.5 mg

Sample weight:

1.0 - 2.0 mg

Note

Standards and samples were analyzed with the addition of about 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

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Biomass

Sulfur determination

SAWDUST

ppm S	RSD%
44	1.32
44	
43	

Sample information

Standard:	Soil WEPAL	33 ppm S
Standard weight:	0.1 - 0.9 mg	
Sample weight:	0.2 - 0.3 mg	

Note

Set FPD Range zero and FPD split 15 ml/min.

Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.

Standard and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

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Biomass Pyrolysis Oils

Sulfur determination

BIOMASS PYROLYSIS OILS

Sample	S%	RSD%
1	0.0186	2.6961
	0.0189	
	0.0196	
2	0.0191	1.6279
	0.0185	
	0.0187	

Sample information

Standard:

Thermo Scientific Soil
Reference Material
0.0320 S%

Standard weight:

0.2 - 2.0 mg

Sample weight:

1.0 - 2.0 mg

Note

Samples were analyzed without the addition of about 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510) and cut into small pieces.



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Biofuel

Sulfur determination

BIOFUEL

ppm S	RSD%
29	2.01
28	
29	

Sample information

Standard:	Soil WEPAL	33 ppm S
Standard weight:	1.5 - 3.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

Set FPD Range zero and FPD split 15 ml/min.

Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.

Standard was analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

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Bio - Oils

Sulfur determination

BIO - OILS

Sample	S%	RSD%
1	0.0050	4.1667
	0.0048	
	0.0046	
2	0.0041	5.3836
	0.0037	
	0.0038	
3	0.0076	4.1660
	0.0074	
	0.0070	
4	0.0065	4.3301
	0.0065	
	0.0070	
5	0.0030	9.2071
	0.0025	
	0.0027	

Sample information

Standard:	Thermo Scientific Soil Reference Material	0.0320 S%
	Thermo Scientific Pasta Reference Material	0.134 S%
Standard weight:	0.5 - 3.5 mg	
Sample weight:	1.0 - 2.0 mg	

Note

Standards and samples 1 to 4 were weighed in the soft tin container (p/n 240 06400) while sample 5 was weighed in the hard tin container (p/n 240 08820) closed with the sealing device (p/n 205 03002). The Soil Reference Material was analyzed with the addition of approximately 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).



Sealing device (p/n 205 03002)



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Coke

Sulfur determination

COKE

ppm S	Average ppm S	RSD%
398		
404	398	1.5075
392		

Sample information

Standard:

Thermo Scientific Soil
Reference Material 0.0320 S%

Standard weight:

0.5 - 2.0 mg

Sample weight:

0.5 - 1.0 mg

Note

Standard and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

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Crude Oil

Sulfur determination

CRUDE OIL

ppm S	Average ppm S	RSD%
312		
338	324	4.024
323		

Sample information

Standard:

Thermo Scientific Soil
Reference Material 320 ppm S

Standard weight:

0.5 - 1.5 mg

Sample weight:

0.8 - 1.0 mg

Note

Soil Reference Material has been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

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Diesel

Sulfur determination

DIESEL

Sample	S ppm	RSD%
1	25	9.03
	22	
	21	
	22	
2	58	4.57
	56	
	52	
	57	

Sample information

Standard:

Thermo Scientific Liquid
Reference Material (Oil in iso-Octane) 100 ppm S

Standard weight:

0.4 - 1.5 mg

Sample weight:

1.0 - 1.5 mg

Note

Standard and samples were weighed in the hard tin containers (p/n 240 08820) closed by the sealing device (p/n 205 03002).



Sealing device (p/n 205 03002)

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Diesel

Sulfur determination

DIESEL

Sample	ppm S	RSD%	Sample	ppm S	RSD%
1	58	1.75	2	49	1.19
	56			48	
	57			49	

Sample information

Standard: Soil WEPAL 33 ppm S
 Standard weight: 1.5 - 3.0 mg
 Sample weight: 1.8 - 2.2 mg

Note

Set FPD Range zero and FPD split 15 ml/min.

Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.

Standard was analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Diesel sample was weighed in double tin containers.



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- Oils

Gasoline - Gasoil

Sulfur determination

GASOLINE - GASOIL

Sample	ppm S	Average ppm S	RSD%
Gasoline 1	28	30	6.8151
	30		
	33		
	30		
Gasoline 2	69	66	3.4670
	68		
	64		
	67		
	64		
Gasoline 3	628	640	2.170
	652		
	651		
	627		

Sample information

Standard:

Thermo Scientific Soil
Reference Material

50 and 500 ppm S

Standard weight:

2.0 - 3.0 mg

Sample weight:

2.0 - 3.0 mg

Note

The calibration was performed with the solution at 50 ppm S for gasoline analysis and solution at 500 ppm for gasoil analysis (kit p/n 338 19040).

Samples were weighed in tin containers (p/n 240 08820) closed with the sealing device for liquid containers (p/n 205 03002).



Sealing device (p/n 205 03002)



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Lignite

Sulfur determination

LIGNITE

ppm S	Average ppm S	RSD%
393		
399	401	1.63
406		
407		

Sample information

Standard:

Thermo Scientific Soil

Reference Material

320 ppm S

Standard weight:

0.5 - 5.0 mg

Sample weight:

2.0 - 3.0 mg

Note

The samples have been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

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Oils

Sulfur determination

OILS

Sample	ppm S	Average ppm S	RSD%
1	576	571	2.09
	557		
	579		
2	531	530	1.61
	538		
	521		
3	540	536	1.80
	525		
	543		

Sample information

Standard:

Thermo Scientific Soil
Reference Material 320 ppm S

Standard weight:

1.0 - 5.0 mg

Sample weight:

2.0 - 3.0 mg

Note

Soil Reference Material has been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

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Geological

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- Rock
- Sand
- Sediments
- Soils

Clay

Sulfur determination

CLAY

ppm S	Average ppm S	RSD%
59		
61	61	4.103
64		

Sample information

Standard: Thermo Scientific Soil Reference Material 320 ppm

Standard weight: 0.5 - 2.5 mg

Sample weight: 1.0 - 1.5 mg

Note

Samples have been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Plankton

Sulfur determination

PLANKTON

Sample	S%	Average S%	RSD%
Plankton	0.4526		
	0.4672	0.4604	1.60
	0.4614		
Zooplankton	0.3232		
	0.3469	0.3335	3.65
	0.3303		

Sample information

Standard:

Thermo Scientific
Pasta Reference Material 0.1350 S%

Standard weight:

1.0 - 2.5 mg

Sample weight:

0.5 - 1.5 mg



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Geological

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- Soils

Rock

Sulfur determination

ROCK

Sample	S%	Average S%	RSD%
1	0.0174	0.0170	2.3529
	0.0166		
	0.0170		
2	0.1074	0.1083	7.6978
	0.1171		
	0.1005		
3	0.0759	0.0751	9.9443
	0.0750		
	0.0745		

Sample information

Standard: Thermo Scientific Pasta
Reference Material 0.1350 S%

Standard weight: 0.2 - 2.0 mg

Sample weight: 1.0 - 2.0 mg

Note

Samples were homogenized by a ball mill and can be analyzed without the addition of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Rock

Sulfur determination

ROCKS

Sample information

Provenance	Sample name	Geological Unit/ Sample origin	Age (billion of years)
Customer	NS1282 - 1	Nonesuch Shale (USA)	unknown
Customer	MC - 4	Mosquito Creek Group (Australia)	0.07

Experimentall Sulfur data

Sample	ppm S	RSD%	Sample	ppm S	RSD%
NS1282 - 1	34	4.25	MC - 4	38	3.35
	35			40	
	32			41	
	31			39	
	34			40	
	33			38	
	31			41	
	31			38	
	34			38	
	35			39	

Sample information

Standard: Thermo Scientific Soil Reference Material 230 ppm S
 Standard weight: 1.0 - 5.0 mg
 Sample weight: 8.0 - 10 mg

Note

Set FPD Range zero and FPD split 15 ml/min.
 Standard and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).
 Samples were analyzed 10 Times.

The data has been obtained by University of St. Andrews, St. Andrews, UK.



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- Soils

Sand

Sulfur determination

SAND

Sample	ppm S	Average ppm S	RSD%
1	13		
	11	12	8.3330
	11		
2	17		
	15	16	7.0696
	17		

Sample information

Standard: Soil WEPAL 33 ppm S
 Standard weight: 0.5 - 4.0 mg
 Sample weight: 3.0 - 5.0 mg

Note

Samples were homogenized by a ball mill and have been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

Comment

Soil standard concentration is the mean value of a Round Robin Test, WEPAL (Wageningen Evaluating Programs for Analytical Laboratories) Wageningen University, Wageningen, The Netherlands.



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Sediments

Sulfur determination

SEDIMENTS

Sample	S%	Average S%	RSD%
1	0.0970		
	0.0961	0.0956	1.84
	0.0936		
2	0.4682		
	0.4690	0.4752	2.42
	0.4885		

Sample information

Standard:

Thermo Scientific Pasta
Reference Material 0.1350 S%

Standard weight:

0.5 - 2.5 mg

Sample weight:

0.5 - 1.5 mg



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Soils

Sulfur determination

SOILS

Sample	ppm S	Average ppm S	RSD%
Soil 1	138		
	129		
	129	132	3.53
	137		
	129		
Soil 2	272		
	269	268	1.51
	264		
Soil 3	661		
	637	652	2.08
	660		
Soil 4	31		
	30		
	27	30	6.24
	30		
	32		
Soil 5	44		
	41		
	42	42	2.60
	42		
	42		

Sample information

Standard:

Thermo Scientific Soil
Reference Material

320 ppm S

Standard weight:

0.5 - 2.0 mg

Sample weight:

2.0 - 4.0 mg

Note

Samples have been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

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Soils

Sulfur determination

SOILS

Sample	ppm S	RSD%
1	58	
	57	
	55	1.84
	57	
	56	
2	82	
	80	
	81	1.61
	80	
	83	

Sample information

Standard: Thermo Scientific Soil Reference Material 230 ppm S
Standard weight: 0.5 - 4.0 mg
Sample weight: 4.0 - 6.0 mg

Note

Set FPD Range zero and FPD split 15 ml/min.
Standard and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Inorganic

- Inorganic Calcium Mixtures

Inorganic Calcium Mixtures

Sulfur determination

INORGANIC CALCIUM MIXTURES $\text{OCa}(\text{OH})_2\text{Ca-SO}_3$

Sample	S%	RSD%
1	0.0143	4.595
	0.0134	
2	0.0590	0.602
	0.0585	
3	0.0843	0.252
	0.0840	

Sample information

Standard:

Thermo Scientific Soil
Reference Material 0.0320 S%

Standard weight:

0.5 - 3.5 mg

Sample weight:

1.0 - 2.0 mg

Note

Standard and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).

Analytical - Sulfur

Materials

- Additives for Cement
- Carbon Fibers
- Carbon Nanotubes
- Carbon Porous
- Catalysts
- Cellulose
- Fat
- Graphite
- Inorganic Fertilizers
- Paper
- Plastic Powders
- Polymer
- Polyethylene Film
- Saw Dust
- Wood

Additives for Cement

Sulfur determination

ADDITIVES FOR CEMENT (water solutions)

Sample	ppm S	Average ppm S	RSD%
1	37	35	5.7143
	33		
	35		
2	202	198	2.3144
	193		
	199		

Sample information

Standard: Thermo Scientific Soil Reference Material 320 ppm S

Standard weight: 0.2 - 3.0 mg

Sample weight: 2.0 - 3.0 mg

Note

Samples were weighed in tin containers (p/n 240 08820) and closed with the sealing device for liquid containers (p/n 205 03002).



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Materials

- Additives for Cement
- Carbon Fibers
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Carbon Fibers

Sulfur determination

CARBON FIBERS

ppm S	Average ppm S	RSD%
704		
712		
659		
672		
705	704	3.06
726		
722		
715		
706		
715		

Sample information

Standard: Thermo Scientific Soil Reference Material 320 ppm S

Standard weight: 0.5 - 6.0 mg

Sample weight: 0.2 - 1.5 mg

Note

The samples have been analyzed with the addition of 5 mg vanadium pentoxide (V₂O₅) (p/n 338 37510).

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Materials

- Additives for Cement
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- Wood

Carbon Fibers

Sulfur determination

CARBON FIBERS

Sample	ppm S	RSD%	Sample	ppm S	RSD%
A	54	2.57	C	36	3.82
	56			38	
B	43	1.63	D	42	3.29
	44			44	

Sample information

Standard: Thermo Scientific Soil Reference Materials 33 and 140 ppm S

Standard weight: 0.2 - 1.5 mg

Sample weight: 1.0 - 2.0 mg

Note

Reference Materials and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

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Carbon Nanotubes

Sulfur determination

CARBON NANOTUBES

Sample	ppm S	Average ppm S	RSD%
1	609	625	3.620
	641		
2	652	641	2.539
	629		
3	3391		
	3221	3342	3.144
	3413		
4	1263	1282	2.096
	1301		

Sample information

Standard: Thermo Scientific Soil Reference Material 320 ppm S

Standard weight: 0.5 - 6.0 mg

Sample weight: 0.2 - 1.5 mg

Note

The samples have been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Carbon Porous

Sulfur determination

CARBON POROUS

ppm S	RSD%
327	0.53
327	
324	

Sample information

Standard: Thermo Scientific Soil Reference Material 230 ppm S

Standard weight: 0.5 - 2.0 mg

Sample weight: 0.8 - 1.0 mg

Note

Standard and sample were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



Analytical - Sulfur

Materials

- Additives for Cement
- Carbon Fibers
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- Catalysts
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- Fat
- Graphite
- Inorganic Fertilizers
- Paper
- Plastic Powders
- Polymer
- Polyethylene Film
- Saw Dust
- Wood

Catalysts

Sulfur determination

CATALYSTS

Sample	ppm S	Average ppm S	RSD%
1	12	14	11.1770
	14		
	15		
2	13	12	9.8974
	11		
	11		
3	73	73	3.4317
	76		
	71		
4	14	16	9.7502
	16		
	17		

Sample information

Standard: Soil WEPAL 33 ppm S
Standard weight: 0.5 - 4.0 mg
Sample weight: 1.0 - 5.0 mg

Note

Samples were homogenized by a ball mill and have been analyzed with the addition of 5 mg vanadium pentoxide (V₂O₅) (p/n 338 37510).

Comment

Soil standard concentration is the mean value of a Round Robin Test, WEPAL (Wageningen Evaluating Programs for Analytical Laboratories) Wageningen University, Wageningen, The Netherlands.

Analytical - Sulfur

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Catalysts

Sulfur determination

CATALYSTS

ppm S	RSD%
35	2.94
34	
33	

Sample information

Standard:	Soil WEPAL	33 ppm S
Standard weight:	1.0 - 2.5 mg	
Sample weight:	1.3 - 1.7 mg	

Note

Set FPD Range zero and FPD split 15 ml/min.
Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.
Standard and sample were analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

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Cellulose

Sulfur determination

CELLULOSE

ppm S	Average ppm S	RSD%
12		
13	12	4.681
12		

Sample information

Standard: Soil WEPAL 33 ppm S
 Standard weight: 1.0 - 5.0 mg
 Sample weight: 2.0 - 3.0 mg

Note

Samples have been weighed in small tin containers (p/n 240 05300).

Comment

Soil standard concentration is the mean value of a Round Robin Test, WEPALI (Wageningen Evaluating Programs for Analytical Laboratories) Wageningen University, Wageningen, The Netherlands.



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Fat

Sulfur determination

FAT

Sample	ppm S	RSD%	Sample	ppm S	RSD%
1	47	3.23	2	110	0.90
	49			112	
	46			111	
3	43	1.32	4	104	1.45
	44			107	
	44			106	

Sample information

Standard: Thermo Scientific Soil Reference Material 230 ppm S

Standard weight: 0.1 - 1.2 mg

Sample weight: 1.0 - 3.0 mg

Note

Set FPD Range zero and FPD split 15 ml/min.

Standard and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



Analytical - Sulfur

Materials

- Additives for Cement
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- Paper
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Graphite

Sulfur determination

GRAPHITE

ppm S	Average ppm S	RSD%
32	36	7.856
38		
38		
36		

Sample information

Standard:	Soil WEPAL	33 ppm S
Standard weight:	1.0 - 7.0 mg	
Sample weight:	2.0 - 3.0 mg	

Note

The sample has been analyzed with the addition of 5 mg vanadium pentoxide (V₂O₅) (p/n 338 37510).

Comment

Soil standard concentration is the mean value of a Round Robin Test, WEPAL (Wageningen Evaluating Programs for Analytical Laboratories) Wageningen University, Wageningen, The Netherlands.

Analytical - Sulfur

Materials

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- Polyethylene Film
- Saw Dust
- Wood

Graphite

Sulfur determination

GRAPHITE

Sample	ppm S	RSD%	Sample	ppm S	RSD%
1	36	1.94	3	42	3.29
	37			44	
2	65	3.34	4	46	1.55
	62			45	

Sample information

Standard: Soil WEPAL 33 ppm S
Standard weight: 0.1 - 0.9 mg
Sample weight: 0.2 - 0.3 mg

Note

Set FPD Range zero and FPD split 15 ml/min.
Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.
Standard and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

Analytical - Sulfur

Materials

- Additives for Cement
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- Polyethylene Film
- Saw Dust
- Wood

Graphite

Sulfur determination

GRAPHITE

Sample	ppm S	RSD%	Sample	ppm S	RSD%
1	42	1.29	2	21	2.56
	42			21	
	43			22	
	42			21	
	43			22	

Sample information

Standard: Soil WEPAL 33 ppm S
Standard weight: 0.5 - 2.0 mg
Sample weight: 1.0 - 2.0 mg

Note

Set FPD Range zero and FPD split 15 ml/min.
Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.
Standard and sample were analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

Analytical - Sulfur

Materials

- Additives for Cement
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- Wood

Graphite

Sulfur determination

GRAPHITE

ppm S	RSD%
65	1.68
65	
67	
65	
64	

Sample information

Standard:	Soil WEPAL	33 ppm S
Standard weight:	1.0 - 4.0 mg	
Sample weight:	1.8 - 2.2 mg	

Note

Set FPD Range zero and FPD split 15 ml/min.
Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.
Standard and samples were analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).

Analytical - Sulfur

Materials

- Additives for Cement
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- Polyethylene Film
- Saw Dust
- Wood

INORGANIC FERTILIZER

ppm S	RSD%
19	
20	2.99
19	

Sample information

Standard:	Soil WEPAL	33 ppm S
Standard weight:	1.0 - 4.0 mg	
Sample weight:	3.0 - 4.0 mg	

Note

Set FPD Range zero and FPD split 15 ml/min.
Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.
Standard and sample were analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).



Analytical - Sulfur

Materials

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- Polyethylene Film
- Saw Dust
- Wood

Paper

Sulfur determination

PAPER

ppm S	Average ppm S	RSD%
566		
575	570	0.791
570		

Sample information

Standard: Thermo Scientific Soil
Reference Material 320 ppm S

Standard weight: 0.3 - 5.0 mg

Sample weight: 1.0 - 1.5 mg

Note

Soil Reference Material has been analyzed with the addition of 5 mg vanadium pentoxide (V₂O₅) (p/n 338 37510).



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- Plastic Powders
- Polymer
- Polyethylene Film
- Saw Dust
- Wood

Plastic Powders

Sulfur determination

PLASTIC POWDERS

Sample	S%	RSD%
1	0.0562	1.8567
	0.0582	
	0.0566	
2	0.0058	5.3286
	0.0054	
	0.0060	
3	0.0039	10.6572
	0.0042	
	0.0048	
4	0.2366	0.8128
	0.2335	
	0.2370	

Sample information

Standard:	Thermo Scientific Soil Reference Material	0.0320 S%
Standard:	Thermo Scientific Pasta Reference Material	0.134 S%
Standard weight:	Thermo Scientific Soil Reference Material	0.4 - 1.5 mg
	Thermo Scientific Pasta Reference Material	0.5 - 1.5 mg
Sample weight:	Sample 1	0.5 - 1.0 mg
	Sample 2 and 3	3.0 - 4.0 mg
	Sample 4	0.4 - 1.5 mg

Note

Standards and samples were analyzed with the addition of approximately 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).



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Polymer

Sulfur determination

POLYMER

ppm S	RSD%
45	1.29
45	
44	

Sample information

Standard: Thermo Scientific Soil Reference material 230 ppm S

Standard weight: 0.1 - 1.0 mg

Sample weight: 1.0 - 2.0 mg

Note

Set FPD Range zero and FPD split 15 ml/min.
Standard and sample were analyzed with the addition of about 5 mg of vanadium pentoxide (V_2O_5) (p/n 338 37510).



Analytical - Sulfur

Materials

- Additives for Cement
- Carbon Fibers
- Carbon Nanotubes
- Carbon Porous
- Catalysts
- Cellulose
- Fat
- Graphite
- Inorganic Fertilizers
- Paper
- Plastic Powders
- Polymer
- Polyethylene Film
- Saw Dust
- Wood

Polyethylene Film

Sulfur determination

POLYETHYLENE FILM

S%	RSD%
0.0571	
0.0573	
0.0540	2.7922
0.0542	
0.0558	

Sample information

Standard:	Thermo Scientific Soil Reference Material	0.0320 S%
Standard weight:	1.0 - 5.0 mg	
Sample weight:	1.0 - 2.0 mg	

Note

Sample was analyzed without the addition of about 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510) and cut into small pieces.



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Saw Dust

Sulfur determination

SAW DUST

S%	Average S%	RSD%
0.0277		
0.0260	0.0268	3.221
0.0266		

Sample information

Standard: Thermo Scientific Pasta
Reference Material 0.135 S%

Standard weight: 0.5 - 2.0 mg

Sample weight: 2.0 - 3.0 mg

Note

Sample was homogenized by a ball mill, and analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).



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- Additives for Cement
- Carbon Fibers
- Carbon Nanotubes
- Carbon Porous
- Catalysts
- Cellulose
- Fat
- Graphite
- Inorganic Fertilizers
- Paper
- Plastic Powders
- Polymer
- Polyethylene Film
- Saw Dust
- Wood

Wood

Sulfur determination

WOOD

ppm S	Average ppm S	RSD%
36		
35		
37	36	3.64
37		
34		

Sample information

Standard: Soil WEPAL 33 ppm S
Standard weight: 3.0 - 5.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Samples have been weighed in small tin containers (p/n 240 05300).

Comment

Soil standard concentration is the mean value of a Round Robin Test, WEPAL (Wageningen Evaluating Programs for Analytical Laboratories) Wageningen University, Wageningen, The Netherlands.



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Analytical - Sulfur

Metals

- Cast Iron
- Metals

Cast Iron

Sulfur determination

CAST IRON

Sample	S%	Average S%	RSD%
BCR Reference Material	0.1645		
	0.1642		
	0.1696		
	0.1703		
	0.1637	0.1675	1.8158
	0.1726		
	0.1653		
	0.1695		
	0.1685		
	0.1666		
Sample A	0.0750		
	0.0735	0.0748	1.6209
	0.0759		

Sample information

Standard:	Thermo Scientific Soil Reference Material	0.033 S%
	Thermo Scientific Pasta Reference Material	0.1350 S%
Standard weight:	0.2 - 2.5 mg	
Sample weight:	0.5 - 1.5 mg	

Note

Cast iron can be analyzed without the addition of vanadium pentoxide (V_2O_5) (p/n 338 37510) and without the GC column. Sample A was homogenized in a ball mill.



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Metals

- Cast Iron
- Metals

Metals

Sulfur determination

METALS (1/2)

Sample	S ppm	Average S ppm	RSD%
Carbon steel	242	242	0.29
	243		
Bronze	158	157	2.60
	153		
	160		
	153		
	162		
Steel 1	205	199	3.66
	193		
	204		
	190		
	205		
Steel 1	52	53	2.45
	54		
	52		
	55		
	53		
Steel 1	115	113	3.46
	117		
	112		
	108		
Steel 1	78	78	0.78
	79		
	78		
CrMoNi alloy	72	68	4.21
	71		
	67		
	66		
	66		



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Analytical - Sulfur

Metals

- Cast Iron
- Metals

Metals

Sulfur determination

METALS (2/2)

Sample information

Standard:	Thermo Scientific Soil Reference Material	320 ppm S
Standard weight:	0.1 - 5.0 mg	
Sample weight:	2.0 - 4.0 mg	

Sample information for steel 2 and CrMoNi alloy

Standard:	Soil WEPAL	30 ppm S
Standard weight:	1.0 - 8.0 mg	
Sample weight:	3.0 - 5.0 mg	

Note

Soil Reference Material has been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510). Samples can be homogenized by a ball mill, analyzed without the addition of vanadium pentoxide (V_2O_5) (p/n 338 37510) and without GC column.

Comment

Soil standard concentration is the mean value of a Round Robin Test WEPAL (Wageningen Evaluating Programs for Analytical Laboratories) Wageningen University, Wageningen, The Netherlands.



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- Volatile Liquid Samples

Lubricant

Sulfur determination

LUBRICANT / ISO-OCTANE SOLUTIONS

Sample	ppm S	RSD%
Solution at 10 ppm S	10.1	2.47
	10.6	
	10.3	
	10.0	
	10.5	
Solution at 5 ppm S	5.4	3.51
	5.1	
	5.3	
	5.0	
	5.1	
	5.3	
	5.1	
	5.6	
	5.4	
	5.2	

Sample information

Standard:	Soil WEPAL	33 ppm S
Standard weight:	0.3 - 1.6 mg	
Sample weight:	3.0 - 4.0 mg solution at 10 ppm S	
	3.0 - 4.0 mg solution at 5 ppm S	

Note

Set FPD Range zero and FPD split 15 ml/min
Soil WEPAL (Wageningen Evaluating Programs for Analytical Laboratories, Wageningen University, The Netherlands) is from a Round Robin Test.
Standard was analyzed with the addition of about 5 mg of vanadium pentoxide (V₂O₅) (p/n 338 37510).
Liquid samples were weighed in hard tin container (p/n 240 08820) closed by a sealing device (p/n 205 03002).



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Polymers

Sulfur determination

POLYMERS

Sample	ppm S	Average ppm S	RSD%
A	495	466	3.87
	466		
	467		
	456		
	447		
B	876	869	4.01
	902		
	820		
	879		
C	1369	1419	3.03
	1442		
	1445		
D	1866	1867	2.61
	1856		
	1813		
	1931		
E	2969	2894	4.02
	2772		
	3016		
	2821		

Sample information to analyze samples A to E

Standard:

Thermo Scientific Pasta
Reference Material

1350 ppm S

Standard weight:

0.5 - 2.5 mg

Sample weight:

0.5 - 1.5 mg



Analytical - Sulfur

Organic

- Lubricant
- Polymers
- Tall Oil Rosin
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- Volatile Liquid Samples

Polymers

Sulfur determination

POLYMERS

Sample	ppm S	Average ppm S	RSD%
F	350		
	328		
	317	329	3.80
	321		
	320		
	336		
G	178		
	186	182	2.20
	182		
H	59		
	59		
	52	57	6.11
	61		
	56		
I	41		
	40		
	42	39	6.10
	36		
	38		
J	25		
	32	27	14.79
	29		
	23		

Sample information to analyze samples F to J

Standard:	Thermo Scientific Soil Reference Material	320 ppm S
Standard weight:	0.5 - 2.5 mg	
Sample weight:	1.0 - 3.0 mg	

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Tall Oil Rosin

Sulfur determination

TALL OIL ROSIN

ppm S	Average ppm S	RSD%
61		
53		
75		
41		
59	55	16.9328
55		
49		
46		
55		
53		

Sample information

Standard:

Thermo Scientific Liquid Oil
Reference Material (Oil in iso-Octane)

50 and 200 ppm S

Standard weight:

1.0 - 2.0 mg

Sample weight:

1.5 - 2.0 mg

Note

Sample must be shaken before weighing because the sample is not homogenous. Sample has been analyzed with the addition of 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

The calibration was performed with Liquid Reference Materials (kit of 4 flasks, p/n 338 19040).

The Standards were weighed in tin container (p/n 240 08820) closed by the sealing device for Liquid containers (p/n 205 03002).



Sealing device (p/n 205 03002)



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Urea Formaldehyde Water Solution

Sulfur determination

UREA FORMALDEHYDE WATER SOLUTIONS

Sample	S%	Average S%	RSD%
1	0.0111	0.0114	3.3307
	0.0112		
	0.0118		
2	0.0015	0.0012	18.7249
	0.0011		
	0.0011		
3	0.2038	0.2068	1.3839
	0.2071		
	0.2095		

Sample information

Standard: Thermo Scientific Liquid Oil
Reference Material (Oil in iso-Octane) 200 ppm S

Standard weight: 0.5 - 2.0 mg

Sample weight: 0.1 - 2.0 mg

Note

Samples must be shaken before weighing and analyzed with the addition of about 5 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

The calibration was performed with Liquid Reference Materials (kit of 4 flasks, p/n 338 19040).

The Standards were weighed in tin container (p/n 240 08820) closed by the sealing device for liquid containers (p/n 205 03002).



Sealing device (p/n 205 03002)



Analytical - Sulfur

Organic

- Lubricant
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- Volatile Liquid Samples

Volatile Liquid Samples

Sulfur determination

VOLATILE LIQUID SAMPLES

ppm S	Average ppm S	RSD%
492		
493		
510		
511		
509	511	2.402
503		
521		
528		
515		
525		

Sample information

Standard: Thermo Scientific Liquid Reference Material (Oil in iso-Octane) 500 ppm S

Note

The calibration was performed with the same liquid reference material at 500 ppm S (kit of 4 flasks, p/n 338 19040). Samples were weighed in tin containers (p/n 240 08820) closed with the sealing device for liquid containers (p/n 205 03002).



Sealing device (p/n 205 03002)

Analytical - Sulfur

Organic

- Lubricant
- Polymers
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- Volatile Liquid Samples

Volatile Liquid Samples

Sulfur determination

VOLATILE LIQUID SAMPLES

ppm S	Average ppm S	RSD%
100		
101		
101		
101		
102		
97		
102	99	3.929
108		
102		
91		
96		
96		
96		
99		
99		

Sample information

Standard: Thermo Scientific Liquid Reference Material (Oil in iso-Octane) 100 ppm S

Note

For the analysis set the Sample delay at 1 second and the Oxygen Injection Time at 3 seconds. The calibration was performed with the same Liquid reference material at 100 ppm S (kit of 4 flasks, p/n 338 19040). Samples were weighed in tin containers (p/n 240 08820) closed with the sealing device for liquid containers (p/n 205 03002).



Sealing device (p/n 205 03002)

Analytical - Sulfur

Vegetation

- Leaves
- Plants
- Wood

Leaves

Sulfur determination

LEAVES

Sample	S%	Average S%	RSD%
Pine needles	0.1156		
	0.1095		
	0.1127		
	0.1108		
	0.1107	0.1119	2.15
	0.1117		
	0.1159		
	0.1125		
	0.1084		
	0.1110		
Oak Leaf	0.0991	0.0992	0.0713
	0.0992		

Sample information

Standard: Thermo Scientific Pasta
Reference Material 0.1350 S%

Standard weight: 0.5 - 2.5 mg

Sample weight: 1.0 - 1.5 mg

Note

The samples have been analyzed with the addition of 5 mg vanadium pentoxide (V₂O₅) (p/n 338 37510).



Analytical - Sulfur

Vegetation

- Leaves
- Plants
- Wood

Plants

Sulfur determination

PLANTS

Sample	S%	Average S%	RSD%
Potato	0.2515		
	0.2531	0.2525	0.3453
	0.2529		
Lucerne	0.2989		
	0.3058	0.3001	1.7198
	0.2957		
Rapeseed Grains	0.2821		
	0.2799	0.2851	2.5008
	0.2932		
Silage	0.1727		
	0.1708	0.1712	0.7858
	0.1701		

Sample information

Standard:	Thermo Scientific Pasta Reference Material	0.1350 S%
Standard weight:	0.5 - 2.5 mg	
Sample weight:	1.0 - 1.5 mg	

Note

The samples have been analyzed with the addition of 5 mg vanadium pentoxide (V₂O₅) (p/n 338 37510).



Analytical - Sulfur

Vegetation

- Leaves
- Plants
- Wood

Wood

Sulfur determination

WOOD

Sample	S ppm	Average S ppm	RSD%
1	44		
	41		
	42	42	2.60
	42		
	42		
2	52		
	54		
	52	53	2.45
	55		
	53		

Sample information

Standard: Soil WEPAL 30 ppm S
Standard weight: 3.0 - 5.0 mg
Sample weight: 3.0 - 4.0 mg

Note

Standards and samples were analyzed with the addition of about 5 mg vanadium pentoxide (V₂O₅) (p/n 338 37510).

Comment

Soil standard concentration is the mean value of a Round Robin Test, WEPAL (Wageningen Evaluating Programs for Analytical Laboratories) Wageningen University, Wageningen, The Netherlands.



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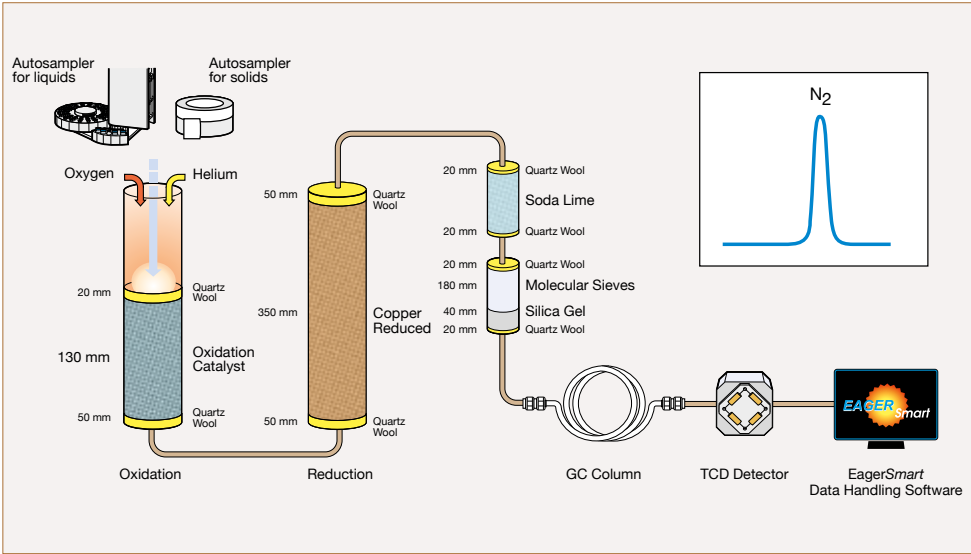
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ANALYTICAL CONFIGURATIONS - N BREW DETERMINATION

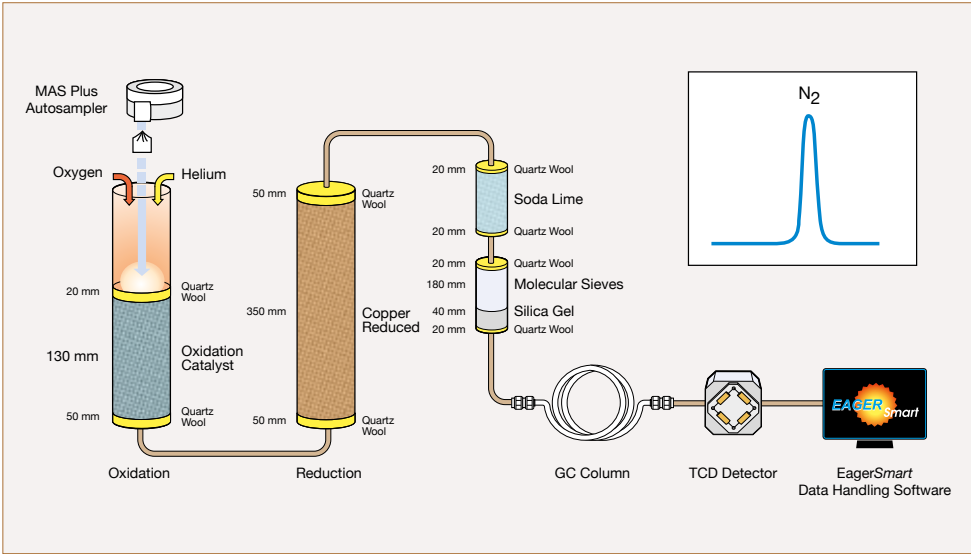


Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	300
Temperature (°C)	Left	950
	Right	840
	Oven	50
Cycle (Run Time)	300 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Oxidation catalyst (40 g)	338 40000
High quality copper (50 g)	338 35312
Silica gel with indicator (100 g)	338 40035
Quartz wool	338 22200
Molecular sieve 3A (100 g)	338 01801
Chromosorb WAW (25 g)	338 37530
Soda lime (200 g)	338 35230
Prepacked HPAR reactor	468 02008
Empty HPAR reactor 25 mm OD	468 20075
Adsorption trap (large)	281 13064
Nitrogen separation(N-Brew) column (PTFE 1 m, 8x6 mm)	260 70004
HPAR crucible	252 05011



ANALYTICAL CONFIGURATIONS - N/PROTEIN DETERMINATION

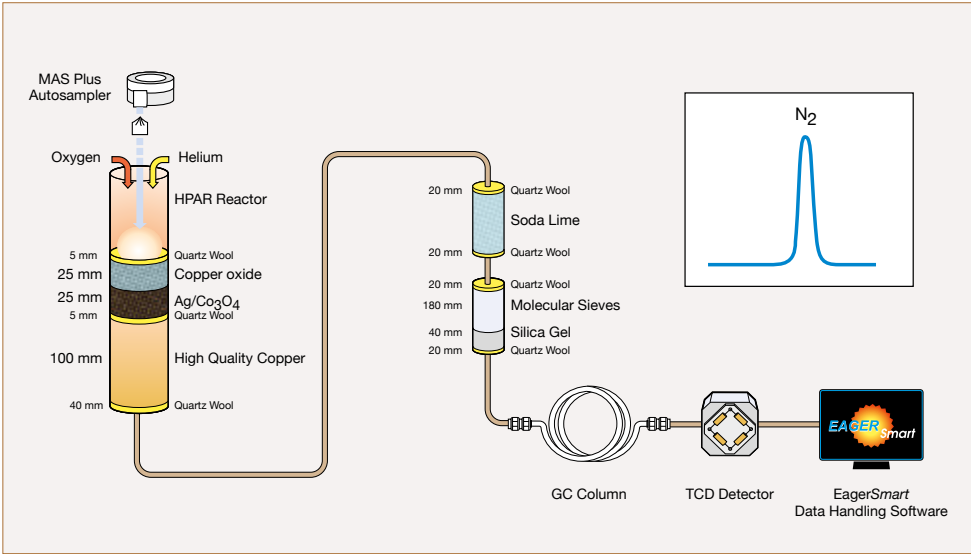


Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	300
Temperature (°C)	Left	950
	Right	840
	Oven	50
Cycle (Run Time)	300 sec	
Sample Delay Time	10 sec	

List of consumables	p/n
Oxidation catalyst (40 g)	338 40000
High quality copper (50 g)	338 35312
Silica gel with indicator (100 g)	338 40035
Quartz wool	338 22200
Molecular sieve 3A (100 g)	338 01801
Chromosorb WAW (25 g)	338 37530
Soda lime (200 g)	338 35230
Prepacked HPAR reactor	468 02008
HPAR crucible	252 05011
Empty HPAR reactor, 25 mm OD	468 20075
Adsorption trap (large)	281 13064
Nitrogen separation column (PTFE, 0.5 m, 8x6 mm)	260 07820



ANALYTICAL CONFIGURATIONS - N/PROTEIN DETERMINATION by SINGLE COMBUSTION/REDUCTION REACTOR



Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	300
Flow (ml/min)	He measurement	140
	He reference	100
	Oxygen	300
Temperature (°C)	Left	950
	Oven	50 (GC column inside the oven)
Oxygen Injection Time	30 sec	
Sample Delay Time	10 sec	
Cycle (Run Time)	400 sec	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 35312
Quartz wool (5 g)	338 22200
Soda lime (100 g)	338 35235
Molecular sieve (100 g)	338 01801
Silicagel plus indicator (100 g)	338 40035
HPAR crucible	252 05011
Empty HPAR reactor	468 20075
Adsorption trap (large)	281 13064
Nitrogen separation column (PTFE, 1 m, 8x6 mm)	260 70004



PERFORMANCE TEST - ANALYTICAL PERFORMANCE TESTS

Sequence of analysis

Configuration	Run 1	Run 2	Run 3 to 5 (Standards)	Weight (mg)	Run 6 to 8 (Unknown)	Weight (mg)
N/Protein	Blank	Bypass	3 Aspartic acid	50 - 100	3 Pasta	200 - 300
N-Brew	Blank	Bypass	3 Aspartic acid	50 - 100	3 Pasta	200 - 300

Theoretical Values, Range of concentration accepted

	N%	Range accepted
Thermo Scientific Pasta Reference Materia	2.21	2.19 - 2.24



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PERFORMANCE TEST - CRUDE PROTEIN IN ANIMAL FEED (AOAC 990.03)

	Nicotinic Acid	Lysine-HCl	AOAC mix	
	N%	N%	N%	Protein %
	11.2983	15.3067	3.2711	20.4442
	11.2996	15.2268	3.2472	20.2951
	11.3495	15.1636	3.2609	20.3807
	11.2918	15.2240	3.2453	20.2832
	11.3697	15.2745	3.2835	20.5219
	11.4206	15.1138	3.2670	20.4191
	11.4218	15.2262	3.2581	20.3635
	11.4401	15.1938	3.2626	20.3914
	11.4803	15.1924	3.2596	20.3723
	11.3938	15.2504	3.2781	20.4883
Average %	11.3757	15.2172	3.2633	20.3960
SD	0.0671	0.0549	0.0122	0.3727
RSD%	0.5900	0.3612	0.0763	0.3739

AOAC (Association of Official Analytical Chemists) 990.03 Performance Requirements

System must meet or exceed following minimum performance specification:

1. Be capable of measuring nitrogen in feed material containing **0.2 - 20 N%**.
2. Be capable of providing reproducibility within ± 0.15 of the respective theoretical values, with standard deviation ≤ 0.15
Accuracy of system is demonstrated by 10 subsequent determinations of nitrogen in Nicotinic Acid and Lysine-HCl.
3. **Relative Standard Deviation (RSD) $\leq 2.0\%$** for 10 determinations of nitrogen in mixture of corn grain and soybeans (2:1)
 $RSD\% = (SD/Mean\ N\%) \times 100$
4. Suitable size of particle (ca. 0.5 mm) required to achieve this precision must be used for all mixed feeds and other nonhomogeneous material.



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PERFORMANCE TEST - N/PROTEIN REPRODUCIBILITY OF SOY SAMPLE

Number of runs	Weight (mg)	N%	Protein %
1	103.4	7.8940	49.3373
2	205.9	7.9581	49.7382
3	296.6	7.9191	49.4944
4	217.4	7.9476	49.6723
5	189.8	7.9208	49.5052
6	200.2	7.8504	49.0648
7	232.4	7.8845	49.2779
8	230.2	7.9527	49.7047
9	188.5	7.8501	49.0629
10	211.8	7.8820	49.2628
11	178.9	7.8610	49.1312
12	216.0	7.9377	49.6105
13	188.0	7.9287	49.5541
14	185.1	7.8600	49.1253
15	242.5	7.8397	48.9982
16	186.7	7.8713	49.1958
17	202.9	7.8923	49.3268
18	218.0	7.9956	49.9727
19	198.7	7.9717	49.8234
20	204.0	7.8579	49.1116
21	220.1	7.9763	49.8520
22	206.2	7.8475	49.0470

Statistical data

N% average: 7.9045

Protein % average: 49.4031

N/Protein conversion factor:

RSD%: 0.61

RSD%: 0.61

6.25

Note

Sample pretreated in a rotary mill, 1 mm granulometry.



PERFORMANCE TEST - DAY BY DAY REPRODUCIBILITY OF NITROGEN/PROTEIN IN SEMOLA SAMPLE (1/2)

DAY 1

Weight (mg)	N%	Protein%
102.5	2.0634	12.8963
167.6	2.0728	12.9547
216.9	2.0653	12.9078
126.7	2.0917	13.0733
184.9	2.0824	13.0149
239.2	2.0728	12.9550
296.6	2.0495	12.8094

DAY 2

Weight (mg)	N%	Protein%
202.2	2.0770	12.9813
208.7	2.0646	12.9040
207.3	2.9808	13.0675
199.7	2.0719	12.9492
199.7	2.0939	13.0871
296.1	2.0787	12.9916
294.2	2.0887	13.0544
304.7	2.0925	13.0779
295.7	2.0944	13.0897
300.0	2.1005	13.1279



PERFORMANCE TEST - DAY BY DAY REPRODUCIBILITY OF NITROGEN/PROTEIN IN SEMOLA SAMPLE (2/2)

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DAY 3

Weight (mg)	N%	Protein%
217.7	2.1018	13.1360
221.1	2.0682	12.9265
215.2	2.0770	12.9811
314.8	2.0841	13.0259
294.9	2.0733	12.9584
285.4	2.1021	13.1382
280.8	2.0962	13.1010
287.1	2.0912	13.0698
108.8	2.0529	12.8309
103.6	2.0308	12.6923

Statistical data

Number of runs: 27

N% average: 2.0788

Protein % average: 12.9927

N/Protein conversion factor:

RSD%: 0.83

RSD%: 0.83

6.25



Analytical - Nitrogen/Protein

Animal Feed

- Animal Feed
- Animal Feed for Horse
- Corn Gluten
- Fish and Krill Meal
- Gluten Products
- Hyperproteic Ref. Mat. BIPEA
- Maltodextrine
- Meat Protein Powder
- Pet Food
- Protein Powders
- Soy Bean and Soy Meal
- Soy Products
- Starch and Slurry Starch

Animal Feed

N/Protein determination

ANIMAL FEED

Sample	N%			Protein%		
A	2.035	2.040	2.037	12.717	12.752	12.732
B	2.562	2.537	2.619	16.011	15.858	16.367
C	10.764	11.026	10.876	67.277	68.915	67.975
D	3.722	3.726	3.725	23.261	23.287	23.283
E	2.127	2.158	2.155	13.296	13.485	13.466
F	2.982	2.987	2.997	18.636	18.671	18.730
G	7.274	7.302	7.295	45.463	45.637	45.593
H	1.738	1.745	1.711	10.860	10.904	10.691

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 60 mg
Sample weight: 200 - 250 mg
OxyTune® Category: B

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Animal Feed

N/Protein determination

ANIMAL FEED

Sample	N%	RSD%
Fish Meal	10.29	1.221
Gluten Meal	10.52	0.854
Maize	7.95	0.784
Starch	0.046	2.031
Chicken Feed	3.01	1.546
Straw	0.45	0.623
Green Grass	3.28	0.954
Meat and Bone Mix	8.20	1.422

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 mg

Sample weight: 200 - 300 mg

OxyTune® Category: B

Note

Each value is the average of 3 runs.



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Animal Feed

N/Protein determination

ANIMAL FEED

N/Protein reproducibility in animal feed (mix of bone, meat and fat)

N%	Protein%	RSD%
9.7579	60.9867	
9.7730	61.0812	
9.6028	60.0176	
9.4569	59.1055	
9.6035	60.0221	1.4179
9.9775	62.3596	
9.7380	60.8622	
9.7282	60.8010	
9.7199	60.7496	
9.6364	60.2277	

Sample information

Standard:	Nicotinamide	22.94 N%
Standard weight:	50 - 90 mg	
Sample weight:	200 - 210 mg	
OxyTune® Category:	F (set a Delta 1.6)	

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Animal Feed

N/Protein determination

ANIMAL FEED - BARLEY - COCOA - FLOUR - MILK POWDER - SOY - STARCH - WHEAT

Sample	N%		Protein%	
Cocoa	3.71	3.72	23.21	23.26
Wheat	1.99	2.00	12.43	12.48
Fodder plant	2.53	2.56	15.83	16.00
Soy	5.91	5.88	36.95	36.74
Barley	1.43	1.42	8.93	8.90
Flour	1.24	1.24	7.76	7.76
Animal food	7.87	7.86	49.17	49.15
Milk powder	4.25	4.24	26.57	26.53
Starch	0.043	0.047	0.269	0.296

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:		80 mg
Sample weight:	Cocoa/milk powder	100 - 200 mg
	Other samples	200 - 300 mg
OxyTune® Category:	A	



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Animal Feed

N/Protein determination

ANIMAL FEED - MEAT MEAL

Sample	N%	RSD%	Protein%	RSD%
Meat meal 1	8.91	0.4091	55.69	0.4162
	8.94		55.84	
	8.98		56.12	
	8.93		55.80	
	8.99		56.20	
	8.97		56.07	
	8.92		55.77	
	8.98		56.11	
	8.92		55.76	
	8.90		55.59	
	8.89		55.56	
	8.89		55.55	
Meat meal 2	7.83	0.896	48.96	0.8833
	7.88		49.24	
	8.00		50.00	
	7.90		49.40	
	7.79		48.70	
	7.92		49.53	
	7.83		48.96	
	7.95		49.68	
	8.03		50.19	
	7.89		49.29	
	7.96		49.73	
	7.91		49.41	

Sample information

Standard: Nicotinamide 22.94 N%
Standard weight: 70 - 100 mg
Sample weight: 200 - 250 mg

Note

Select a new Category (Thermo Scientific OxyTune®) with a delta 1.4 for sample 1 and select category A for sample 2. The 6.25 factor was used to calculate the Protein content.



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Animal Feed

N/Protein determination

ANIMAL FEED - FEED

N%	RSD%	Protein%	RSD%
3.09	0.6389	19.34	0.653
3.12		19.52	
3.14		19.64	
3.13		19.56	
3.12		19.52	
3.13		19.56	
3.13		19.58	
3.09		19.29	
3.11		19.42	
3.09		19.30	
3.12		19.48	
3.15		19.67	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 70 mg
Sample weight: 200 - 250 mg

Note

Select Category A (Thermo Scientific OxyTune®) for sample analysis.
The 6.25 factor was used to calculate the Protein content.

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Animal Feed

N/Protein determination

ANIMAL FEED - DOGS

N%	RSD%	Protein%	RSD%
4.20	0.8037	26.25	0.7848
4.13		25.83	
4.23		26.42	
4.15		25.95	
4.16		25.97	
4.15		25.95	
4.17		26.08	
4.12		25.75	
4.17		26.04	
4.22		26.38	
4.17		26.03	
4.19		26.16	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:		50 - 70 mg
Sample weight:		200 - 250 mg

Note

Select a new Category (Thermo Scientific OxyTune®) with a delta 1.4 for sample analysis.
The 6.25 factor was used to calculate the Protein content.



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Animal Feed

N/Protein determination

ANIMAL FEED

Sample Code	Sample Nature	N%	RSD%	Protein %	RSD%
1	Gluten Process (liquid)	1.50	0.50	9.38	0.46
		1.51		9.46	
		1.51		9.45	
2	Starch Process (liquid)	0.211	1.10	1.32	0.88
		0.211		1.32	
		0.207		1.30	
3	Water Process (liquid)	0.277	1.15	1.73	1.19
		0.282		1.76	
		0.283		1.77	
4	Corn Starch	0.0557	0.27	0.348	0.29
		0.0558		0.349	
		0.0560		0.350	
5	Corn Starch	0.0540	0.21	0.338	0.34
		0.0538		0.336	
		0.0538		0.336	
6	Corn Starch	0.0535	0.54	0.335	0.52
		0.0540		0.338	
		0.0535		0.335	
7	Corn Starch	0.0621	0.74	0.388	0.79
		0.0612		0.382	
		0.0615		0.384	
8	Corn Starch	0.0738	0.67	0.461	0.70
		0.0730		0.456	
		0.0739		0.462	
9	Corn Starch	0.0752	0.91	0.470	0.89
		0.0739		0.462	
		0.0742		0.464	
10	Corn Starch	0.0705	0.54	0.440	0.48
		0.0698		0.436	
		0.0699		0.437	
11	Gluten dry 1	10.40	0.06	65.01	0.06
		10.40		65.08	
		10.40		65.08	
12	Gluten dry 2	10.91	0.14	68.18	0.13
		10.88		68.01	
		10.89		68.07	

Sample information

Standard: Aspartic acid 10.52 N% for samples 1 to 11
Nicotinamide 22.94 N% for samples 11 and 12

Standard weight: 50 - 60 mg Aspartic acid
80 - 100 mg Nicotinamide

Sample weight: 100 - 150 mg samples 1, 2, 3
250 - 300 mg sample 4 to 10
200 - 250 mg samples 11, 12

Note

Select Category B (OxyTune®) for sample 4 to 12, Category C for 1 to 3.
Liquid samples were mixed well before weighing and adsorbed on 30 - 50 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) inert material. The 6.25 factor was used to calculate the Protein content.



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Animal Feed

N/Protein determination

ANIMAL FEED (1/2)

Sample Code	Sample Nature	N%	RSD%	Protein %	RSD%
1	Soy Bean	5.34	0.47	33.35	0.47
		5.39		33.66	
		5.35		33.46	
2	Extracted Sunflower	6.09	0.27	38.09	0.27
		6.08		38.02	
		6.06		37.88	
3	Fish Flour	9.36	0.09	58.49	0.09
		9.35		58.44	
		9.34		58.38	
4	Starch	0.0589	0.60	0.37	0.59
		0.0586		0.37	
		0.0582		0.36	
5	Animal Feed	4.51	0.21	28.19	0.21
		4.50		28.15	
		4.52		28.27	
6	Wheat	1.86	1.06	11.65	1.06
		1.84		11.52	
		1.83		11.41	
7	Dog Food	3.13	0.30	19.55	0.30
		3.13		19.57	
		3.15		19.66	
8	Syrup	0.922	0.33	5.76	0.33
		0.918		5.74	
		0.924		5.77	
9	Pea Protein	3.62	0.26	22.65	0.26
		3.62		22.60	
		3.61		22.54	
10	Dry Sausage	3.45	0.62	21.58	0.62
		3.41		21.33	
		3.42		21.38	
11	Long Life Milk	0.503	0.24	3.21	0.25
		0.505		3.22	
		0.505		3.22	
12	Hempseed	3.94	0.31	24.63	0.32
		3.95		24.67	
		3.96		24.78	
13	Fat (for Animal feed)	0.0569	0.44	0.356	0.47
		0.0564		0.352	
		0.0566		0.354	



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Animal Feed

N/Protein determination

ANIMAL FEED (2/2)

Sample information

Code	Sample				Standard	
	Nature	Homogenization	Maximum Weight (mg)	OxyTune® Category	Type	Weight (mg)
1	Soy Bean	Knife Mill	320	B	Nicotinamide	70 - 100
2	Extracted Sunflower	Ball Mill	300	B	Nicotinamide	70 - 100
3	Fish Flour	No	390	B	Imidazole	90 - 100
4	Starch	No	350	B	Aspartic acid	50 - 100
5	Animal Feed	No	390	B	Nicotinamide	70 - 100
6	Wheat	Ball Mill	320	B	Aspartic acid	50 - 100
7	Dog Food	Ball Mill	320	B	Aspartic acid	50 - 100
8	Syrup	No	130	A	Aspartic acid	50 - 100
9	Pea Protein	No	400	B	Nicotinamide	70 - 100
10	Dry Sausage	Cut by Knife	440	B	Nicotinamide	70 - 100
11	Long Life Milk	No	130	C	Urea water solution (0.6 N%)	120 - 130
12	Hempseed	Ball Mill	220	A	Aspartic acid	50 - 100
13	Fat (for Animal feed)	No	100	E (δ 3)	Aspartic acid	50 - 100

Note

The long life milk was adsorbed on Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) inert material.
The protein factor used to calculate the protein content was 6.25 for most of the samples while for milk derivatives samples the protein factor was 6.38.

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Animal Feed

N/Protein determination

ANIMAL FEED

Sample Nature	Day 1				Day 2			
	N%	RSD%	Protein %	RSD%	N%	RSD%	Protein %	RSD%
Feed Mixture	2.44	0.23	15.23	0.10	2.45 2.44	0.29	15.32 15.26	0.28
	2.43		15.20					
	2.44		15.23					
	2.43		15.20					
	2.43		15.21					
Feed Mixture	2.72	0.42	17.01	0.40	2.73 2.75	0.52	17.09 17.16	0.29
	2.72		16.99					
	2.74		17.12					
	2.71		16.96					
	2.73		17.09					
Soybean Extract	7.57	0.13	47.30	0.15	7.60 7.58	0.19	47.48 47.39	0.13
	7.57		47.33					
	7.58		47.38					
	7.59		47.46					
	7.59		47.45					
Fish Meal	9.95	0.16	62.18	0.16	9.97 9.94	0.21	62.29 62.14	0.17
	9.94		62.13					
	9.95		62.18					
	9.96		62.25					
	9.92		61.98					

Sample information

Standard: Aspartic acid 10.52 N%
Nicotinamide 22.94 N%

Standard weight: 60 - 80 mg Aspartic acid
70 - 90 mg Nicotinamide

Sample weight: 200 - 250 mg

Note

Select Category B (OxyTune®) for feed mixtures and Category A for soybean extract and fish meal. The protein factor used to calculate the protein content was 6.25. Samples were analyzed in two consecutive days without recalibration of the Analyzer.



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Animal Feed

N/Protein determination

ANIMAL FEED

Code	Material	Sample	N%	RSD%	Protein %	RSD%
1	Vegetal Raw	Feather meal	12.44	0.12	77.72	0.12
			12.42		77.61	
			12.41		77.53	
2	Vegetal Raw	Visce flour	11.02	0.24	68.87	0.25
			11.01		68.82	
			11.06		69.14	
3	Vegetal Raw	Soy bean paste	7.76	0.07	48.48	0.06
			7.76		48.52	
			7.75		48.46	
4	Vegetal Raw	Maiz gluten	10.22	0.23	63.90	0.22
			10.27		64.21	
			10.27		64.17	
			10.25		64.06	
5	Vegetal Raw	Beer bran	4.29	0.47	26.83	0.45
			4.25		26.59	
			4.27		26.68	
6	Final product	Cat food	5.48	0.28	34.25	0.26
			5.49		34.29	
			5.46		34.12	

Sample information

Standard:

Nicotinamide

22.94 N% for samples 1 - 4

Aspartic acid

10.52 N% for samples 5 - 6

Standard weight:

70 - 100 mg Nicotinamide

60 - 90 mg Aspartic acid

Sample weight:

190 - 200 mg samples 1, 2

220 - 240 mg sample 3

180 - 190 mg sample 4

130 - 150 mg sample 5

140 - 150 mg sample 6

Note

Select Category B (OxyTune®) for sample 1 - 4 and Category A for samples 5 and 6.

The 6.25 factor was used to calculate the Protein content.



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Animal Feed

N/Protein determination

ANIMAL FEED

Sample	N%	RSD%	Protein %	RSD%
Layer Feed	2.72	0.43	17.02	0.56
	2.72		16.98	
	2.70		16.84	
Poultry Meal 1	8.13	0.45	50.79	0.42
	8.11		50.71	
	8.06		50.39	
Rapeseed	5.76	0.17	35.98	0.17
	5.77		36.06	
	5.75		35.94	
Corn	1.23	1.23	7.68	1.17
	1.26		7.86	
	1.24		7.75	
DDGS	4.48	0.64	28.00	0.63
	4.53		28.32	
	4.53		28.29	
Feather Meal	12.46	0.35	77.87	0.35
	12.53		78.33	
	12.54		78.35	
Sheeps Food	2.94	0.39	18.36	0.49
	2.96		18.51	
	2.96		18.35	
Yeast	5.96	0.29	37.23	0.25
	5.99		37.41	
	5.96		37.28	
Alfalfa	2.44	0.62	15.22	0.75
	2.47		15.45	
	2.46		15.35	
Feed for sow	2.75	0.55	17.21	0.50
	2.77		17.31	
	2.74		17.14	

Sample information

Standard: Aspartic acid 10.52 N%
Nicotinamide 22.94 N%

Standard weight: 50 - 70 mg Aspartic acid
50 - 60 mg Nicotinamide

Sample weight: 80 - 100 mg for layer feed, poultry meal, feather meal, yeast, DDGS
130 - 140 mg for corn, rapeseed, sheeps food, alfalfa, feed for sow

Note

select OxyTune® Categories as follows:

- @ 20 seconds for Aspartic acid and Nicotinamide
- Category A for poultry meal, feather meal, yeast, poultry meal, DDGS
- Category B for layer feed, corn, rapeseed, sheeps food, alfalfa, feed for sow

The 6.25 factor was used to calculate the Protein content and K factor as calibration method.



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N/Protein determination

ANIMAL FEED

Sample	N%	RSD%	Protein %	RSD%
Layer Feed	2.73	0.562	17.06	0.556
	2.72		17.02	
	2.70		16.88	
Poultry Meal 1	8.41	0.119	52.59	0.067
	8.43		52.66	
	8.42		52.62	
Poultry Meal 2	10.06	0.251	62.90	0.263
	10.04		62.73	
	10.01		62.57	
Broiler Meal	3.67	0.157	22.91	0.266
	3.68		22.99	
	3.68		23.03	
Rapeseed	5.75	0.174	35.94	0.170
	5.74		35.90	
	5.76		36.02	
Corn Gluten feed	3.73	0.155	23.32	0.150
	3.74		23.35	
	3.74		23.39	
Corn	1.23	0.000	7.69	0.150
	1.23		7.69	
	1.23		7.71	
DDGS (Dried Distillers Grains with Solubles)	4.53	0.220	28.30	0.282
	4.55		28.46	
	4.54		28.38	
Feather Meal	12.69	0.091	79.34	0.069
	12.71		79.44	
	12.71		79.43	
Sheeps Food	2.99	0.388	18.66	0.276
	2.97		18.59	
	2.97		18.56	
Sunflower Seed	6.18	0.187	38.60	0.206
	6.16		38.48	
	6.18		38.63	
Fibre Feed	3.37	1.173	21.07	1.104
	3.45		21.54	
	3.41		21.29	

Sample information

Standard:	Aspartic acid	10.52 N%
	Nicotinamide	22.94 N%
	Imidazole	41.15 N%
Standard weight:	50 - 100 mg Aspartic acid	
	60 - 100 mg Nicotinamide	
	60 - 90 mg Imidazole	
Sample weight:	150 - 190 mg for fibre feed	
	200 - 300 mg for other samples	

Note

Select Category A (OxyTune®) for soy protein, gluten and fibre feed, Category B for all other animal feed samples. The 6.25 factor was used to calculate the Protein content.



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Animal Feed

N/Protein determination

ANIMAL FEED

Sample	N%	RSD%	Protein %	RSD%
Meat Meal 1	8.46	0.36	52.86	0.35
	8.39		52.44	
	8.40		52.51	
	8.40		52.48	
	8.44		52.74	
Meat Meal 2	7.37	0.35	46.04	0.32
	7.32		45.77	
	7.33		45.81	
	7.38		46.10	
	7.36		46.01	
Poultry Meal	9.74	0.30	60.89	0.30
	9.79		61.18	
	9.73		60.79	
	9.72		60.75	
	9.77		61.06	
Feather Meal	12.88	0.22	80.50	0.21
	12.85		80.32	
	12.86		80.35	
	12.91		80.70	
	12.84		80.28	
Blood Meal	15.95	0.25	99.71	0.27
	15.87		99.17	
	15.97		99.84	
	15.90		99.37	
	15.92		99.47	

Sample information

Standard: Nicotinamide 22.94 N%

Standard weight: 70 - 100 mg

Sample weight: 200 - 250 mg for meat meal and poultry meal
180 - 200 mg for feather meal
150 - 200 mg for blood meal

Note

Oxygen Injection Time 30 seconds for Nicotinamide and OxyTune® Category B for samples.
The sample must be weighed in Tin disk 35 mm diam. (p/n 252 08018).



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Animal Feed

N/Protein determination

ANIMAL FEED

Sample	N%	RSD%	Protein %	RSD%
Wheat Flour	2.84	0.45	17.73	0.49
	2.83		17.69	
	2.86		17.89	
	2.82		17.61	
	2.84		17.77	
	2.84		17.76	
	2.84		17.75	
	2.82		17.62	
	2.82		17.61	
	2.83		17.71	
Wheat	2.03	0.69	12.69	0.67
	2.03		12.70	
	2.01		12.57	
	2.03		12.66	
	2.03		12.66	
	2.03		12.59	
	2.02		12.64	
	2.02		12.63	
	2.00		12.51	
	1.99		12.43	
Corn	1.42	0.94	8.87	0.95
	1.39		8.68	
	1.40		8.75	
	1.38		8.64	
	1.42		8.90	
	1.40		8.74	
	1.39		8.70	
	1.40		8.74	
	1.39		8.68	
	1.39		8.70	
Barley	2.06	0.74	12.88	0.68
	2.05		12.70	
	2.05		12.80	
	2.05		12.71	
	2.05		12.81	
	2.03		12.71	
	2.04		12.76	
	2.06		12.88	
	2.07		12.93	
	2.13		13.59	
Pet Food	1.14	0.47	19.65	0.53
	1.11		19.41	
	1.11		19.43	
	1.11		19.43	
	1.15		19.69	
	1.14		19.61	
	1.14		19.56	
	1.14		19.63	
	1.12		19.47	
	2.22		20.10	
Feed Mixture	2.24	0.87	20.27	0.92
	2.26		20.37	
	2.29		20.58	
	2.25		20.31	
	2.22		20.11	
	2.27		20.44	
	2.29		20.59	
	2.26		20.40	
	3.30		20.62	
	3.56		22.24	
Corn Grains + Soy Beans	3.53	0.65	22.06	0.67
	3.50		21.85	
	3.51		21.96	
	3.51		21.93	
	3.51		21.93	
	3.52		22.00	
	3.49		21.79	
	3.53		22.04	
	3.48		21.72	

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Animal Feed

N/Protein determination

ANIMAL FEED

Sample	N%	RSD%	Protein %	RSD%
Soy Beans	7.76	0.29	48.50	0.30
	7.73		48.32	
	7.77		48.55	
	7.78		48.63	
	7.75		48.47	
	7.79		48.71	
	7.74		48.35	
	7.72		48.23	
	7.77		48.56	
	7.76		48.53	
Sunflower Scraps	6.33	0.38	39.56	0.38
	6.27		39.18	
	6.29		39.31	
	6.31		39.44	
	6.29		39.30	
	6.30		39.39	
	6.26		39.11	
	6.32		39.47	
	6.33		39.54	
	6.31		39.44	
Corn Gluten	10.90	0.32	68.12	0.32
	10.91		68.21	
	10.96		68.50	
	10.89		68.08	
	10.98		68.65	
	10.98		68.64	
	10.94		68.35	
	10.97		68.56	
	10.98		68.60	
	10.93		68.33	
Poultry meal	10.66	0.39	66.60	0.40
	10.68		66.77	
	10.59		66.16	
	10.63		66.42	
	10.58		66.11	
	10.65		66.58	
	10.57		66.09	
	10.62		66.39	
	10.69		66.84	
	10.64		66.50	

Sample information

Sample	Standard used and weight	Sample weight (mg)	OxyTune® Category
Wheat Flour	Aspartic Acid 50-80 mg	200-250	B
Wheat	Aspartic Acid 50-80 mg	200-250	B
Corn	Aspartic Acid 50-80 mg	220-270	B
Barley	Aspartic Acid 50-80 mg	200-230	B
Pet Food	Aspartic Acid 50-80 mg	200-270	B
Feed Mixture	Aspartic Acid 50-80 mg	200-260	A
Corn Grains + Soy Beans	Aspartic Acid 50-80 mg	200-270	B
Soy Beans	Aspartic Acid 50-80 mg	180-220	B
Sunflower Scraps	Nicotinamide 50-80 mg	200-260	B
Corn Gluten	Nicotinamide 50-80 mg	150-200	B
Poultry meal	Nicotinamide 50-80 mg	200-250	B

Note

The sample must be weighed in Tin disk 35 mm diam. (p/n 252 08018).



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Animal Feed

N/Protein determination

INSECT ANIMAL FEED

Sample	N%	RSD%	Protein %	RSD%
Blood Worm	7.34	0.30	7.34	0.28
	7.34		7.34	
	7.33		7.33	
	7.29		7.29	
	7.31		7.31	
Midge Larva	7.71	0.50	7.71	0.52
	7.73		7.73	
	7.69		7.69	
	7.78		7.78	
	7.77		7.77	
Barley Pests	7.99	0.39	7.99	0.38
	7.97		7.97	
	7.94		7.94	
	7.92		7.92	
	7.99		7.99	
Mealworms	8.92	0.22	8.92	0.22
	8.97		8.97	
	8.94		8.94	
	8.93		8.93	
	8.93		8.93	
Mealworms powder	8.64	0.82	8.64	0.80
	8.61		8.61	
	8.64		8.64	
	8.78		8.78	
	8.61		8.61	
Cricket Flour	11.03	0.27	11.03	0.27
	11.05		11.05	
	11.07		11.07	
	11.07		11.07	
	11.00		11.00	
Maggot Powder (Fly Larva)	8.74	0.37	8.74	0.36
	8.68		8.68	
	8.68		8.68	
	8.67		8.67	
	8.73		8.73	

Sample information

Standard: Nicotinamide 22.94 N%

Standard weight: 80 - 100 mg

Sample weight: 200 - 250 mg

Note

OxyTune® Category A

The sample must be weighed in Tin disk 35 mm diam. (p/n 252 08018).



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Animal Feed

N/Protein determination

HAY AND MAIZE SILAGE

Sample	N%	RSD%	Protein %	RSD%
Hay silage	1.67	1.23	10.45	1.15
	1.66		10.35	
	1.70		10.62	
	1.69		10.58	
	1.65		10.34	
	1.71		10.68	
	1.69		10.54	
	1.69		10.56	
	1.67		10.45	
	1.71		10.66	
	1.17		7.33	
Hay	1.18	1.47	7.39	1.46
	1.18		7.35	
	1.21		7.57	
	1.17		7.30	
	1.21		7.54	
	1.18		7.39	
	1.21		7.55	
	1.21		7.58	
	1.20		7.50	
	1.01		6.29	
	1.00		6.28	
Maize silage	1.01	0.87	6.31	0.88
	1.00		6.25	
	1.03		6.44	
	1.02		6.39	
	1.01		6.29	
	1.01		6.32	
	1.01		6.32	
	1.01		6.32	
	1.01		6.33	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 70 - 80 mg

Sample weight: 90 - 130 mg for hay silage
110 - 170 mg for hay
140 - 190 mg for maize silage

Note

Oxygen Injection Time 30 seconds for aspartic acid and OxyTune® Category A for hay and hay silage and B for maize silage.
The sample must be weighed in Tin disk 35 mm diam. (p/n 252 08018).



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Animal Feed for Horse

N/Protein determination

ANIMAL FEED FOR HORSE

Sample	N%	RSD%	Protein%	RSD%
1	3.59	0.80	22.43	0.87
	3.64		22.76	
	3.59		22.41	
2	1.75	0.57	10.93	0.73
	1.76		11.00	
	1.77		11.09	
3	10.37	0.31	64.82	0.29
	10.38		64.86	
	10.32		64.52	
4	0.55	1.06	3.44	1.39
	0.54		3.35	
	0.55		3.42	
5	7.42	0.61	46.39	0.61
	7.51		46.95	
	7.48		46.78	
6	3.18	0.48	19.91	0.43
	3.21		20.08	
	3.20		20.02	
7	4.78	0.32	29.87	0.29
	4.79		29.94	
	4.76		29.77	

Sample information

Standard: Aspartic acid 10.52 N%
Nicotinamide 22.94 N%

Standard weight: 50 - 100 mg Aspartic acid
70 - 100 mg Nicotinamide

Sample weight: 200 - 300 mg

Note

Select Category B (OxyTune®) for animal feed samples.
The 6.25 factor was used to calculate the Protein content.



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Animal Feed for Horse

N/Protein determination

ANIMAL FEED FOR HORSE

N/Protein Determination by Single Combustion/Reduction Reactor				
Sample	N%	RSD%	Protein%	RSD%
1	0.56	1.02	3.49	1.39
	0.57		3.58	
	0.57		3.57	
2	3.23	0.36	20.00	0.28
	3.25		20.29	
	3.23		20.19	
3	4.81	0.43	30.08	0.42
	4.85		30.31	
	4.82		30.09	
4	3.66	0.32	22.87	0.32
	3.64		22.74	
	3.66		22.85	
5	1.79	0	11.19	0.18
	1.79		11.16	
	1.79		11.20	
6	7.43	0.54	46.44	0.54
	7.51		46.94	
	7.48		46.75	
7	10.34	0.43	64.63	0.43
	10.43		65.19	
	10.38		64.88	

Sample information

Standard: Aspartic acid 10.52 N%
 Nicotinamide 22.94 N%

Standard weight: 50 - 70 mg Aspartic acid
 50 - 60 mg Nicotinamide

Sample weight: 110 - 120 mg for sample 1
 70 - 90 mg for samples 2, 3, 4 and 5
 80 - 90 mg for samples 6 and 7

Note

Select @ 20 seconds for Aspartic acid and Nicotinamide, Category A (OxyTune®) for samples 1 to 5 and a new Category (δ 1.6) for sample 6 and 7. The 6.25 factor was used to calculate the Protein content and K factor as calibration method.



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Corn Gluten

N/Protein determination

CORN GLUTEN

Sample	N%	RSD%	Protein%	RSD%
1	10.0489	0.0274	62.8055	0.0271
	10.0461		62.7881	
	10.0516		62.8222	
2	9.4731	0.0235	59.2069	0.0235
	9.4775		59.2345	
	9.4759		59.2241	
3	10.4201	0.0925	65.1256	0.0925
	10.4356		65.2225	
	10.4378		65.2362	
4	10.7510	0.1170	67.1940	0.1169
	10.7734		67.3337	
	10.7722		67.3265	
5	10.3815	0.0159	64.8846	0.0161
	10.3800		64.8752	
	10.3782		64.8637	

Sample information

Standard:	Aspartic acid	10.52 N%
	Nicotinamide	22.94 N%
Standard weight:		70 - 100 mg
Sample weight:		200 - 250 mg

Note

Select Category B (Thermo Scientific OxyTune®) for samples analysis.
The 6.25 factor was used to calculate the Protein content.



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Fish and Krill Meal

N/Protein determination

FISH AND KRILL MEAL

Sample		N%	Protein %	RDS%
Fish meal	1	10.191	63.69	0.326
	2	10.472	65.45	0.899
	3	11.145	69.66	0.331
	4	11.505	71.91	0.568
	5	11.287	70.55	0.087
Krill meal	1	9.954	62.21	0.681
	2	9.122	57.01	1.050
	3	9.899	61.87	0.385
	4	9.271	57.94	0.509
	5	9.259	57.87	1.454

Sample information

Standard: Nicotinamide 22.94 N%
 Standard weight: 50 - 100 mg
 Sample weight: 200 - 250 mg
 OxyTune® Category: A

Note

Samples were analyzed three Times.



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Fish and Krill Meal

N/Protein determination

FISH MEAL

Fish meal sample	FlashSmart EA - Protein %	Kjeldahl Method - Protein %	Difference
1	63.7	63.5	0.2
2	65.4	65.4	0.0
3	65.5	65.2	0.3
4	69.7	70.2	-0.5
5	69.8	70.0	-0.2
6	71.6	72.0	-0.4
7	69.7	69.5	0.2
8	67.9	68.5	-0.6
9	69.6	69.4	0.2
10	70.4	70.0	0.4
11	69.9	69.6	0.3
12	67.5	67.3	0.2
13	67.8	67.5	0.3
14	65.3	64.8	0.5
15	69.7	69.7	0.0
16	64.4	65.3	0.1
17	70.5	70.0	0.5
18	70.7	70.2	0.5
19	71.9	71.9	0.0
20	69.1	69.5	-0.4
21	69.9	70.0	-0.1
22	65.4	65.6	-0.2
23	67.3	67.6	-0.2
24	65.2	64.8	0.4

Sample information

Standard: Nicotinamide 22.94 N%
 Standard weight: 90 - 100 mg
 Sample weight: 200 - 250 mg

Note

Select Category A (OxyTune®) for animal feed samples.
 The 6.25 factor was used to calculate the Protein content.

Comment

The Table shows a comparison of the protein data obtained of fish meal analysis with the traditional Kjeldahl method and the FlashSmart EA.
 The small differences between the data demonstrate an optimal correlation of the techniques.



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Gluten Products

N/Protein determination

GLUTEN PRODUCTS

Sample	N%	RSD%	Protein %	RSD%
Gluten 1	10.97	0.294	68.54	0.309
	10.96		68.51	
	10.91		68.16	
Gluten 2	9.83	0.294	61.44	0.187
	9.81		61.33	
	9.85		61.56	
Gluten Meal 1	11.29	0.178	70.57	0.179
	11.25		70.32	
	11.27		70.47	
Gluten Meal 2	9.81	0.000	61.30	0.009
	9.81		61.31	
	9.81		61.30	

Sample information

Standard: Nicotinamide 22.94 N%
 Standard weight: 70 - 100 mg
 Sample weight: 200 - 250 mg

Note

Select Category B (OxyTune®) for sample analysis.
 The 6.25 factor was used to calculate the Protein content.



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Gluten Products

N/Protein determination

GLUTEN PRODUCTS

Sample	N%	RSD%	Protein %	RSD%
Corn Gluten 1	3.77	0.82	23.54	0.74
	3.73		23.31	
	3.71		23.20	
Corn Gluten 2	3.78	1.01	23.60	0.98
	3.79		23.70	
	3.72		23.26	
Gluten Meal	11.21	0.05	70.07	0.04
	11.22		70.11	
	11.22		70.13	

Sample information

Standard:	Aspartic acid	10.52 N%
	Nicotinamide	22.94 N%
Standard weight:	50 - 70 mg Aspartic acid	
	50 - 60 mg Nicotinamide	
Sample weight:	80 - 90 mg	

Note

Select OxyTune® Categories as follows:

- @ 20 seconds for Aspartic acid and Nicotinamide
- Category A

The 6.25 factor was used to calculate the Protein content and K factor as calibration method.



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Hyperproteic Ref. Mat. BIPEA

N/Protein determination

HYPERPROTEIC REFERENCE MATERIAL BIPEA

BIPEA (Bureau InterProfessionnel d'Etudes Analytiques), Paris, France					
BIPEA - Hyperproteic Powder			FLASHSmart EA		
Fat	Kjeldahl Protein	Combustion Protein	N %	Protein %	RSD %
%	Av. % - Tolerance	Av. % - Tolerance			
0.8	85.4 - 3.4	86.4 - 3.5	13.65 13.63	85.31 85.19	0.10

Sample information

Standard: Nicotinamide 22.94 N%

Standard weight: 90 - 100 mg

Sample weight: 200 - 250 mg

Note

Select Category A (OxyTune®) for animal feed samples.
The 6.25 factor was used to calculate the Protein content.

Comment

The material was characterized through a laboratory intercomparison using Kjeldahl and combustion methods.
The Table shows the sample information included in the certificate and the data obtained by FlashSmart EA.



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Hyperproteic Ref. Mat. BIPEA

N/Protein determination

HYPERPROTEIC REFERENCE MATERIAL BIPEA

BIPEA (Bureau InterProfessionnel d'Etudes Analytiques), Paris, France					
BIPEA - Hyperproteic Powder			FlashSmart EA		
Fat	Kjeldahl Protein	Combustion Protein	N %	Protein %	RSD %
%	Av.% - Tolerance	Av.% - Tolerance			
0.8	85.4 - 3.4	86.4 - 3.5	13.50 13.59 13.54	84.37 84.92 84.64	0.32

Sample information

Standard: Nicotinamide 22.94 N%

Standard weight: 50 - 600 mg

Sample weight: 70 - 90 mg

Note

select OxyTune® Categories as follows:

- @ 20 seconds for Nicotinamide
- A new Category (δ 1.6) for the sample

The 6.25 factor was used to calculate the Protein content and K factor as calibration method.

Comment

The material was characterized through a laboratory intercomparison using Kjeldahl and combustion methods. The Table shows the sample information included in the certificate and the data obtained by FlashSmart EA.



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Maltodextrine

N/Protein determination

MALTODEXTRINE

N%	RSD%	Protein%	RSD%
0.0089	1.2281	0.0555	1.1171
0.0089		0.0557	
0.0088		0.0550	
0.0091		0.0567	
0.0089		0.0559	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 - 100 mg

Sample weight: 220 - 250 mg

Note

Select Category A (OxyTune®).

The 6.25 factor was used to calculate the Protein content.



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Meat Protein Powder

N/Protein determination

MEAT PROTEIN POWDER

N%	RSD%	Protein%	RSD%
13.65	0.04	85.32	0.04
13.65		85.30	
13.64		85.26	

Sample information

Standard:	Nicotinamide	22.94 N%
Standard weight:	90 - 100 mg	
Sample weight:	220 - 250 mg	

Note

Select Category B (OxyTune®) for animal feed samples.
The 6.25 factor was used to calculate the Protein content.



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Pet Food

N/Protein determination

PET FOOD

Sample	N%	RSD%	Protein %	RSD%
1	1.083	0.861	6.771	0.864
	1.068		6.676	
	1.085		6.782	
2	5.245	0.339	32.779	0.341
	5.233		32.708	
	5.268		32.927	
3	13.980	0.207	87.376	0.208
	13.931		87.069	
	13.929		87.056	

Sample information

Standard: Aspartic acid 10.52 N%
Nicotinamide 22.94 N%

Standard weight: 50 - 100 mg
Sample weight: 200 - 300 mg

Note

Select Category B (OxyTune®) for sample analysis.
The 6.25 factor was used to calculate the Protein content.



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Protein Powders

N/Protein determination

PROTEIN POWDERS

Sample	N%	RSD%	Protein%	RSD%
Soy protein powder	8.2368		51.4800	
	8.2643	0.1669	51.6520	0.1670
	8.2518		51.5738	
Meat protein powder	13.6517		85.3229	
	13.6475	0.0368	85.2967	0.0367
	13.6417		85.2606	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 40 - 50 mg

Sample weight: 100 - 120 mg

Note

Select Category A (Thermo Scientific OxyTune®) for sample analyses.
The 6.25 factor was used to calculate the Protein content.



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Soy Bean and Soy Meal

N/Protein determination

SOY BEAN AND SOY MEAL

Sample Nature	Sample Code	N%	RSD%	Protein %	RSD%
Soy bean	1	5.70	0.37	35.63	0.42
		5.73		35.84	
	2	5.64	0.25	35.23	0.28
		5.66		35.37	
	3	5.76	0.12	36.01	0.14
		5.77		36.08	
Soy meal	4	7.71	0.37	48.19	0.34
		7.75		48.42	
	5	7.22	0.29	45.12	0.25
		7.19		44.96	
	6	7.66	0.09	47.389	0.07
		7.65		47.84	
	7	7.76	0.18	48.51	0.19
		7.78		48.64	
	8	8.31	0.34	51.91	0.39
		8.35		52.20	
	9	8.11	0.44	50.71	0.46
		8.06		50.38	
	10	7.99	0.18	49.94	0.17
		8.01		50.06	

Sample information

Standard: Nicotinamide 22.94 N%

Standard weight: 50 - 100 mg

Sample weight: 200 - 300 mg

Note

Select Category B (OxyTune®) for sample analysis. The protein factor used to calculate the protein content was 6.25.



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Soy Products

N/Protein determination

SOY PRODUCTS

Sample	N%	RSD%	Protein%	RSD%
De-hulled soybean meal	7.68		48.00	
	7.65	0.2713	47.81	0.2721
	7.69		48.06	
Soy protein concentrate	10.53		65.81	
	10.50	0.1453	65.63	0.1369
	10.51		65.72	
Cream colored soy protein isolate	13.95		87.20	
	13.95	0.0414	87.19	0.0434
	13.94		87.13	

Sample information

Standard: Nicotinamide 22.94 N%

Standard weight: 70 - 100 mg

Sample weight: 200 - 250 mg for de-hulled soy bean and soy protein concentrate
150 - 160 mg for cream colored soy protein isolate

Note

Select Category C (Thermo Scientific OxyTune®) for sample analysis.

Comment

The de-hulled soy bean meal is for animal consumption while the soy protein concentrate is for human food industries. The cream colored soy protein isolate is applicable for a wide range of food products requiring a particularly high protein and bland flavor profile, providing gel strength and emulsifying properties.



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Soy Products

N/Protein determination

SOY PRODUCTS

Sample	N%	RSD%	Protein %	RSD%
Soy	7.89		49.29	
	7.87	0.194	49.20	0.193
	7.90		49.39	
Soybean Meal 1	7.88		49.22	
	7.87	0.073	49.21	0.031
	7.88		49.24	
Soybean Meal 2	7.71		48.20	
	7.70	0.130	48.10	0.158
	7.72		48.25	
Soybean Meal 3	7.46		46.60	
	7.47	0.077	46.71	0.126
	7.47		46.69	
Soy Protein Meal	10.65		66.54	
	10.65	0.108	66.57	0.119
	10.63		66.42	
Soy protein concentrate	10.53		65.81	
	10.50	0.15	65.63	0.14
	10.51		65.72	
Soy protein powder	8.24		51.48	
	8.26	0.17	51.65	0.17
	8.25		51.57	

Sample information

Standard: Nicotinamide 22.94 N%

Standard weight: 70 - 100 mg

Sample weight: 150 - 250 mg

Note

Select Category B (OxyTune®) for sample analysis.
The 6.25 factor was used to calculate the Protein content.



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Soy Products

N/Protein determination

SOY PRODUCTS

N/Protein Determination by Single Combustion/Reduction Reactor				
Sample	N%	RSD%	Protein%	RSD%
Soybean Meal 1	7.73		48.31	
	7.75	0.13	48.42	0.11
	7.74		48.36	
Soybean Meal 2	7.63		47.71	
	7.74	0.72	48.37	0.70
	7.70		48.14	
Soy Protein Meal	10.20		63.78	
	10.25	0.64	64.04	0.64
	10.33		64.59	

Sample information

Standard:	Nicotinamide	22.94 N%
Standard weight:	50 - 60 mg	
Sample weight:	80 - 90 mg	

Note

Select OxyTune® Categories as follows:

- @ 20 seconds for Nicotinamide
- Category A

The 6.25 factor was used to calculate the Protein content and K factor as calibration method.



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Starch and Slurry Starch

N/Protein determination

STARCH AND SLURRY STARCH

Sample	N%	RSD%	Protein%	RSD%
Starch 1	0.0484	0.3389	0.3024	0.3810
	0.0486		0.3040	
	0.0483		0.3016	
	0.0487		0.3042	
	0.0484		0.3022	
Starch 2	0.0357	0.8259	0.2233	0.8871
	0.0350		0.2185	
	0.0351		0.2191	
	0.0352		0.2202	
	0.0355		0.2217	
Starch Slurry	0.0166	2.3179	0.1038	2.2782
	0.0165		0.1029	
	0.0159		0.0994	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 - 100 mg

Sample weight: 200 - 250 mg for starch
300 - 320 mg for starch slurry
adsorbed on 30 - 40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530)

Note

Select Category A (OxyTune®) for starch, Category D for starch slurry.
The 6.25 factor was used to calculate the Protein content.



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- Wort

Beer

Nitrogen determination

BEER

Sample	N%		RSD%
Beer (manual injection)	0.0801	0.0806	
	0.0789	0.0805	
	0.0766	0.0769	2.004
	0.0787	0.0763	
	0.0790	0.0789	
Beer (automatic injection by liquid autosampler)	0.0677	0.0691	
	0.0691	0.0710	
	0.0698	0.0722	
	0.0698	0.0709	
	0.0706	0.0699	1.720
	0.0697	0.0697	
	0.0678	0.0685	
	0.0706	0.0698	
	0.0698	0.0692	
	0.0675	0.0684	

Sample information

Standard:	Urea Water Solution	700 ppm N
Standard volume:	100 µl	
Sample volume:	100 µl	
Oxygen Injection Time:	3 sec	

Note

Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 4 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears.



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- Wort

Beer

Nitrogen determination

BEER

Sample	N%	N% Average	RSD%
Labatt-Blue beer	0.0561		
	0.0559		
	0.0554		
	0.0548		
	0.0553	0.550	1.23
	0.0551		
	0.0546		
	0.0543		
	0.0544		
	0.0541		

Sample information

Standard:	Urea Water Solution	486 ppm N
Standard volume:	80 µl	
Sample volume:	80 µl	
Oxygen Injection Time:	3 sec	

Note

Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 4 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears.



Analytical - Nitrogen/Protein

Beverages

- Beer
- Coffee
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Beer

Nitrogen determination

BEER

Sample	N%	RSD%
Beer 1	0.1716	
	0.1761	
	0.1729	0.9526
	0.1740	
	0.1734	
Beer 2	0.1387	
	0.1288	
	0.1326	2.7333
	0.1336	
	0.1315	

Sample information

Standard:	Urea Water Solution	0.1126 N%
Standard volume:	50 µl	
Sample volume:	50 µl	

Note

Since samples contain carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears.
Samples can be analyzed by manual or automatic liquid injection.
Set Oxygen Injection Time to 15 seconds for standards and samples analysis.
The injection is at 4 seconds after the start.

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Beer

Nitrogen determination

BEER - WORT

Sample	N mg/l	rsd%	No. of run
Beer A	867	0.920	20
Beer B	662	1.313	20
Beer C	634	0.827	20
Beer D	630	0.896	2
Beer E	671	0.709	2
Beer F	705	0.634	2
Wort A	620	0.652	2
Wort B	526	0.356	2
Wort C	553	0.107	2
Wort D	309	1.008	2
Wort E	1242	1.098	16

Sample information

Standard:	Urea Water Solution	500 ppm N
Standard volume:	100 µl	
Sample volume:	100 µl	
Oxygen Injection Time:	Beer	3 sec
	Wort	8 sec

Note

Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 8 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears. Wort is rather viscous due to high sugar content. Samples can be analyzed without any pre-treatment (washing the syringe several Times) or diluted.



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Beer

Nitrogen determination

BEER - CHEESE - JUICES - MILK PROTEIN - WINE - WORT

Sample	N%	ppm N	RSD%
Beer A		867	0.920
Beer B		595	1.236
Wort A		318	1.008
Wort B		961	1.113
White wine		230	1.207
Red wine		274	1.125
Apple Juice		109	1.554
Orange Juice		150	2.137
Cheese Extract A		50	2.320
Cheese Extract B		120	1.715
Milk Protein Fraction A	0.127		0.543
Milk Protein Fraction B	0.134		0.416
Soluble Protein in Fodder Plant A	0.104		2.060
Soluble Protein in Fodder Plant B		870	1.952

Sample information

Standard:	Urea Water Solution	500 ppm N
Standard volume:	100 µl	
Sample volume:	100 µl	
Oxygen Injection Time:	8 sec	

Note

Each value is the average of 20 runs.
 Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 8 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears.
 Wort is rather viscous due to high sugar content. Samples can be analyzed without any pre-treatment (washing the syringe several Times) or diluted.



Analytical - Nitrogen/Protein

Beverages

- Beer
- Coffee
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Beer

Nitrogen determination

BEER

Sample 1		Sample 2		Sample 3		Sample 4	
N%	RSD%	N%	RSD%	N%	RSD%	N%	RSD%
0.1048	0.41	0.0924	0.66	0.0921	0.61	0.0953	0.62
0.1040		0.0932		0.0906		0.0961	
0.1051		0.0920		0.0916		0.0956	
0.1046		0.0936		0.0917		0.0952	
0.1050		0.0931		0.0914		0.0951	
0.1052		0.0919		0.0906		0.0944	
0.1045		0.0923		0.0906		0.0945	
0.1039		0.0919		0.0912		0.0958	
0.1047		0.0924		0.0916		0.0961	
0.1045		0.0920		0.0907		0.0953	

Sample information

Standard: Urea Water Solution 0,1 N%
Standard weight: 125 µl
Sample weight: 125 µl

Note

Beer samples were degassed before the analysis by shaken.
Samples were analyzed by direct injection at 8 seconds after the start of the analysis, through the AS 1310 Liquid Autosampler.
Set Oxygen Flow at 300 ml/min and Oxygen Injection Time at 3 seconds.
The 1 m GC column (p/n 260 70004) installed outside the oven is suggested.

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Coffee

Nitrogen determination

COFFEE

N%	RSD%	Prot.%	RSD %
2.90	0.12	18.14	0.12
2.90		18.14	
2.91		18.18	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 - 60 mg

Sample weight: 150 - 190 mg

Note

Select Category A (OxyTune®) for samples.
The 6.25 factor was used to calculate the Protein content.



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Juices

Nitrogen determination

BEER - CHEESE - JUICES - MILK PROTEIN - WINE - WORT

Sample	N%	ppm N	RSD%
Beer A		867	0.920
Beer B		595	1.236
Wort A		318	1.008
Wort B		961	1.113
White wine		230	1.207
Red wine		274	1.125
Apple Juice		109	1.554
Orange Juice		150	2.137
Cheese Extract A		50	2.320
Cheese Extract B		120	1.715
Milk Protein Fraction A	0.127		0.543
Milk Protein Fraction B	0.134		0.416
Soluble Protein in Fodder Plant A	0.104		2.060
Soluble Protein in Fodder Plant B		870	1.952

Sample information

Standard:	Urea Water Solution	500 ppm N
Standard volume:	100 µl	
Sample volume:	100 µl	
Oxygen Injection Time:	8 sec	

Note

Each value is the average of 20 runs.
 Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 8 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears.
 Wort is rather viscous due to high sugar content. Samples can be analyzed without any pre-treatment (washing the syringe several Times) or diluted.



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Beverages

- Beer
- Coffee
- Juices
- Wine
- Wort

Juices

N/Protein determination

JUICE

Sample	N%	RSD%	Protein%	RSD%
1	0.3599		2.2495	
	0.3585	0.3104	2.2409	0.3129
	0.3577		2.2356	
2	0.0572		0.3573	
	0.0583	2.7621	0.3643	2.7327
	0.0552		0.3451	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 6.0 - 7.0 mg
Sample weight: 100 mg adsorbed on 40 mg Chromosorb WAW (30 - 60 mesh)
(p/n 338 37530)

Note

Set fixed amount of Oxygen of 15 seconds @ (Thermo Scientific OxyTune® function) for all standard and sample analyses.
The 6.25 factor was used to calculate the Protein content.



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- Juices
- Wine
- Wort

Wine

Nitrogen determination

BEER - CHEESE - JUICES - MILK PROTEIN - WINE - WORT

Sample	N%	ppm N	RSD%
Beer A		867	0.920
Beer B		595	1.236
Wort A		318	1.008
Wort B		961	1.113
White wine		230	1.207
Red wine		274	1.125
Apple Juice		109	1.554
Orange Juice		150	2.137
Cheese Extract A		50	2.320
Cheese Extract B		120	1.715
Milk Protein Fraction A	0.127		0.543
Milk Protein Fraction B	0.134		0.416
Soluble Protein in Fodder Plant A	0.104		2.060
Soluble Protein in Fodder Plant B		870	1.952

Sample information

Standard:	Urea Water Solution	500 ppm N
Standard volume:	100 µl	
Sample volume:	100 µl	
Oxygen Injection Time:	8 sec	

Note

Each value is the average of 20 runs.
 Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 8 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears.
 Wort is rather viscous due to high sugar content. Samples can be analyzed without any pre-treatment (washing the syringe several Times) or diluted.



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- Juices
- Wine
- Wort

Wort

Nitrogen determination

BEER - WORT

Sample	N mg/l	RDS%	No. of runs
Beer A	867	0.920	20
Beer B	662	1.313	20
Beer C	634	0.827	20
Beer D	630	0.896	2
Beer E	671	0.709	2
Beer F	705	0.634	2
Wort A	620	0.652	2
Wort B	526	0.356	2
Wort C	553	0.107	2
Wort D	309	1.008	2
Wort E	1242	1.098	16

Sample information

Standard:	Urea Water Solution	500 ppm N
Standard volume:	100 µl	
Sample volume:	100 µl	
Oxygen Injection Time:	Beer	3 sec
	Wort	8 sec

Note

Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 8 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears.

Wort is rather viscous due to high sugar content. Samples can be analyzed without any pre-treatment (washing the syringe several Times) or diluted.



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- Wort

Wort

Nitrogen determination

BEER - CHEESE - JUICES - MILK PROTEIN - WINE - WORT

Sample	N%	ppm N	RSD%
Beer A		867	0.920
Beer B		595	1.236
Wort A		318	1.008
Wort B		961	1.113
White wine		230	1.207
Red wine		274	1.125
Apple Juice		109	1.554
Orange Juice		150	2.137
Cheese Extract A		50	2.320
Cheese Extract B		120	1.715
Milk Protein Fraction A	0.127		0.543
Milk Protein Fraction B	0.134		0.416
Soluble Protein in Fodder Plant A	0.104		2.060
Soluble Protein in Fodder Plant B		870	1.952

Sample information

Standard:	Urea Water Solution	500 ppm N
Standard volume:	100 µl	
Sample volume:	100 µl	
Oxygen Injection Time:	8 sec	

Note

Each value is the average of 20 runs.
 Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 8 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears.
 Wort is rather viscous due to high sugar content. Samples can be analyzed without any pre-treatment (washing the syringe several Times) or diluted.



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Barley

N/Protein determination

BARLEY - MALT

Sample	N%	Protein%
Malt	1.59	9.94
	1.60	9.99
	1.64	10.23
	1.65	10.28
	1.61	10.03
	1.63	10.19
	1.62	10.10
	1.63	10.16
	1.59	9.96
	1.64	10.24
Barley	1.35	8.44
	1.39	8.70
	1.41	8.82
	1.39	8.71
	1.40	8.73
	1.37	8.56
	1.41	8.79
	1.38	8.64
	1.38	8.66
	1.42	8.87

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	60 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	B	

Note

Samples have been treated in a rotary mill, 1 mm granulometry.



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- Soy
- Soy Sauce
- Soybean
- Wheat

Barley

N/Protein determination

BARLEY - PASTA

Sample	N%	Protein%	RSD%	No. of run
Barley (1° day)	1.44	9.02	0.789	14
Barley (2° day)	1.44	9.00	0.567	10
Pasta	1.95	12.16	0.874	85

Sample information

Standard: Thermo Scientific Pasta Reference Material 1.93 N%

Standard weight: 200 mg

Sample weight: 200 - 300

OxyTune® Category: B

Note

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- Rice
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- Soy Sauce
- Soybean
- Wheat

Barley

N/Protein determination

BARLEY - MAIZE - MALT - SOY - WHEAT

Sample	N%		
Malt	1.77	1.76	1.76
Barley	1.70	1.68	1.68
Maize	1.83	1.83	1.85
Wheat	2.98	2.96	2.95
Soy	8.12	8.14	8.15
Textured soy	7.76	7.76	7.80

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:	30 - 40 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	B	

Note

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- Soy
- Soy Sauce
- Soybean
- Wheat

Barley

N/Protein determination

ANIMAL FEED - BARLEY - COCOA - FLOUR - MILK POWDER - SOY - STARCH - WHEAT

Sample	N%		Protein%	
Cocoa	3.71	3.72	23.21	23.26
Wheat	1.99	2.00	12.43	12.48
Fodder plant	2.53	2.56	15.83	16.00
Soy	5.91	5.88	36.95	36.74
Barley	1.43	1.42	8.93	8.90
Flour	1.24	1.24	7.76	7.76
Animal food	7.87	7.86	49.17	49.15
Milk powder	4.25	4.24	26.57	26.53
Starch	0.043	0.047	0.269	0.296

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:		80 mg
Sample weight:	Cocoa/milk powder	100 - 200 mg
	Other samples	200 - 300 mg
OxyTune® Category:	A	



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- Soy Sauce
- Soybean
- Wheat

Barley

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.



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- Soy Sauce
- Soybean
- Wheat

Barley

Nitrogen determination

BARLEY- FLOWERS - GRASS - MAIZE - OIL PALM - WHEAT

Sample	N%
Rose (plant) 4	1.283
Sprouts 2	1.884
Rose (plant) 5	1.349
Oil palm (leaf) 1	2.571
Wheat (straw)	0.448
Oil palm (leaf) 2	2.655
Maize (plant) 1	1.843
Grass	2.482
Gladiolus (bulb)	1.074
Maize (plant) 2	1.516
Acacia (leaf)	4.227
Grass (mixture)	3.348
Wheat (grain) 1	1.288
Strawberry (plant)	1.814
Barley (grain) 1	1.833

Sample information

Standard: Tomato Leaves
Reference Material (NIST SRM. 1573) 3.03 N%

Standard weight: 80 mg
Sample weight: 200 mg
OxyTune® Category: A

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Barley

Nitrogen determination

BARLEY - GRASS - MAIZE - OATS - OIL PALM - SAW DUST - WHEAT

Sample	N%
Oil palm (leaf) 3	2.705
Oats (straw)	0.736
Wheat (grain) 2	1.932
Farine de Lucerne (animal food)	2.554
Summer barley (grain)	1.964
Spinach	4.582
Yam	1.694
Grass (GR 94) 2	2.864
Rose (Plant) 6	1.295
Barley (grain) 2	1.719
Oil palm (leaf) 4	2.566
Maize (plant) 3	1.268
Barley (straw)	0.433
Saw-dust (forest trees)	0.508
Maize	1.821

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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- Soy
- Soy Sauce
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- Wheat

Beans

N/Protein determination

BEANS - LENTILS - MAIZE - SOY - WHEAT

Sample	N%	Protein%	RSD%	No. of run
Soy	7.90	49.40	0.61	22
Maize	1.38	8.65	1.35	10
Wheat HRS	3.00	18.73	0.40	3
Wheat CPS-W	2.25	14.07	0.44	3
Wheat SWS	2.29	14.29	0.49	3
Lentils	3.99	24.93	0.43	10
Green beans	3.90	24.40	0.53	3
Red beans	4.46	27.89	0.45	5

Sample information

Standard: Aspartic acid 10.52 N%
 Standard weight: 100 mg
 Sample weight: 200 - 300 mg
 OxyTune® Category: B

Note

Samples have been treated in a rotary mill, 1 mm granulometry.



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- Soybean
- Wheat

Beans

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
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- Wheat

Beans

N/Protein determination

BEANS - EGGPLANT - FLOWERS - FRUIT - GRASS - PLANTS - WHEAT

Sample	N%
Carrots (root)	1.019
Sprouts	3.409
Broad beans (bark)	2.466
Mango tree (leaves)	1.311
Summer wheat	2.123
Parsley	3.956
Chervil	4.368
Clover (honey-stalk)	1.277
Chives	3.739
Rose (plant) A	1.913
Rose (plant) B	1.700
Rose (plant) C	1.494
Aubergine (plant)	1.556
Grass (GR 94)	2.864
Medlar (fruit)	0.465

Sample information

Standard: Tomato Leaves
Reference Material (NIST SRM. 1573) 3.03 N%

Standard weight: 80 mg
Sample weight: 100 - 200 mg
OxyTune® Category: A

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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Beans

Nitrogen determination

BEANS - OIL SEED - PLANTS

Sample	N%		
Beans	5.24	5.27	5.28
Oil seed rape	3.74	3.72	3.71
Kale leaf	2.37	2.37	2.38

Sample information

Standard: Acetanilide 10.36 N%

Standard weight: 30 - 40 mg

Sample weight: 100 - 200 mg

OxyTune® Category: A

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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- Soy
- Soy Sauce
- Soybean
- Wheat

Bran

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.



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- Soybean
- Wheat

Canola Seeds

N/Protein determination

CANOLA SEEDS

Sample	N%	Protein%
1	3.2485 - 3.2448	20.3030 - 20.2803
2	3.9364 - 3.9315	24.6022 - 24.5718
3	4.3126 - 4.3292	26.9539 - 27.0575
4	4.1918 - 4.2080	26.1985 - 26.2998
5	4.2126 - 4.2301	26.3290 - 26.4384
6	3.7552 - 3.7634	23.4699 - 23.5214
7	4.4078 - 4.3983	27.5488 - 27.4895
8	3.8674 - 3.8569	24.1716 - 24.1059
9	3.2459 - 3.2592	20.2869 - 20.3699
10	3.6889 - 3.6971	23.0554 - 23.1069

Sample information

Standard:

Standard weight:

Sample weight:

OxyTune® Category:

Aspartic acid

50 - 100 mg

100 mg

A

10.52 N%



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- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Corn and Oat

N/Protein determination

CORN - LENTILS - PEAS - SOYBEAN

Sample	N%	Protein%	RSD%	No. of run
Soybean	6.27	39.20	0.18	3
Lentils A	3.99	24.93	0.43	10
Corn	1.41	8.81	1.42	3
Peas A	3.91	24.42	0.88	6
Lentils B	4.35	27.17	0.06	3
HRS A	3.14	19.61	1.02	3
HRS B	3.00	18.73	0.38	3
HRS C	2.31	14.44	1.14	3
CPS W	2.25	14.07	0.44	3
SWS	2.29	14.29	0.44	3
Peas B	4.46	27.89	0.40	5

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 90 mg

Sample weight: 200 - 300 mg

OxyTune® Category: A

Note

Samples have been treated in a rotary mill (1 mm granulometry).



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- Canola Seeds
- Corn and Oati
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Corn and Oati

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B ca.t, A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oati
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Corn and Oati

N/Protein determination

CORN AND OATS

Sample	N%	RSD%	Protein%	RSD%
Corn	1.340	0.397	8.380	0.437
	1.330		8.311	
	1.332		8.325	
Oats	0.760	0.201	4.760	0.068
	0.763		4.766	
	0.762		4.761	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 70 mg
Sample weight: 130 - 140 mg Corn
250 - 300 mg Oats

Note

Select Category A (OxyTune®) for corn, Category B (OxyTune®) for oats.
The 6.25 factor was used to calculate the Protein content.

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- Soy
- Soy Sauce
- Soybean
- Wheat

Corn and Oati

Nitrogen determination

BARLEY - GRASS - MAIZE - OATS - OIL PALM - SAW DUST - WHEAT

Sample	N%
Oil palm (leaf) 3	2.705
Oats (straw)	0.736
Wheat (grain) 2	1.932
Farine de Lucerne (animal food)	2.554
Summer barley (grain)	1.964
Spinach	4.582
Yam	1.694
Grass (GR 94) 2	2.864
Rose (Plant) 6	1.295
Barley (grain) 2	1.719
Oil palm (leaf) 4	2.566
Maize (plant) 3	1.268
Barley (straw)	0.433
Saw-dust (forest trees)	0.508
Maize	1.821

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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- Soy Sauce
- Soybean
- Wheat

Lentils

N/Protein determination

CORN - LENTILS - PEAS - SOYBEAN

Sample	N%	Protein%	RSD%	No. of run
Soybean	6.27	39.20	0.18	3
Lentils A	3.99	24.93	0.43	10
Corn	1.41	8.81	1.42	3
Peas A	3.91	24.42	0.88	6
Lentils B	4.35	27.17	0.06	3
HRS A	3.14	19.61	1.02	3
HRS B	3.00	18.73	0.38	3
HRS C	2.31	14.44	1.14	3
CPS W	2.25	14.07	0.44	3
SWS	2.29	14.29	0.44	3
Peas B	4.46	27.89	0.40	5

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 90 mg

Sample weight: 200 - 300 mg

OxyTune® Category: A

Note

Samples have been treated in a rotary mill (1 mm granulometry).



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- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Lentils

N/Protein determination

BEANS - LENTILS - MAIZE - SOY - WHEAT

Sample	N%	Protein%	RSD%	No. of run
Soy	7.90	49.40	0.61	22
Maize	1.38	8.65	1.35	10
Wheat HRS	3.00	18.73	0.40	3
Wheat CPS-W	2.25	14.07	0.44	3
Wheat SWS	2.29	14.29	0.49	3
Lentils	3.99	24.93	0.43	10
Green beans	3.90	24.40	0.53	3
Red beans	4.46	27.89	0.45	5

Sample information

Standard: Aspartic acid 10.52 N%
 Standard weight: 100 mg
 Sample weight: 200 - 300 mg
 OxyTune® Category: B

Note

Samples have been treated in a rotary mill, 1 mm granulometry.



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- Soybean
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Lentils

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.



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- Soy
- Soy Sauce
- Soybean
- Wheat

Maize

N/Protein determination

BARLEY - MAIZE - MALT - SOY - WHEAT

Sample	N%		
Malt	1.77	1.76	1.76
Barley	1.70	1.68	1.68
Maize	1.83	1.83	1.85
Wheat	2.98	2.96	2.95
Soy	8.12	8.14	8.15
Textured Soy	7.76	7.76	7.80

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:	30 - 40 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	B	

Note

Samples have been treated in a rotary mill, 1 mm granulometry.



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- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Maize

N/Protein determination

BEANS - LENTILS - MAIZE - SOY - WHEAT

Sample	N%	Protein%	RSD%	No. of run
Soy	7.90	49.40	0.61	22
Maize	1.38	8.65	1.35	10
Wheat HRS	3.00	18.73	0.40	3
Wheat CPS-W	2.25	14.07	0.44	3
Wheat SWS	2.29	14.29	0.49	3
Lentils	3.99	24.93	0.43	10
Green beans	3.90	24.40	0.53	3
Red beans	4.46	27.89	0.45	5

Sample information

Standard: Aspartic acid 10.52 N%
 Standard weight: 100 mg
 Sample weight: 200 - 300 mg
 OxyTune® Category: B

Note

Samples have been treated in a rotary mill, 1 mm granulometry.



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
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- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Maize

Nitrogen determination

BARLEY- FLOWERS - GRASS - MAIZE - OIL PALM - WHEAT

Sample	N%
Rose (plant) 4	1.283
Sprouts 2	1.884
Rose (plant) 5	1.349
Oil palm (leaf) 1	2.571
Wheat (straw)	0.448
Oil palm (leaf) 2	2.655
Maize (plant) 1	1.843
Grass	2.482
Gladiolus (bulb)	1.074
Maize (plant) 2	1.516
Acacia (leaf)	4.227
Grass (mixture)	3.348
Wheat (grain) 1	1.288
Strawberry (plant)	1.814
Barley (grain) 1	1.833

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	200 mg	
OxyTune® Category:	A	

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Maize

Nitrogen determination

BARLEY - GRASS - MAIZE - OATS - OIL PALM - SAW DUST - WHEAT

Sample	N%
Oil palm (leaf) 3	2.705
Oats (straw)	0.736
Wheat (grain) 2	1.932
Farine de Lucerne (animal food)	2.554
Summer barley (grain)	1.964
Spinach	4.582
Yam	1.694
Grass (GR 94) 2	2.864
Rose (Plant) 6	1.295
Barley (grain) 2	1.719
Oil palm (leaf) 4	2.566
Maize (plant) 3	1.268
Barley (straw)	0.433
Saw-dust (forest trees)	0.508
Maize	1.821

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



Analytical - Nitrogen/Protein

Crops

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- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Malt

N/Protein determination

BARLEY - MALT

Sample	N%	Protein%
Malt	1.59	9.94
	1.60	9.99
	1.64	10.23
	1.65	10.28
	1.61	10.03
	1.63	10.19
	1.62	10.10
	1.63	10.16
	1.59	9.96
	1.64	10.24
Barley	1.35	8.44
	1.39	8.70
	1.41	8.82
	1.39	8.71
	1.40	8.73
	1.37	8.56
	1.41	8.79
	1.38	8.64
	1.38	8.66
	1.42	8.87

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	60 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	B	

Note

Samples have been treated in a rotary mill, 1 mm granulometry.



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- Soy
- Soy Sauce
- Soybean
- Wheat

Malt

N/Protein determination

BARLEY - MALT

Sample	Protein%	RSD%
A	10.46	1.17
B	10.76	0.74
C	9.53	1.09
D	10.65	0.96
E	11.06	2.28
F	9.33	0.47
G	10.08	1.41
H	10.60	0.91

Sample information

Standard:

Malt Reference Material

8.47 %Protein

Standard weight:

200 - 300 mg

Sample weight:

200 - 300 mg

OxyTune® Category:

B

Note

Each value is the average of 10 runs.



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- Soy
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- Soybean
- Wheat

Malt

N/Protein determination

BARLEY - MAIZE - MALT - SOY - WHEAT

Sample	N%		
Malt	1.77	1.76	1.76
Barley	1.70	1.68	1.68
Maize	1.83	1.83	1.85
Wheat	2.98	2.96	2.95
Soy	8.12	8.14	8.15
Textured Soy	7.76	7.76	7.80

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:	30 - 40 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	B	

Note

Samples have been treated in a rotary mill, 1 mm granulometry.



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Malt

N/Protein determination

MALT

Sample	N%	RSD%	Protein %	RSD%
1	1.70	0.59	10.61	0.46
	1.71		10.68	
	1.69		10.59	
	1.69		10.57	
	1.71		10.67	
2	1.56	0.74	9.73	0.64
	1.55		9.69	
	1.55		9.70	
	1.53		9.57	
	1.54		9.65	
3	1.74	0.51	10.89	0.47
	1.75		10.91	
	1.75		10.94	
	1.73		10.82	
	1.75		10.95	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 - 100 mg

Sample weight: 250 - 300 mg

Note

Select Category B (OxyTune®) for sample analysis.
The protein factor used to calculate the protein content was 6.25.



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- Soybean
- Wheat

Peas

N/Protein determination

CORN - LENTILS - PEAS - SOYBEAN

Sample	N%	Protein%	RSD%	No. of run
Soybean	6.27	39.20	0.18	3
Lentils A	3.99	24.93	0.43	10
Corn	1.41	8.81	1.42	3
Peas A	3.91	24.42	0.88	6
Lentils B	4.35	27.17	0.06	3
HRS A	3.14	19.61	1.02	3
HRS B	3.00	18.73	0.38	3
HRS C	2.31	14.44	1.14	3
CPS W	2.25	14.07	0.44	3
SWS	2.29	14.29	0.44	3
Peas B	4.46	27.89	0.40	5

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 90 mg

Sample weight: 200 - 300 mg

OxyTune® Category: A

Note

Samples have been treated in a rotary mill (1 mm granulometry).



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Peas

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.



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- Soybean
- Wheat

Rice

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.



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- Soy
- Soy Sauce
- Soybean
- Wheat

Soy

N/Protein determination

BARLEY - MAIZE - MALT - SOY - WHEAT

Sample	N%		
Malt	1.77	1.76	1.76
Barley	1.70	1.68	1.68
Maize	1.83	1.83	1.85
Wheat	2.98	2.96	2.95
Soy	8.12	8.14	8.15
Textured Soy	7.76	7.76	7.80

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:	30 - 40 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	B	

Note

Samples have been treated in a rotary mill, 1 mm granulometry.



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- Soy Sauce
- Soybean
- Wheat

Soy

N/Protein determination

CORN - LENTILS - PEAS - SOYBEAN

Sample	N%	Protein%	RSD%	No. of run
Soybean	6.27	39.20	0.18	3
Lentils A	3.99	24.93	0.43	10
Corn	1.41	8.81	1.42	3
Peas A	3.91	24.42	0.88	6
Lentils B	4.35	27.17	0.06	3
HRS A	3.14	19.61	1.02	3
HRS B	3.00	18.73	0.38	3
HRS C	2.31	14.44	1.14	3
CPS W	2.25	14.07	0.44	3
SWS	2.29	14.29	0.44	3
Peas B	4.46	27.89	0.40	5

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 90 mg

Sample weight: 200 - 300 mg

OxyTune® Category: A

Note

Samples have been treated in a rotary mill (1 mm granulometry).



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- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Soy

N/Protein determination

ANIMAL FEED - BARLEY - COCOA - FLOUR - MILK POWDER - SOY - STARCH - WHEAT

Sample	N%		Protein%	
Cocoa	3.71	3.72	23.21	23.26
Wheat	1.99	2.00	12.43	12.48
Fodder plant	2.53	2.56	15.83	16.00
Soy	5.91	5.88	36.95	36.74
Barley	1.43	1.42	8.93	8.90
Flour	1.24	1.24	7.76	7.76
Animal food	7.87	7.86	49.17	49.15
Milk powder	4.25	4.24	26.57	26.53
Starch	0.043	0.047	0.269	0.296

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	80 mg	
Sample weight:	Cocoa/milk powder	100 - 200 mg
	Other samples	200 - 300 mg
OxyTune® Category:	A	



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- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Soy

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Soy

N/Protein determination

SOY

Sample	N%					Protein%				
Soy 50%	7.05	7.06	7.00	6.98	7.04	44.07	48.11	43.74	43.66	44.00
Soy 55%	7.86	7.81	7.83	7.78	7.84	49.14	48.80	48.93	48.64	48.99
Soy CR	5.51	5.61	5.58			34.47	35.07	34.86		
Soy M	5.92	5.85	5.88			36.98	36.57	36.76		

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 200 mg

Sample weight: 200 - 300 mg

OxyTune® Category: B

Note

These samples of soy have been treated in a rotary mill, 1 mm granulometry.

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- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Soy Sauce

N/Protein determination

SOY SAUCE

Sample	N%	Protein%	RSD%
1	0.6135	3.8346	
	0.6134	3.8339	0.384
	0.6176	3.8598	
2	0.8181	5.1132	
	0.8207	5.1293	
	0.8186	5.1161	0.144
	0.8190	5.1188	
	0.8206	5.1287	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 - 100 mg

Sample weight: 100 - 200 mg

OxyTune® Category: B

Note

Sample was absorbed on about 30 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 375530).



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- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Soybean

N/Protein determination

CORN - LENTILS - PEAS - SOYBEAN

Sample	N%	Protein%	RSD%	No. of run
Soybean	6.27	39.20	0.18	3
Lentils A	3.99	24.93	0.43	10
Corn	1.41	8.81	1.42	3
Peas A	3.91	24.42	0.88	6
Lentils B	4.35	27.17	0.06	3
HRS A	3.14	19.61	1.02	3
HRS B	3.00	18.73	0.38	3
HRS C	2.31	14.44	1.14	3
CPS W	2.25	14.07	0.44	3
SWS	2.29	14.29	0.44	3
Peas B	4.46	27.89	0.40	5

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 90 mg

Sample weight: 200 - 300 mg

OxyTune® Category: A

Note

Samples have been treated in a rotary mill (1 mm granulometry).



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- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Wheat

N/Protein determination

BARLEY - MAIZE - MALT - SOY - WHEAT

Sample	N%		
Malt	1.77	1.76	1.76
Barley	1.70	1.68	1.68
Maize	1.83	1.83	1.85
Wheat	2.98	2.96	2.95
Soy	8.12	8.14	8.15
Textured Soy	7.76	7.76	7.80

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:	30 - 40 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	B	

Note

Samples have been treated in a rotary mill, 1 mm granulometry.



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Wheat

N/Protein determination

CORN - LENTILS - PEAS - SOYBEAN

Sample	N%	Protein%	RSD%	No. of run
Soybean	6.27	39.20	0.18	3
Lentils A	3.99	24.93	0.43	10
Corn	1.41	8.81	1.42	3
Peas A	3.91	24.42	0.88	6
Lentils B	4.35	27.17	0.06	3
HRS A	3.14	19.61	1.02	3
HRS B	3.00	18.73	0.38	3
HRS C	2.31	14.44	1.14	3
CPS W	2.25	14.07	0.44	3
SWS	2.29	14.29	0.44	3
Peas B	4.46	27.89	0.40	5

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 90 mg
Sample weight: 200 - 300 mg
OxyTune® Category: A

Note

Samples have been treated in a rotary mill (1 mm granulometry).

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- Soybean
- Wheat

Wheat

N/Protein determination

ANIMAL FEED - BARLEY - COCOA - FLOUR - MILK POWDER - SOY - STARCH - WHEAT

Sample	N%		Protein%	
Cocoa	3.71	3.72	23.21	23.26
Wheat	1.99	2.00	12.43	12.48
Fodder plant	2.53	2.56	15.83	16.00
Soy	5.91	5.88	36.95	36.74
Barley	1.43	1.42	8.93	8.90
Flour	1.24	1.24	7.76	7.76
Animal food	7.87	7.86	49.17	49.15
Milk powder	4.25	4.24	26.57	26.53
Starch	0.043	0.047	0.269	0.296

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	80 mg	
Sample weight:	Cocoa/milk powder	100 - 200 mg
	Other samples	200 - 300 mg
OxyTune® Category:	A	



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- Soy
- Soy Sauce
- Soybean
- Wheat

Wheat

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Wheat

N/Protein determination

BEANS - EGGPLANT - FLOWERS - FRUIT - GRASS - PLANTS - WHEAT

Sample	N%
Carrots (root)	1.019
Sprouts	3.409
Broad beans (bark)	2.466
Mango tree (leaves)	1.311
Summer wheat	2.123
Parsley	3.956
Chervil	4.368
Clover (honey-stalk)	1.277
Chives	3.739
Rose (plant) A	1.913
Rose (plant) B	1.700
Rose (plant) C	1.494
Aubergine (plant)	1.556
Grass (GR 94)	2.864
Medlar (fruit)	0.465

Sample information

Standard: Tomato Leaves
Reference Material (NIST SRM. 1573) 3.03 N%

Standard weight: 80 mg
Sample weight: 100 - 200 mg
OxyTune® Category: A

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Wheat

Nitrogen determination

BARLEY- FLOWERS - GRASS - MAIZE - OIL PALM - WHEAT

Sample	N%
Rose (plant) 4	1.283
Sprouts 2	1.884
Rose (plant) 5	1.349
Oil palm (leaf) 1	2.571
Wheat (straw)	0.448
Oil palm (leaf) 2	2.655
Maize (plant) 1	1.843
Grass	2.482
Gladiolus (bulb)	1.074
Maize (plant) 2	1.516
Acacia (leaf)	4.227
Grass (mixture)	3.348
Wheat (grain) 1	1.288
Strawberry (plant)	1.814
Barley (grain) 1	1.833

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	200 mg	
OxyTune® Category:	A	

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



Analytical - Nitrogen/Protein

Crops

- Barley
- Beans
- Bran
- Canola Seeds
- Corn and Oat
- Lentils
- Maize
- Malt
- Peas
- Rice
- Soy
- Soy Sauce
- Soybean
- Wheat

Wheat

Nitrogen determination

BARLEY - GRASS - MAIZE - OATS - OIL PALM - SAW DUST - WHEAT

Sample	N%
Oil palm (leaf) 3	2.705
Oats (straw)	0.736
Wheat (grain) 2	1.932
Farine de Lucerne (animal food)	2.554
Summer barley (grain)	1.964
Spinach	4.582
Yam	1.694
Grass (GR 94) 2	2.864
Rose (Plant) 6	1.295
Barley (grain) 2	1.719
Oil palm (leaf) 4	2.566
Maize (plant) 3	1.268
Barley (straw)	0.433
Saw-dust (forest trees)	0.508
Maize	1.821

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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Environmental

- Nitrogen Containing Water Solution

Nitrogen Containing Water Solution

Nitrogen determination

NITROGEN CONTAINING WATER SOLUTIONS

Sample	ppm N	RSD%
1	732	0.79
	742	
	732	
2	71	2.11
	74	
	72	
3	390	1.05
	383	
	383	
4	97	1.03
	96	
	98	
5	20	2.99
	19	
	19	

Sample information for sample 1 and 2

Standard: Urea water solutions 60 and 800 ppm N
 Standard weight: 180 - 200 mg
 Sample weight: 180 - 240 mg

Sample information for sample 3, 4 and 5

Standard: Urea water solutions 20, 100 and 400 ppm N
 Standard volume: 125 ul
 Sample volume: 125 ul

Note

Sample 1 and 2 were analyzed by weighing in tin container adsorbed on Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) inert material while sample 3 to 5 were analyzed by direct injection through the AS 1310 Liquid Autosampler. Set Oxygen Flow at 300 ml/min and Oxygen Injection Time at 8 seconds. The Sample Delay was 10 seconds using the MAS Plus Autosampler and 8 seconds by AS 1310 Liquid Autosampler.



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- Solid Inorganic Fertilizers

Liquid Inorganic Fertilizers

Nitrogen determination

LIQUID INORGANIC FERTILIZERS

N%	RSD%
10.13	
10.24	0.7217
10.27	

Sample information

Standard:	Urea	46.65 N%
Standard weight:	70 - 80 mg	
Sample weight:	250 - 270 mg	

Note

Set fixed 10 seconds in @ (Thermo Scientific OxyTune® function).
The liquid sample was adsorbed on about 40 - 50 mg Chromosorb WAW (30 - 60 mesh) (p/n 338 37530).



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- Solid Inorganic Fertilizers

Solid inorganic Fertilizers

Nitrogen determination

SOLID INORGANIC FERTILIZERS

Sample	N%	RSD%
1	18.18	0.3651
	18.22	
	18.31	
2	21.32	0.5897
	21.08	
	21.14	

Sample information

Standard:	Urea	46.65 N%
Standard weight:	250 mg	
Sample weight:	250 - 270 mg	

Note

Set fixed 10 seconds in @ (Thermo Scientific OxyTune® function).



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
- Mushroom Soup
- Pasta Topping
- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Bouillon Powder

N/Protein determination

BOUILLON POWDER - CHEESE - WURSTEL

Sample	N%	Protein%	RSD%	No. of run
Wurstel	2.424	15.150	0.834	10
Bouillon powder	5.739	35.811	0.325	4
Emmenthal cheese	3.378	21.076	0.886	10
Tigre soft cheese	3.363	20.986	0.994	5

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 90 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
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- Chocolate and Cocoa
- Dietary Fiber (Celite)
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Bouillon Powder

Nitrogen determination

FOOD INGREDIENTS - BOUILLON POWDER

Sample	N%				
Extruded wheat gluten	10.943	10.949	10.827		
Processed wheat gluten	4.537	4.632	4.535		
Tastemaker for instant noodles (curry)	2.231	2.262	2.226		
Tastemaker for instant noodles	1.701	1.768	1.749		
Bacon powder	1.868	1.874	1.869		
Bouillon powder	2.939	2.925	2.936	2.933	2.939

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 80 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
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- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Candy

N/Protein determination

CANDY

Sample	N%				Protein%			
Pink & White	0.473	0.475	0.466		2.957	2.968	2.909	
Twisters	0.509	0.520	0.520		3.180	3.249	3.252	
Superchoo	0.0567	0.0523	0.0538	0.0570	0.354	0.327	0.336	0.356
Fizzer	0.0643	0.0668	0.0687	0.0666	0.402	0.418	0.429	0.416

Sample information

Standard: Atropina 4.84 N%
Standard weight: 50 mg
N/Protein factor: 6.25
Sample weight: 200 - 300 mg
OxyTune® Category: B

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- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Candy

N/Protein determination

PEANUT BUTTER

Sample 1			Sample 2		
N%	Protein%	RSD%	N%	Protein%	RSD%
4.4051	27.5317		4.8077	30.0483	
4.3869	27.4178		4.8140	30.0876	
4.3949	27.4679		4.8103	30.0645	
4.3970	27.4814		4.7809	30.8808	
4.3549	27.2180		4.8959	30.5991	
4.3744	27.3400		4.8341	30.2129	
4.3536	27.2099		4.8515	30.3215	
4.3869	27.4179	0.4709	4.8554	30.3460	0.6236
4.4070	27.5436		4.8443	30.2770	
4.3568	27.2301		4.8293	30.1829	
			4.8254	30.1587	
			4.8318	30.1985	
			4.8643	30.4016	
			4.7810	30.8815	
			4.8184	30.1152	
			4.8565	30.3534	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 70 mg	
Sample weight:	50 - 80 mg	
OxyTune® Category:	E (delta 3)	

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
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- Milk Products
- Molasses
- Mushroom Soup
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- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Candy

N/Protein determination

COCOA - MILK - SWEETS

Sample	N%			Protein%		
Cocoa	4.54	4.58	4.58	28.37	28.59	28.62
Ice Cream	0.41	0.40	0.40	2.62	2.58	2.55
Hazelnut	2.75	2.70	2.70	17.21	16.90	16.90
Milk	5.78	5.82	5.81	36.88	37.11	37.07

Sample information

Standard:

Standard weight:

Sample weight:

OxyTune® Category:

EDTA (Ethylenediaminetetraacetic acid)

100 mg

Cocoa / hazelnuts

Ice cream / milk

Cocoa / hazelnuts

Ice cream / milk

9.59 N%

100 - 200 mg

200 - 300 mg

A

C

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
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- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Candy

N/Protein determination

COCOA - SWEETS

Sample	N%			Protein%		
Snack	1.259	1.255	1.266	7.870	7.842	7.909
Vanilla Ice Cream	0.476	0.476	0.478	2.972	2.972	2.984
Cocoa Ice Cream	0.531	0.533	0.536	3.320	3.333	3.350
Cocoa Cream	0.907	0.906	0.908	5.668	5.659	5.673

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:		100 mg
Sample weight:	Snack	200 - 300 mg
	Ice cream	200 - 300 mg
	Cocoa cream	100 - 150 mg
OxyTune® Category:	Snack	B
	Ice cream	C
	Cocoa cream	A

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
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- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Candy

N/Protein determination

SWEETS

Sample	N%	Protein%
Mars	0.696	4.351
	0.718	4.487
	0.705	4.408
	0.727	4.541
	0.692	4.324
	0.703	4.395
	0.706	4.410
	0.719	4.493
	0.713	4.459
	0.707	4.420

Sample information

Standard: Atropine 4.84 N%
Standard weight: 50 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
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- Tahine (Sesame seed)
- Whey Protein

Candy

N/Protein determination

TURRON NOUGAT

N%	RSD%	Protein%	RSD%
2.90		18.10	
2.90		18.09	
2.89	0.1891	18.04	0.1377
2.90		18.10	
2.89		18.08	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 70 mg
Sample weight: 200 - 250 mg

Note

Select a new Category (Thermo Scientific OxyTune®) with a delta 2 for sample analysis.
The 6.25 factor was used to calculate the Protein content.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
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- Tahine (Sesame seed)
- Whey Protein

Cereal Flakes

N/Protein determination

CEREAL FLAKES

Sample	N%	RSD%	Protein %	RSD%
Honey cereals	1.25	0	7.80	0.20
	1.25		7.83	
	1.25		7.82	
Corn cereals	0.83	0.17	5.22	0.20
	0.83		5.21	
	0.82		5.16	
Chocolate cereals	1.32	0.76	8.23	0.58
	1.31		8.21	
	1.30		8.14	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 70 mg
Sample weight: 200 - 230 mg

Note

Select Category B (OxyTune®) for sample analysis.
The protein factor used to calculate the protein content was 6.25.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
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- Whey Protein

Cereal Flakes

N/Protein determination

CEREAL FLAKES

Sample	N%	RSD%	Protein %	RSD%
Honey cereals	1.27	0.79	7.97	1.11
	1.26		7.85	
	1.25		7.80	
Corn cereals	0.83	0.69	5.18	0.67
	0.84		5.22	
	0.84		5.25	
Chocolate cereals	1.31	1.33	8.20	1.50
	1.28		7.98	
	1.31		8.18	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 60 - 70 mg
Sample weight: 130 - 140 mg honey and chocolate cereals,
145 - 150 mg corn cereals

Note

Select Category B (OxyTune®) for sample analysis.
Protein factor used to calculate the protein content was 6.25.

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- Whey Protein

Cheese

Nitrogen determination

BEER - CHEESE - JUICES - MILK PROTEIN - WINE - WORT

Sample	N%	ppm N	RSD%
Beer A		867	0.920
Beer B		595	1.236
Wort A		318	1.008
Wort B		961	1.113
White wine		230	1.207
Red wine		274	1.125
Apple Juice		109	1.554
Orange Juice		150	2.137
Cheese Extract A		50	2.320
Cheese Extract B		120	1.715
Milk Protein Fraction A	0.127		0.543
Milk Protein Fraction B	0.134		0.416
Soluble Protein in Fodder Plant A	0.104		2.060
Soluble Protein in Fodder Plant B		870	1.952

Sample information

Standard:	Urea Water Solution	500 ppm N
Standard volume:	100 µl	
Sample volume:	100 µl	
Oxygen Injection Time:	8 sec	

Note

Each value is the average of 20 runs.
 Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 8 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis.
 Degassing can be done by shaking and waiting until foam disappears.
 Wort is rather viscous due to high sugar content.
 Samples can be analyzed without any pre-treatment (washing the syringe several Times) or diluted.



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
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Cheese

N/Protein determination

CHEESE

Sample	N%	Protein%
Caprine	2.283	14.564
	2.298	14.662
Mascarpone	0.642	4.099
	0.629	4.013
Seasoned Provolone	4.335	27.657
	4.394	28.031
	4.364	27.843
	4.293	27.391
	4.350	27.756
	4.366	27.852
	4.358	27.806
	4.382	27.960
	4.324	27.589
Parmesan	4.359	27.811
	5.190	33.115
	5.164	32.944
	5.172	32.999
	5.181	33.054
	5.261	33.567
	5.267	33.604
	5.229	33.360
	5.260	33.558
	5.170	32.984
	5.230	33.370

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B

Note

The samples are typical Italian cheese. *Caprino* is goats milk cheese.

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Cheese

N/Protein determination

CHEESE

Sample	N%	Protein%
A	3.31	20.69
	3.23	20.21
	3.24	20.25
B	4.29	26.84
	4.24	26.48
	4.31	26.91
C	2.14	13.36
	2.17	13.54
	2.11	13.20
D	2.64	16.48
	2.64	16.51
	2.60	16.28
E	2.56	16.48
	2.57	16.06
	2.55	16.28
F	2.51	15.67
	2.49	15.55
	2.49	15.54
	2.52	15.76
	2.48	15.51
	2.50	15.65
	2.51	15.68
	2.53	15.83

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 100 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
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- Whey Protein

Cheese

Nitrogen determination

CHEESE

Sample	N%		
Solution Protein Cheese A	0.0144	0.0152	0.0151
Solution Protein Cheese B	0.0134	0.0137	0.0133
Solution Protein Cheese C	0.1498	0.1506	0.1502
Solution Whey Protein	0.1600	0.1599	0.1589
Control Solution Whey Protein A	0.1400	0.1426	0.1422
Control Solution Whey Protein B	0.1484	0.1483	0.1468

Sample information

Standard: Urea Standard Solution 1000 ppm N
Standard volume: 100 µl
Sample volume: 100 µl
OxyTune® Category: C

Note

Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 8 seconds after the start.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
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- Whey Protein

Cheese

N/Protein determination

CHEESE - CHOCOLATE - EGGPLANT - MILK

Sample	N%			Protein%		
Chocolate	1.056	1.050	1.052	6.598	6.564	6.572
Cheese	2.940	2.932	2.912	18.378	18.32	18.197
Milk	0.475	0.475	0.474	2.971	2.969	2.962
Whipped cream	0.378	0.372	0.371	2.365	2.323	2.320
Artichokes (preserved in oil)	0.347	0.355	0.351	2.167	2.218	2.192
Eggplants/peppers (preserved in oil)	0.141	0.139	0.137	0.880	0.871	0.859

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:		100 mg
Sample amount:	Milk	100 µl
	Chocolate	100 - 200 mg
	Others	200 - 300 mg
OxyTune® Category:	Milk	C
	Chocolate	A
	Others	B

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
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- Whey Protein

Cheese

N/Protein determination

CHEESE - CHOCOLATE - MILK - MILK POWDER - YOGURT

Sample	N%	Protein%	RSD%
Milk	0.476	3.036	0.618
Milk powder	2.085	13.304	0.301
Casein	14.239	90.844	0.285
Cream	0.445	2.780	2.169
Yogurt	0.719	4.497	0.706
Baby food A	0.929	5.931	0.994
Baby food B	0.231	1.475	1.798
Spread cheese	1.548	9.676	0.753
Emmenthal cheese	4.772	30.448	1.095
Lindenberger cheese	5.409	34.510	1.019
Philadelphia spread cheese	1.268	8.092	2.193
Chocolate A	0.919	5.865	0.260
Chocolate B	2.044	12.777	0.412

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B cat., A cat. for milk powder and chocolate

Note

Each value is the average of 10 runs.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
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- Whey Protein

Cheese

N/Protein determination

BOUILLON POWDER - CHEESE - WURSTEL

Sample	N%	Protein%	RSD%	No. of run
Wurstel	2.424	15.150	0.834	10
Bouillon powder	5.739	35.811	0.325	4
Emmenthal cheese	3.378	21.076	0.886	10
Tigre soft cheese	3.363	20.986	0.994	5

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 90 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
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- Whey Protein

Cheese

N/Protein determination

CHEESE - MILK - WURSTEL

Sample	N%	Protein%	RSD%	No. of run
Wurstel	2.42	15.15	0.83	10
Milk	0.529	3.380	0.56	10
Emmenthal cheese	3.38	21.08	0.88	10

Sample information

Standard:	Milk	Urea Standard Solution	500 ppm N
	Others	Aspartic acid	10.52 N%
Standard amount:	Milk	100 µl	
Others	Others	100 mg	
Sample weight:		200 - 300 mg	
OxyTune® Category:	Milk	A	
	Others	B	

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
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- Whey Protein

Cheese

N/Protein determination

PARMESAN CHEESE

N%	RSD%	Protein %	RSD%
5.56	0.21	34.74	0.22
5.54		34.60	
5.56		34.76	
5.57		34.80	
5.55		34.68	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 60 - 90 mg
Sample weight: 200 - 250 mg

Note

Select Category B (OxyTune®) for sample analysis.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
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- Whey Protein

Cheese

Nitrogen determination

CHEESE

Sample	Total N		NCN		NPN	
	%	RSD%	%	RSD%	%	RSD%
Crescenza	2.43	0.889	0.407 0.411 0.400	0.347	0.132 0.128 0.136	2.985
	2.47					
	2.42					
	2.43					
	2.46					
Ricotta	1.39	0.826	0.212 0.216 0.212	1.089	0.0799 0.0764 0.0721	5.141
	1.36					
	1.38					
	1.37					
	1.37					
Mascarpone	0.614	2.267	0.138 0.130 0.136	3.039	0.0431 0.0486 0.0486	6.925
	0.635					
	0.627					
	0.611					
	0.600					

Sample information

Standard: Aspartic acid 10.52 N%
Urea water solutions 0.4 and 0.08 N%

Standard weight: 50 - 100 mg Aspartic acid
80 - 125 ul Urea water solutions

Sample weight: 200 - 300 mg cheese
80 - 125 ul NCN and NPN fractions injected directly by AS 1310 liquid autosampler

Note

Select Category B (OxyTune®) for cheese samples.
The NCN and NPN fractions were analyzed by liquid injection.
The 6.38 factor was used to calculate the Protein content.
Crescenza Ricotta e Mascarpone are typical Italian cheeses.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
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- Tahine (Sesame seed)
- Whey Protein

Chocolate and Cocoa

N/Protein determination

CHOCOLATE

Sample	N%	Protein%	RSD%
White chocolate	1.018	6.365	0.190
	1.019	6.370	
	1.016	6.347	
Black chocolate	0.969	6.057	0.114
	0.969	6.057	
	0.971	6.069	
Plain chocolate	1.530	9.540	0.745
	1.512	9.442	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 80 - 100 mg
OxyTune® Category: E (Delta 2)

Note

Protein factor used was 6.25.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
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- Tahine (Sesame seed)
- Whey Protein

Chocolate and Cocoa

N/Protein determination

CHEESE - CHOCOLATE - EGGPLANT - MILK

Sample	N%			Protein%		
Chocolate	1.056	1.050	1.052	6.598	6.564	6.572
Cheese	2.940	2.932	2.912	18.378	18.32	18.197
Milk	0.475	0.475	0.474	2.971	2.969	2.962
Whipped cream	0.378	0.372	0.371	2.365	2.323	2.320
Artichokes (preserved in oil)	0.347	0.355	0.351	2.167	2.218	2.192
Eggplants/peppers (preserved in oil)	0.141	0.139	0.137	0.880	0.871	0.859

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	100 mg	
Sample amount:	Milk	100 µl
	Chocolate	100 - 200 mg
	Others	200 - 300 mg
OxyTune® Category:	Milk	C
	Chocolate	A
	Others	B

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- Whey Protein

Chocolate and Cocoa

N/Protein determination

CHEESE - CHOCOLATE - MILK - MILK POWDER - YOGURT

Sample	N%	Protein%	RSD%
Milk	0.476	3.036	0.618
Milk powder	2.085	13.304	0.301
Casein	14.239	90.844	0.285
Cream	0.445	2.780	2.169
Yogurt	0.719	4.497	0.706
Baby food A	0.929	5.931	0.994
Baby food B	0.231	1.475	1.798
Spread cheese	1.548	9.676	0.753
Emmenthal cheese	4.772	30.448	1.095
Lindenberger cheese	5.409	34.510	1.019
Philadelphia spread cheese	1.268	8.092	2.193
Chocolate A	0.919	5.865	0.260
Chocolate B	2.044	12.777	0.412

Sample information

Standard:
Standard weight:
Sample weight:
OxyTune® Category:

Aspartic acid
50 - 100 mg
200 - 300 mg
B cat., A cat. for milk powder and chocolate

10.52 N%

Note

Each value is the average of 10 runs.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
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- Infant Food
- Meat Products
- Milk Products
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- Pasta
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- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Chocolate and Cocoa

N/Protein determination

ANIMAL FEED - BARLEY - COCOA - FLOUR - MILK POWDER - SOY - STARCH - WHEAT

Sample	N%		Protein%	
Cocoa	3.71	3.72	23.21	23.26
Wheat	1.99	2.00	12.43	12.48
Fodder plant	2.53	2.56	15.83	16.00
Soy	5.91	5.88	36.95	36.74
Barley	1.43	1.42	8.93	8.90
Flour	1.24	1.24	7.76	7.76
Animal food	7.87	7.86	49.17	49.15
Milk powder	4.25	4.24	26.57	26.53
Starch	0.043	0.047	0.269	0.296

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 80 mg
Sample weight: Cocoa/milk powder 100 - 200 mg
Other samples 200 - 300 mg
A
OxyTune® Category:

Analytical - Nitrogen/Protein

Food

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- Whey Protein

Chocolate and Cocoa

N/Protein determination

COCOA - MILK - SWEETS

Sample	N%			Protein%		
Cocoa	4.54	4.58	4.58	28.37	28.59	28.62
Ice Cream	0.41	0.40	0.40	2.62	2.58	2.55
Hazelnut	2.75	2.70	2.70	17.21	16.90	16.90
Milk	5.78	5.82	5.81	36.88	37.11	37.07

Sample information

Standard:	EDTA (Ethylenediaminetetraacetic acid)	9.59 N%
Standard weight:	100 mg	
Sample weight:	Cocoa / hazelnuts	100 - 200 mg
	Ice cream / milk	200 - 300 mg
OxyTune® Category:	Cocoa / hazelnuts	A
	Ice cream / milk	C

Analytical - Nitrogen/Protein

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Chocolate and Cocoa

N/Protein determination

COCOA - MILK - SWEETS

Sample	N%			Protein%		
Snack	1.259	1.255	1.266	7.870	7.842	7.909
Vanilla Ice Cream	0.476	0.476	0.478	2.972	2.972	2.984
Cocoa Ice Cream	0.531	0.533	0.536	3.320	3.333	3.350
Cocoa Cream	0.907	0.906	0.908	5.668	5.659	5.673

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	100 mg	
Sample weight:	Snack	200 - 300 mg
	Ice cream	200 - 300 mg
	Cocoa cream	100 - 150 mg
OxyTune® Category:	Snack	B
	Ice cream	C
	Cocoa cream	A

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Dietary Fiber (Celite)

N/Protein determination

DIETARY FIBER (CELITE)

Sample	N%	RSD%	Protein%	RSD%
1	0.123		0.771	
	0.125	0.9337	0.782	0.8198
	0.123		0.771	
2	0.175		1.094	
	0.174	0.3305	1.089	0.2423
	0.175		1.093	
3	0.358		2.240	
	0.352	0.9786	2.200	1.0061
	0.352		2.203	
4	0.281		1.755	
	0.285	0.9316	1.782	1.0328
	0.286		1.790	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 40 - 50 mg
Sample weight: 100 - 120 mg

Note

For standards and samples use fixed Oxygen Injection Time 15 seconds.
The 6.25 factor was used to calculate the Protein content.



Analytical - Nitrogen/Protein

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Egg Albumin

N/Protein determination

EGG ALBUMIN

Sample	N%	RSD%	Protein%	RSD%
1	13.17		82.34	
	13.18	0.0438	82.35	0.0321
	13.17		82.30	
2	13.09		81.84	
	13.08	0.0441	81.72	0.0764
	13.08		81.75	
3	13.26		82.85	
	13.23	0.1571	82.70	0.1576
	13.27		82.96	

Sample information

Standard: Nicotinamide 22.94 N%
Standard weight: 90 - 100 mg
Sample weight: 150 - 200 mg

Note

Set Category A (Thermo Scientific OxyTune®) for sample analyses.
The 6.25 factor was used to calculate the Protein content.

Analytical - Nitrogen/Protein

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Egg Albumin

N/Protein determination

WHITE EGG

N%	RSD%	Protein %	RSD%
7.36	0.15	46.03	0.14
7.36		46.03	
7.35		45.94	
7.37		46.04	
7.34		45.89	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 90 - 100 mg

Note

Oxygen Injection Time 30 seconds.

Analytical - Nitrogen/Protein

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Eggplants

N/Protein determination

CHEESE - CHOCOLATE - EGGPLANT - MILK

Sample	N%			Protein%		
Chocolate	1.056	1.050	1.052	6.598	6.564	6.572
Cheese	2.940	2.932	2.912	18.378	18.32	18.197
Milk	0.475	0.475	0.474	2.971	2.969	2.962
Whipped cream	0.378	0.372	0.371	2.365	2.323	2.320
Artichokes (preserved in oil)	0.347	0.355	0.351	2.167	2.218	2.192
Eggplants/peppers (preserved in oil)	0.141	0.139	0.137	0.880	0.871	0.859

Sample information

Standard:	Aspartic acid	10.52 N%
Standard volume:	100 mg	
Sample amount:	Milk	100 µl
	Chocolate	100 - 200 mg
	Others	200 - 300 mg
OxyTune® Category:	Milk	C
	Chocolate	A
	Others	B

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Eggplants

N/Protein determination

CURED MEATS - EGGPLANT - PASTA TOPPING

Sample	N%	Protein%
Spinach <i>pesto</i> pasta topping	0.934	5.837
	0.968	6.052
	0.942	5.887
Pesto pasta topping	0.777	4.854
	0.797	4.980
	0.768	4.802
	0.787	4.918
	0.752	4.697
	0.768	4.800
5042 NNP	0.0078	0.0487
	0.0076	0.0473
	0.0077	0.0483
	0.0079	0.0496
	0.0078	0.0487
5042 NNC	0.036	0.226
	0.035	0.217
	0.036	0.228
Eggplants	0.141	0.880
	0.144	0.900
Bacon	3.314	20.710
	3.125	19.534
	3.040	18.999

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	100 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	Pesto	G
	Other samples	B

Comment

Pesto pasta topping is constituted of basil, pine-kernels, cheese and oil.



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Eggplants

N/Protein determination

BEANS - EGGPLANT - FLOWERS - FRUIT - GRASS - PLANTS - WHEAT

Sample	N%
Carrots (root)	1.019
Sprouts	3.409
Broad beans (bark)	2.466
Mango tree (leaves)	1.311
Summer wheat	2.123
Parsley	3.956
Chervil	4.368
Clover (honey-stalk)	1.277
Chives	3.739
Rose (plant) A	1.913
Rose (plant) B	1.700
Rose (plant) C	1.494
Aubergine (plant)	1.556
Grass (GR 94)	2.864
Medlar (fruit)	0.465

Sample information

Standard: Tomato Leaves
Reference Materia (NIST SRM. 1573) 3.03 N%

Standard weight: 80 mg

Sample weight: 100 - 200 mg

OxyTune® Category: A

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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Enzymes mixed With Flour

N/Protein determination

ENZYMES MIXED WITH FLOUR

Sample	N%	RSD%	Protein%	RSD%
1	3.210	0.1244	20.061	0.1299
	3.214		20.086	
	3.218		20.116	
	3.220		20.123	
2	3.218	0.0501	20.115	0.0513
	9.227		57.671	
	9.216		57.598	
	9.218		57.615	
	9.216		57.602	
	9.221		57.631	
3	2.411	0.2545	15.068	0.2556
	2.414		15.086	
	2.421		15.134	
	2.414		15.086	
	2.404		15.027	
4	11.844	0.0567	74.027	0.0561
	11.860		74.126	
	11.845		74.032	
	11.848		74.049	
	11.854		74.085	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 90 - 100 mg
Sample weight: 100 - 120 mg

Note

Set fixed amount of Oxygen of 15 seconds (Thermo Scientific OxyTune®) for all standard and sample analyses.
The 6.25 factor was used to calculate the Protein content.



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Flour

N/Protein determination

FLOUR

Sample	N%	Protein%	RSD%
Flour 1	1.9707	12.3170	0.4320
	1.9812	12.3823	
	1.9643	12.2770	
Flour 2	1.6720	10.4480	0.2889
	1.6640	10.3980	
	1.6630	10.3940	
Oats flour	2.1407	13.3793	0.0478
	2.1391	13.3693	
	2.1410	13.3812	
Rape flour	6.2041	38.7757	0.5782
	6.2691	39.1821	
	6.2638	39.1490	
Sieved rape flour	7.1316	44.5728	0.3240
	7.1029	44.3933	
	7.1486	44.6790	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 200 - 250 mg
OxyTune® Category: B

Note

Samples were analyzed without pre-treatment.
Protein factor used was 6.25.



Analytical - Nitrogen/Protein

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Flour

N/Protein determination

ANIMAL FEED - BARLEY - COCOA - FLOUR - MILK POWDER - SOY - STARCH - WHEAT

Sample	N%		Protein%	
Cocoa	3.71	3.72	23.21	23.26
Wheat	1.99	2.00	12.43	12.48
Fodder plant	2.53	2.56	15.83	16.00
Soy	5.91	5.88	36.95	36.74
Barley	1.43	1.42	8.93	8.90
Flour	1.24	1.24	7.76	7.76
Animal food	7.87	7.86	49.17	49.15
Milk powder	4.25	4.24	26.57	26.53
Starch	0.043	0.047	0.269	0.296

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 80 mg
Sample weight: Cocoa/milk powder 100 - 200 mg
Other samples 200 - 300 mg
A
OxyTune® Category:

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Flour

N/Protein determination

FLOUR

N%	RSD%	Protein%	RSD%
2.089	0.159	13.058	0.153
2.091		13.070	
2.089		13.056	
2.096		13.100	
2.095		13.092	
2.099		13.118	
2.090		13.066	
2.092		13.073	
2.095		13.093	
2.092		13.07	

Sample information

Standard:
Standard weight:
Sample weight:

Aspartic acid
50 - 70 mg
200 - 250 mg

10.52 N%

Note

Select the Category B (Thermo Scientific OxyTune®).
The 6.25 factor was used to calculate the Protein content.

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Food

N/Protein determination

FOOD (1/2)

Sample	N%	RSD%	Protein %	RSD%
Vegetable burger	0.656	0.153	4.100	0.160
	0.655		4.092	
	0.654		4.087	
Blend green coffe	2.399	0.168	14.991	0.188
	2.407		15.047	
	2.402		15.013	
Soy cutlet	2.487	0.198	15.546	0.200
	2.495		15.596	
	2.486		15.539	
Concentrated chicken	6.451	0.545	40.319	0.560
	6.480		40.500	
	6.410		40.062	
Cheese	4.953	0.185	30.956	0.189
	4.959		30.995	
	4.971		31.071	
Soy protein shake	12.200	0.19	76.250	0.21
	12.162		75.972	
	12.161		75.971	
Diet crunch	1.798	0.582	11.237	0.574
	1.819		11.366	
	1.810		11.313	
Body fit crunch	7.696	0.091	48.101	0.089
	7.702		48.138	
	7.688		48.053	
Nuts mix	4.179	0.229	26.117	0.233
	4.186		26.164	
	1.198		26.238	
Tomato soup dried	1.616	0.564	10.101	0.559
	1.628		10.173	
	1.634		10.213	
Indian chilli sauce	0.056	1.786	0.352	1.349
	0.057		0.354	
	0.055		0.345	



Analytical - Nitrogen/Protein

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Food

N/Protein determination

FOOD (2/2)

Sample information

Standard:	Aspartic acid	10.52 N%
	Nicotinamide	22.94 N%
Standard weight:	50 - 100 mg Aspartic acid	
	90 - 100 mg Nicotinamide	
Sample weight:	200 - 300 mg vegetable burger, blend green coffee, soy cutlet, concentrated chicken, cheese	
	150 - 180 mg soy protein shake	
	180 - 230 mg diet crunch	
	200 - 250 mg body fit crunch	
	50 - 60 mg nuts mix	
	140 - 180 mg tomato soup dried	
	200 - 250 mg indian chilli sauce adsorbed on Chromosorb WAW (30 - 60 mesh) (p/n 338 37530)	

Note

Select OxyTune® Categories as follows:

- Category A for soy protein shake, body fit crunch, tomato soup dried,
- Category B for vegetable burger, blend green coffee, soy cutlet, concentrated chicken, cheese,
- Category C for indian chilli sauce
- New Category with a Delta 1.6 for diet crunch
- New Category with a Delta 3.6 for nuts mix

Diet crunch, tomato soup dried and nuts mix samples were homogenized by a ball mill.
Indian chilli sauce was weighed as follows: after the tara of the tin container, weigh the sample and take note of the weight value, add Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) inert material to adsorb the liquid, close the container and analyse the sample.
The 6.25 factor was used to calculate the Protein content.

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Food

N/Protein determination

FOOD (1/2)

N/Protein Determination by Single Combustion/Reduction Reactor				
Sample	N%	RSD%	Protein %	RSD%
Cheese	4.94	0.31	4.94	0.34
	4.96		4.96	
	4.97		4.97	
Baby milk powder	1.44	0	1.44	0.23
	1.44		1.44	
	1.44		1.44	
Soy protein shake	12.10	0.08	12.10	0.07
	12.11		12.11	
	12.12		12.12	
Diet Crunch	1.79	0	1.79	0.19
	1.79		1.79	
	1.79		1.79	
Body fit crunch	7.72	0.52	7.72	0.58
	7.75		7.75	
	7.67		7.67	
Tomato soup dried	1.56	0.37	1.56	0.48
	1.57		1.57	
	1.56		1.56	
Nuts	4.18	0.50	4.18	0.45
	4.17		4.17	
	4.21		4.21	
Indian Chilli	0.055	0	0.055	0.44
	0.055		0.055	
	0.055		0.055	
Biscuits	1.15	1.35	1.15	1.55
	1.12		1.12	
	1.13		1.13	



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Food

N/Protein determination

FOOD (2/2)

Standard and Sample information

Sample	Single reactor	
	OxyTune® Category	Sample Weight (mg)
Aspartic acid standard	@ 20 sec	50 - 70
Nicotinamide standard	@ 20 sec	60 - 70
Cheese	B	110 - 140
Baby milk powder	A	80 - 100
Soy protein shake	A	80 - 100
Diet crunch	A	100 - 140
Body fit crunch	E (d=1.6)	80 - 100
Tomato soup dried	A	115 - 220
Nuts mix	F (d=3.6)	40 - 50
Indian chilli sauce	C	110 - 200
Biscuit (20% fat)	A	70 - 100

Note

- Diet crunch, tomato soup dried and nuts mix samples were homogenized by a ball mill.
- Indian chilli sauce was weighed as follows: after the tara in the balance of the tin container weigh the sample amount and take note of the weight value, then add Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) to adsorb the liquid, close the container and analyze the sample.
- Calibration method: K factor
- The 6.25 factor was used to calculate the Protein content.

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Food

N/Protein determination

INSECT FOOD

Sample	N%	RSD%	Protein %	RSD%
Tenebrio Beetle	9.09	0.25	56.81	0.27
	9.08		56.76	
	9.08		56.76	
	9.04		56.50	
	9.10		56.91	
Sigillatus Crickets	9.01	0.14	56.32	0.16
	9.02		56.37	
	9.03		56.46	
	9.00		56.25	
	9.03		56.46	
Tenebrio Beetle Barbecue	8.50	0.12	53.14	0.12
	8.48		53.01	
	8.49		53.07	
	8.50		53.14	
	8.48		53.02	
Tenebrio Beetle Salsa	8.78	0.35	54.85	0.33
	8.82		55.13	
	8.77		54.83	
	8.74		54.65	
	8.80		55.01	
Pasta with Worms	3.59	0.34	22.43	0.37
	3.56		22.23	
	3.57		22.30	
	3.57		22.29	
	3.56		22.23	
Worm Chocolate	2.35	0.88	14.71	0.83
	2.37		14.78	
	2.33		14.58	
	2.36		14.74	
	2.32		14.49	
Crispy Silkworms	8.00	0.27	49.98	0.26
	7.95		49.70	
	8.00		50.00	
	7.97		49.82	
	7.99		49.96	
Crispy Small Crickets	8.98	0.36	56.15	0.34
	9.03		56.43	
	8.95		55.94	
	8.99		56.21	
	9.02		56.35	
Silkworm Chrysalis	8.67	0.53	54.19	0.55
	8.66		54.14	
	8.74		54.64	
	8.77		54.84	
	8.70		54.39	

Sample information

Standard: Nicotinamide 22.94 N%

Standard weight: 80 - 100 mg

Sample weight: 200 - 250 mg

Note

OxyTune® Category B for Pasta with worms and Category A for the other samples.
The sample must be weighed in Tin disk 35 mm diam. (p/n 252 08018).



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Food

N/Protein determination

SPIRULINA ALGAE

N%	RSD%	Protein %	RSD%
10.80	0.24	67.50	0.25
10.85		67.81	
10.80		67.49	
10.82		67.63	
10.79		67.44	
10.84		67.75	
10.85		67.82	
10.86		67.88	
10.81		67.56	
10.80		67.52	

Sample information

Standard:	Nicotinamide	22.94 N%
Standard weight:	80 - 100 mg	
Sample weight:	200 - 250 mg	

Note

OxyTune® Category B.
The sample must be weighed in Tin disk 35 mm diam. (p/n 252 08018).



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Food Ingredients

Nitrogen determination

FOOD INGREDIENTS - BOUILLON POWDER

Sample	N%				
Extruded wheat gluten	10.943	10.949	10.827		
Processed wheat gluten	4.537	4.632	4.535		
Tastemaker for instant noodles (curry)	2.231	2.262	2.226		
Tastemaker for instant noodles	1.701	1.768	1.749		
Bacon powder	1.868	1.874	1.869		
Bouillon powder	2.939	2.925	2.936	2.933	2.939

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 80 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B

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Food Ingredients

Nitrogen determination

FOOD INGREDIENTS

Sample	N%		
Culinary paste A	1.057	1.079	1.055
Culinary paste B	0.896	0.888	0.898
Culinary paste C	1.594	1.565	1.572
Culinary paste D	0.939	0.901	0.926
Culinary sauce	1.551	1.587	1.559
Culinary sauce powder	5.701	5.698	5.678

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 80 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B

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Infant Food

N/Protein determination

INFANT FOOD

Sample	N%	RSD%	Protein %	RSD%
Infant Formula A	2.020	0.470	12.627	0.487
	2.002		12.510	
	2.006		12.538	
Infant Formula B	2.611	0.492	16.316	0.492
	2.636		16.473	
	2.618		16.363	
Infant Formula C	2.486	0.129	15.535	0.129
	2.481		15.505	
	2.487		15.543	
Infant Formula D (liquid)	0.807	0.124	5.046	0.139
	0.808		5.048	
	0.809		5.059	
Infant Tea	0.0353	3.491	0.2209	3.624
	0.0333		0.2079	
	0.0332		0.2073	
Chocolate Powder (Nesquik)	1.288	0.195	8.051	0.205
	1.291		8.067	
	1.286		8.034	
Baby Milk Powder	1.473	0.596	9.208	0.605
	1.459		9.117	
	1.457		9.108	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 - 100 mg

Sample weight: 200 - 300 mg

100 - 110 mg (adsorbed on 30 - 40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530)) for infant formula D (liquid)

Note

- Select OxyTune® Categories as follows:
- Category A for infant formula A, chocolate powder, infant tea, baby milk powder
 - New Category with a Delta 2.5 for infant formula B
 - New Category with a Delta 4 for infant formula C
 - Category C for infant formula D

The 6.25 factor was used to calculate the Protein content.



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Infant Food

N/Protein determination

INFANT FOOD (1/2)

N/Protein Determination by Single Combustion/Reduction Reactor						
Ref No.	Sample	Consuming age	Total Fat %	N%	Protein %	RSD%
1	Milk based powder sucrose free	1 - 3 years	17	2.35	14.67	0.64
				2.34	14.62	
				2.32	14.49	
2	Milk based powder	From birth onwards	27.3	2.18	13.63	0.62
				2.16	13.49	
				2.16	13.48	
3	Milk based powder	1 - 3 years	23.8	2.75	17.17	0.12
				2.74	17.14	
				2.75	17.18	
4	Milk based powder	1 - 3 years	21	2.37	14.79	0.90
				2.41	15.05	
				2.38	14.86	
5	Milk based powder	3 years onwards	19.4	1.61	10.05	1.41
				1.56	9.76	
				1.58	9.88	
6	Milk based powder	6 - 12 months	22	2.45	15.33	0.17
				2.46	15.37	
				2.46	15.38	
7	Milk based powder sucrose free	0 - 6 months	29	1.67	10.41	0.17
				1.67	10.44	
				1.67	10.41	
8	Milk based powder	1 - 10 years	15.8	2.50	15.63	0.32
				2.50	15.64	
				2.49	15.52	
9	Milk based powder	From birth onwards	26	2.15	13.45	1.71
				2.12	13.27	
				2.08	13.00	
10	Milk based powder sucrose free	From birth onwards	27.3	1.79	11.17	0.75
				1.77	11.05	
				1.76	11.01	
11	Milk based powder	From birth onwards of premature babies	3.95	0.452	2.82	1.02
				0.450	2.82	
				0.459	2.87	



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Infant Food

N/Protein determination

INFANT FOOD (2/2)

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 70 mg	
Sample weight:	80 - 90 mg for powders	
	200 - 220 mg for liquid sample	

Note:

Select OxyTune® Categories as follows:

- @ 20 seconds for aspartic acid
- A new Category (δ 1.6) for powder samples
- Category C for liquid sample (adsorbed on 40-50 mg Chromosorb WAW (30 - 60 mesh) (p/n 338 37530))

The 6.38 factor was used to calculate the Protein content and K factor as calibration method.

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Infant Food

N/Protein determination

INFANT FOOD (1/2)

Ref No.	Sample	Consuming age	Total Fat	N%	Protein %	RSD%
1	Milk based powder sucrose free	1 - 3 years	17	2.34	14.90	0.11
				2.33	14.89	
				2.34	14.92	
2	Milk based powder	From birth onwards	27.3	2.23	14.26	0.16
				2.23	14.22	
				2.23	14.26	
3	Milk based powder	1 - 3 years	23.8	2.79	17.78	0.32
				2.80	17.88	
				2.79	17.80	
4	Milk based powder	1 - 3 years	21	2.44	15.54	0.21
				2.42	15.47	
				2.43	15.51	
5	Milk based powder	3 years onwards	19.4	1.61	10.25	0.16
				1.61	10.26	
				1.61	10.28	
6	Milk based powder	1 - 8 years	0.5	4.95	31.59	0.30
				4.97	31.72	
				4.94	31.54	
7	Milk based powder	6 - 12 months	22	2.50	15.97	0.13
				2.50	15.96	
				2.51	16.00	
8	Milk based powder sucrose free	0 - 6 months	29	1.69	10.78	0.14
				1.69	10.79	
				1.69	10.81	
9	Milk based powder	1 - 10 years	15.8	2.48	15.83	0.31
				2.49	15.91	
				2.48	15.81	
10	Milk based powder	From birth onwards	26	2.09	13.32	0.54
				2.09	13.35	
				2.07	13.21	
11	Milk based powder sucrose free	From birth onwards	27.3	1.69	10.78	0.13
				1.69	10.80	
				1.69	10.77	
12	Milk based liquid	From birth onwards	3.47	0.208	1.33	1.61
				0.211	1.35	
				0.215	1.37	
13	Milk based liquid	From birth onwards of premature babies	3.95	0.449	2.87	1.42
				0.461	2.94	
				0.450	2.87	



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Infant Food

N/Protein determination

INFANT FOOD (2/2)

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
Sample weight:	200 - 220 mg for samples 1, 2, 3, 4, 6, 9, 10 and 11	
	170 - 180 mg for sample 5	
	190 - 210 mg for samples 7 and 8	
	180 - 220 mg (adsorbed on 30 - 40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530)) for liquid samples 12 and 13	

Note

- Select OxyTune® Categories as follows:
- Category A for samples 1, 3, 4, 5, 6, 7, 8, 9, 10 and 11
 - Category C for samples 12 and 13
 - Category D ($\delta=1.4$) for sample 2

The 6.38 factor was used to calculate the Protein content.

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Meat Products

N/Protein determination

MEAT PRODUCT (Majorcan Paprika Spreadable Sausage)

N%	RSD%	Protein%	RSD%
4.05	0.6004	25.31	0.6088
4.09		25.54	
4.06		25.39	
4.09		25.55	
4.11		25.71	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 70 mg
Sample weight: 200 - 300 mg

Note

Select the Category B (Thermo Scientific OxyTune®).
The 6.25 factor was used to calculate the Protein content.

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Meat Products

N/Protein determination

MEAT PRODUCT

Sample	N%	RSD%	Protein %	RSD%
Cured Ham	4.49	0.544	28.08	0.543
	4.52		28.22	
	4.49		28.05	
	4.47		27.91	
	4.53		28.31	
Coppa	4.37	0.652	27.33	0.652
	4.31		26.91	
	4.33		27.09	
	4.32		26.98	
	4.37		27.30	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 60 mg
Sample weight: 300 - 350 mg

Note

Select Category B (OxyTune®) for ham and coppa.
The 6.25 factor was used to calculate the Protein content.
Coppa is a typical North Italian cured meat.

Analytical - Nitrogen/Protein

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Meat Products

N/Protein determination

CURED MEATS (1/2)

Sample	N%	Protein%	RSD%
Bacon	2.744	17.153	
	2.725	17.032	
	2.710	16.939	
	2.755	17.224	
	2.734	17.090	1.867
	2.834	17.716	
	2.664	16.654	
	2.752	17.199	
	2.814	17.590	
	2.772	17.325	
Salami	4.649	29.057	
	4.512	28.201	
	4.808	30.051	
	4.550	28.439	
	4.530	28.315	2.206
	4.682	29.265	
	4.708	29.424	
	4.677	29.233	
	4.771	29.821	
	4.569	28.556	

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Meat Products

N/Protein determination

CURED MEATS (2/2)

Sample	N%	Protein%	RSD%
Bologna	3.335	20.843	
	3.318	20.737	
	3.147	19.671	
	3.214	20.085	
	3.289	20.555	1.823
	3.257	20.355	
	3.347	20.917	
	3.274	20.465	
	3.306	20.666	
	3.274	20.464	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B

Comment

Bologna is a typical North Italian cured meat.

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Meat Products

N/Protein determination

CURED MEATS

Sample	N%	Protein%
Spinach <i>pesto</i> pasta topping	0.934	5.837
	0.968	6.052
	0.942	5.887
Pesto pasta topping	0.777	4.854
	0.797	4.980
	0.768	4.802
	0.787	4.918
	0.752	4.697
	0.768	4.800
5042 NNP	0.0078	0.0487
	0.0076	0.0473
	0.0077	0.0483
	0.0079	0.0496
	0.0078	0.0487
5042 NNC	0.036	0.226
	0.035	0.217
	0.036	0.228
Eggplants	0.141	0.880
	0.144	0.900
Bacon	3.314	20.710
	3.125	19.534
	3.040	18.999

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	100 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	Pesto	G
	Other samples	B

Comment

Pesto pasta topping is constituted of basil, pine-kernels, cheese and oil.



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
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- Milk Products
- Molasses
- Mushroom Soup
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- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Meat Products

N/Protein determination

CURED MEATS - SALAMI

Sample	N%	Protein%	RSD%
1	2.7944	17.46	1.179
	2.7488	17.18	
	2.8121	17.58	
2	3.1628	19.77	0.496
	3.1916	19.95	
	3.1882	19.93	
3	3.1351	19.59	0.544
	3.1003	19.38	
	3.1209	19.51	
4	3.3266	20.79	0.953
	3.3906	21.19	
	3.3599	20.00	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 200 - 300 mg
OxyTune® Category: A

Comment

Samples were homogenized with a rotary speed mill.
Protein factor used was 6.25.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
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- Pasta Topping
- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Meat Products

N/Protein determination

CURED MEATS - SAUSAGE - SALAMI

Sample	No of runs	N%	RSD%
Beef sausage	34	2.9972	1.6697
Pepperone salame	36	3.2163	1.7932
Turkey salame	27	5.0592	1.6987
Genoa salame	40	3.3069	1.4353

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 200 - 250 mg
OxyTune® Category: B

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Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
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- Tahine (Sesame seed)
- Whey Protein

Meat Products

N/Protein determination

PATE - LIVER PATE

N%	Protein%	RSD%
1.7576	10.9852	
1.7276	10.7975	
1.7265	10.7904	
1.7487	10.9295	
1.7259	10.7872	0.8339
1.7493	10.9331	
1.7201	10.7508	
1.7325	10.8281	
1.7276	10.7975	
1.7585	10.9906	

Sample information

Standard:
Standard weight:
Sample weight:
OxyTune® Category:

Aspartic acid
50 - 60 mg
200 - 220 mg
E (delta 1.2)

10.52 N%

Note

Samples were weighed and analyzed immediately to avoid weight loss.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
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- Whey Protein

Meat Products

N/Protein determination

BOUILLON POWDER - CHEESE - WURSTEL

Sample	N%	Protein%	RSD%	No. of run
Wurstel	2.424	15.150	0.834	10
Bouillon powder	5.739	35.811	0.325	4
Emmenthal cheese	3.378	21.076	0.886	10
Tigre soft cheese	3.363	20.986	0.994	5

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 90 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
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- Whey Protein

Meat Products

N/Protein determination

CHEESE - MILK - WURSTEL

Sample	N%	Protein%	RSD%	No. of run
Wurstel	2.42	15.15	0.83	10
Milk	0.529	3.380	0.56	10
Emmenthal cheese	3.38	21.08	0.88	10

Sample information

Standard:	Milk	Urea Standard Solution	500 ppm N
	Others	Aspartic acid	10.52 N%
Standard amount:	Milk	100 µl	
Others	Others	100 mg	
Sample weight:	200 - 300 mg		
OxyTune® Category:	Milk	A	
	Others	B	

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Meat Products

N/Protein determination

DRIED BAKERS YEAST

N%	RSD%	Protein %	RSD%
7.24	0.18	45.27	0.18
7.25		45.31	
7.24		45.28	
7.25		45.29	
7.23		45.18	
7.24		45.24	
7.25		45.34	
7.25		45.31	
7.24		45.23	
7.24		45.25	
7.23		45.16	
7.24		45.28	
7.23		45.17	
7.23		45.19	
7.23		45.17	
7.26		45.34	
7.24		45.23	
7.23		45.19	
7.26		45.35	
7.22		45.15	
7.23		45.20	
7.21		45.04	
7.22		45.13	
7.23		45.18	
7.22		45.14	
7.22		45.11	
7.22		45.12	
7.22		45.12	
7.23		45.16	
7.26		45.36	

Sample information

Standard: Nicotinamide 22.94 N%

Standard weight: 50 - 80 mg

Sample weight: 200 - 300 mg

Note

Select Category B (OxyTune®) for sample analysis.

The protein factor used to calculate the protein content was 6.25.



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
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Meat Products

Nitrogen determination

MOLASSES - YEAST

Sample	N%		
Molasses	1.80	1.81	1.80
Yeast	6.55	6.52	6.54

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:	30 - 40 mg	
Sample weight:	Yeast	200 - 300 mg
	Molasses	50 - 60 mg
OxyTune® Category:	Yeast	B
	Molasses	E (delta 3)

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
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- Whey Protein

Milk Products

N/Protein determination

ANIMAL FEED - BARLEY - COCOA - FLOUR - MILK POWDER - SOY - STARCH - WHEAT

Sample	N%		Protein%	
Cocoa	3.71	3.72	23.21	23.26
Wheat	1.99	2.00	12.43	12.48
Fodder plant	2.53	2.56	15.83	16.00
Soy	5.91	5.88	36.95	36.74
Barley	1.43	1.42	8.93	8.90
Flour	1.24	1.24	7.76	7.76
Animal food	7.87	7.86	49.17	49.15
Milk powder	4.25	4.24	26.57	26.53
Starch	0.043	0.047	0.269	0.296

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 80 mg
Sample weight: Cocoa/milk powder 100 - 200 mg
Other samples 200 - 300 mg
A
OxyTune® Category:

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
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- Whey Protein

Milk Products

N/Protein determination

CHEESE - CHOCOLATE - MILK - MILK POWDER - YOGURT

Sample	N%	Protein%	RSD%
Milk	0.476	3.036	0.618
Milk powder	2.085	13.304	0.301
Casein	14.239	90.844	0.285
Cream	0.445	2.780	2.169
Yogurt	0.719	4.497	0.706
Baby food A	0.929	5.931	0.994
Baby food B	0.231	1.475	1.798
Spread cheese	1.548	9.676	0.753
Emmenthal cheese	4.772	30.448	1.095
Lindenberger cheese	5.409	34.510	1.019
Philadelphia spread cheese	1.268	8.092	2.193
Chocolate A	0.919	5.865	0.260
Chocolate B	2.044	12.777	0.412

Sample information

Standard:

Standard weight:

Sample weight:

OxyTune® Category:

Aspartic acid

50 - 100 mg

200 - 300 mg

B cat., A cat. for milk powder and chocolate

10.52 N%

Note

Each value is the average of 10 runs.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
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- Tahine (Sesame seed)
- Whey Protein

Milk Products

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.

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- Whey Protein

Milk Products

Nitrogen determination

BEER - CHEESE - JUICES - MILK PROTEIN - WINE - WORT

Sample	N%	ppm N	RSD%
Beer A		867	0.920
Beer B		595	1.236
Wort A		318	1.008
Wort B		961	1.113
White wine		230	1.207
Red wine		274	1.125
Apple Juice		109	1.554
Orange Juice		150	2.137
Cheese Extract A		50	2.320
Cheese Extract B		120	1.715
Milk Protein Fraction A	0.127		0.543
Milk Protein Fraction B	0.134		0.416
Soluble Protein in Fodder Plant A	0.104		2.060
Soluble Protein in Fodder Plant B		870	1.952

Sample information

Standard: Urea Water Solution 500 ppm N
 Standard volume: 100 µl
 Sample volume: 100 µl
 Oxygen Injection Time: 8 sec

Note

Each value is the average of 20 runs.
 Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by the liquid autosampler at 8 seconds after the start.

Comment

Since beer contains carbon dioxide the samples should be degassed prior to analysis. Degassing can be done by shaking and waiting until foam disappears.
 Wort is rather viscous due to high sugar content. Samples can be analyzed without any pre-treatment (washing the syringe several Times) or diluted.



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Milk Products

Nitrogen determination

MILK PROTEIN CONCENTRATES

Sample	Weight (mg)	N%	Protein %	Std. Dev.	RSD%
1	82.7	12.199	77.83	0.21	0.42
	83.3	12.246	78.13		
2	84.7	12.324	78.63	0.39	0.79
	85.6	12.237	78.07		
3	83.4	12.970	82.75	0.06	0.11
	84.3	12.958	82.67		
4	83.1	12.824	81.82	0.04	0.08
	83.8	12.815	81.76		
5	85.8	12.929	82.49	0.08	0.17
	85.6	12.911	82.37		
6	84.6	12.373	78.94	0.02	0.04
	84.1	12.378	78.97		
7	83.1	12.260	78.22	0.18	0.35
	83.8	12.299	78.47		
8	87.5	12.426	79.28	0.10	0.20
	88.6	12.448	79.42		
9	84.3	12.933	82.51	0.25	0.49
	84.6	12.987	82.86		
10	83.6	12.519	79.87	0.08	0.16
	83.7	12.536	79.98		
11	86.4	12.418	79.23	0.02	0.04
	86.8	12.414	79.20		

Sample information

Standard: Aspartic acid 10.52 N%
 Nicotinamide 22.94 N%

Standard weight: 50 - 100 mg
 Standard weight: 80 - 100 mg

Note

Select @ 30 seconds (OxyTune®) for samples and standards.
 The 6.38 factor was used to calculate the Protein content.



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
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- Tahine (Sesame seed)
- Whey Protein

Milk Products

N/Protein determination

CHEESE - CHOCOLATE - EGGPLANT - MILK

Sample	N%			Protein%		
Chocolate	1.056	1.050	1.052	6.598	6.564	6.572
Cheese	2.940	2.932	2.912	18.378	18.32	18.197
Milk	0.475	0.475	0.474	2.971	2.969	2.962
Whipped cream	0.378	0.372	0.371	2.365	2.323	2.320
Artichokes (preserved in oil)	0.347	0.355	0.351	2.167	2.218	2.192
Eggplants/peppers (preserved in oil)	0.141	0.139	0.137	0.880	0.871	0.859

Sample information

Standard:	Aspartic acid	10.52 N%
Standard volume:	100 mg	
Sample amount:	Milk	100 µl
	Chocolate	100 - 200 mg
	Others	200 - 300 mg
OxyTune® Category:	Milk	C
	Chocolate	A
	Others	B

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
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- Whey Protein

Milk Products

N/Protein determination

CHEESE - CHOCOLATE - MILK - MILK POWDER - YOGURT

Sample	N%	Protein%	RSD%
Milk	0.476	3.036	0.618
Milk powder	2.085	13.304	0.301
Casein	14.239	90.844	0.285
Cream	0.445	2.780	2.169
Yogurt	0.719	4.497	0.706
Baby food A	0.929	5.931	0.994
Baby food B	0.231	1.475	1.798
Spread cheese	1.548	9.676	0.753
Emmenthal cheese	4.772	30.448	1.095
Lindenberger cheese	5.409	34.510	1.019
Philadelphia spread cheese	1.268	8.092	2.193
Chocolate A	0.919	5.865	0.260
Chocolate B	2.044	12.777	0.412

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 200 - 300 mg
OxyTune® Category: B cat., A cat. for milk powder and chocolate

Note

Each value is the average of 10 runs.

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Milk Products

N/Protein determination

BARLEY - BEANS - BRAN - CORN - LENTILS - MILK - MILK POWDER - PEAS - RICE - SOY - WHEAT

Sample	N%	Protein%	RSD%
Corn	1.137	7.104	0.736
Soy	6.207	38.796	0.549
Corn-soy (2:1)	2.545	15.907	0.659
Barley	1.590	9.939	1.356
Bran	2.271	14.192	0.807
Wheat	1.742	10.889	0.305
Oats-wheat mix	2.871	16.361	0.705
Rice	1.101	6.270	0.831
Seeds of cartam	2.375	14.845	1.531
Lentils	3.840	23.993	0.553
Beans	3.544	22.150	0.695
Peas	3.873	24.204	0.532
Milk	0.510	3.254	0.768
Milk powder	1.840	11.741	0.460

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
N/Protein factor:	Milk products	6.38
	Others	6.25
Sample weight:	200 - 300 mg	
OxyTune® Category:	B cat., A cat. for milk powder	

Note

Each value is the average of 10 runs.
Crops and beans have been treated in a rotary mill, 1 mm granulometry.



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
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- Tahine (Sesame seed)
- Whey Protein

Milk Products

N/Protein determination

CHEESE - MILK - WURSTEL

Sample	N%	Protein%	RSD%	No. of run
Wurstel	2.42	15.15	0.83	10
Milk	0.529	3.380	0.56	10
Emmenthal cheese	3.38	21.08	0.88	10

Sample information

Standard:	Milk	Urea Standard Solution	500 ppm N
	Others	Aspartic acid	10.52 N%
Standard amount:	Milk	100 µl	
Others	Others	100 mg	
Sample weight:	200 - 300 mg		
OxyTune® Category:	Milk	A	
	Others	B	

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
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- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
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- Tahine (Sesame seed)
- Whey Protein

Milk Products

N/Protein determination

MILK POWDER

Sample	N%	
Milk powder	4.322	4.328
	4.306	4.328
	4.304	4.331
	4.305	4.329
	4.321	4.323
CECA Lait A	0.519	
	0.521	
	0.526	
CECA Lait B	0.531	0.525
	0.529	0.534
	0.532	0.526
	0.534	0.529
	0.531	0.528

CECA = Centre d'Etude et de Controle des Analyses aux Industries Laitiere (Poligny - France)

Sample information

Standard:	Atropine	4.84 N%
Standard weight:	10 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	A	

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Milk Products

N/Protein determination

MILK POWDER

Milk powder Sample	FlashSmart		Kjeldahl		Milk powder Sample	FlashSmart		Kjeldahl	
	N%	Prot. %	N%	Prot. %		N%	Prot. %	N%	Prot. %
A	4.91	31.30	4.91	31.31	C	4.19	26.73	4.18	26.64
	4.89	31.19	4.93	31.45		4.21	26.87	4.19	26.73
	4.93	31.45	4.88	31.13		4.19	26.73	4.19	26.71
	4.94	31.50	4.92	31.39		4.19	26.73	4.22	26.92
	4.93	31.45	4.91	31.29		4.22	26.92	4.19	26.73
Average% RSD%	4.92	31.38	4.91	31.32	Average% RSD%	4.20	26.80	4.19	26.75
	0.41	0.41	0.38	0.39		0.34	0.34	0.36	0.39
B	4.43	28.24	4.41	28.14	D	5.46	34.80	5.46	34.82
	4.42	28.20	4.42	28.20		5.46	34.80	5.46	34.82
	4.38	27.96	4.38	27.94		5.48	34.96	5.44	34.70
	4.44	28.33	4.41	28.10		5.47	34.90	5.43	34.66
	4.43	28.24	4.43	28.24		5.44	34.69	5.44	34.69
Average% RSD%	4.43	28.19	4.41	28.12	Average% RSD%	5.46	34.83	5.45	34.74
	0.53	0.49	0.42	0.41		0.27	0.30	0.25	0.22

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 - 100 mg

Sample weight: 200 - 300 mg

Note

Select CategoryA (OxyTune®) for samples.
The 6.38 factor was used to calculate the Protein content.

Comment

The Table shows a comparison of the protein data obtained of milk sample analysis with the traditional Kjeldahl method and the FlashSmart™ EA.
The small differences between the data demonstrate an optimal correlation of the techniques.



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Milk Products

N/Protein determination

MILK AND MILK POWDER

Sample	N%	
Milk powder	4.322	4.328
	4.306	4.328
	4.304	4.331
	4.305	4.329
	4.321	4.323
CECA Lait A	0.519	
	0.521	
	0.526	
CECA Lait B	0.531	0.525
	0.529	0.534
	0.532	0.526
	0.534	0.529
	0.531	0.528

CECA = Centre d'Etude et de Controle des Analyses aux Industries Laitiere (Poligny - France)

Sample information

Standard:	Atropine	4.84 N%
Standard weight:	10 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	A	

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Milk Products

N/Protein determination

MILK AND MILK POWDER

Sample	N%	RSD%	Protein %	RSD%
Milk (liquid) 1	0.0362	1.10	0.231	1.18
	0.0352		0.224	
	0.0356		0.227	
	0.0353		0.225	
	0.0356		0.227	
Milk (liquid) 2	0.0538	1.12	0.343	1.20
	0.0546		0.348	
	0.0545		0.348	
	0.0539		0.344	
	0.0531		0.338	
Milk powder 1	0.386	0.96	2.46	1.08
	0.386		2.46	
	0.392		2.50	
	0.387		2.47	
	0.394		2.52	
Milk powder 2	2.30	0.39	14.69	1.45
	2.28		14.55	
	2.30		14.67	
	2.30		14.68	
	2.29		14.61	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 - 100 mg

Sample weight: 50 - 100 mg

Note:

Oxygen Injection Time 30 seconds for aspartic acid, and OxyTune® Category A for milk powder and C for liquid milk. The 6.38 factor was used to calculate the Protein content. Liquid milk sample was adsorbed on 50 - 60 mg Chromosorb WAW (30 - 60 mesh) (p/n 338 37530)



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Milk Products

N/Protein determination

COCOA - MILK - SWEETS

Sample	N%			Protein%		
Cocoa	4.54	4.58	4.58	28.37	28.59	28.62
Ice Cream	0.41	0.40	0.40	2.62	2.58	2.55
Hazelnut	2.75	2.70	2.70	17.21	16.90	16.90
Milk	5.78	5.82	5.81	36.88	37.11	37.07

Sample information

Standard:

Standard weight:

Sample weight:

OxyTune® Category:

EDTA (Ethylenediaminetetraacetic acid)

100 mg

Cocoa / hazelnuts

Ice cream / milk

Cocoa / hazelnuts

Ice cream / milk

9.59 N%

100 - 200 mg

200 - 300 mg

A

C

Analytical - Nitrogen/Protein

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Milk Products

N/Protein determination

MILK

N%	RSD%	Protein %	RSD%
0.51	1.12	3.21	0.65
0.51		3.20	
0.52		3.24	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
Sample weight:	135 - 140 mg	

Note

Select Category C (OxyTune®) for sample analysis.
Milk sample was weighed in tin containers adsorbed on 30-40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) inert material.
The 6.38 factor was used to calculate the Protein content.

Analytical - Nitrogen/Protein

Food

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- Whey Protein

Milk Products

N/Protein determination

MILK

N/Protein Determination by Single Combustion / Reduction Reactor			
N%	RSD%	Protein %	RSD%
0.51	0.00	3.20	0.18
0.51		3.20	
0.51		3.19	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 60 - 70 mg
Sample weight: 155 - 175 mg

Note

Select Category C (OxyTune®) for sample analysis.
Milk sample was weighed in tin containers adsorbed on 30-40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) inert material.
Protein factor used to calculate the protein content was 6.25.

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Milk Products

N/Protein determination

MILK

Milk Sample	FlashSmart		Kjeldahl		Milk Sample	FlashSmart		Kjeldahl	
	N%	Prot. %	N%	Prot. %		N%	Prot. %	N%	Prot. %
Crude 1	0.498	3.18	0.498	3.18	Crude 3	0.433	2.76	0.429	2.74
	0.497	3.17	0.498	3.18		0.434	2.77	0.428	2.73
Crude 2	0.574	3.66	0.571	3.64	Crude 4	0.422	2.69	0.415	2.65
	0.577	3.68	0.567	3.62		0.414	2.64	0.412	2.63
Pastorized 1	0.500	3.19	0.497	3.17	UHT 1	0.531	3.39	0.520	3.32
	0.495	3.16	0.495	3.16		0.527	3.36	0.528	3.37
Pastorized 2	0.495	3.16	0.494	3.15	UHT 2	0.522	3.33	0.525	3.35
	0.497	3.17	0.492	3.14		0.528	3.37	0.523	3.34
Pastorized 3	0.469	2.99	0.465	2.97	UHT 3	0.500	3.19	0.500	3.19
	0.467	2.98	0.464	2.96		0.498	3.18	0.500	3.19

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 100 - 200 mg adsorbed
on 30 - 50 mg Chromosorb
WAW (30 - 60 mesh) (p/n 338 37530)

Note

Select Category C (OxyTune®) for samples.
The 6.38 factor was used to calculate the Protein content.

Comment

The Table shows a comparison of the protein data obtained of milk sample analysis with the traditional Kjeldahl method and the FlashSmart™ EA.
The small differences between the data demonstrate an optimal correlation of the techniques.

Analytical - Nitrogen/Protein

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Milk Products

Nitrogen determination

HYDROLIZED MILK

Sample	N%	RSD%
A	0.129	1.027
B	0.138	1.021
C	0.132	1.350
D	0.137	0.368
E	0.135	0.417
F	0.129	1.271
G	0.135	0.197
H	0.131	0.602

Sample information

Standard: Urea Standard Solution 1000 ppm N
Sample volume: 100 µl
Oxygen Injection Time: 8 sec

Note

Each value is the average of 10 runs.
For milk product we suggest to fill the tin container with Chromosorb WAW (30 - 60 mesh) (p/n 338 37530).
For 100 µl of milk, add about 30 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530).
Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) has the function to adsorb milk and to optimize the combustion condition.

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Milk Products

N/Protein determination

YOGURT

Weight (mg)	N%	Protein %
271.9	0.520	3.326
288.8	0.519	3.314
277.6	0.522	3.329
268.4	0.518	3.306
273.0	0.515	3.286
277.5	0.508	3.238
276.5	0.510	3.252
280.7	0.512	3.265
273.8	0.512	3.265
285.0	0.510	3.256
Average%	0.515	3.284
RSD %	0.948	1.006

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 -100 mg
Sample weight: 200 - 300 mg adsorbed
on 30 - 50 mg Chromosorb WAW (30 - 60 mesh) (p/n 338 37530)

Note

Select Category C (OxyTune®) for samples.
The 6.38 factor was used to calculate the Protein content.



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Molasses

N/Protein determination

MOLASSES

Sample	N%	Average N%	RSD%
Molasses	0.3799		
	0.3759		
	0.3857		
	0.3870		
	0.3844		
	0.3717	0.3804	1.5905
	0.3741		
	0.3757		
	0.3808		
	0.3911		
	0.3780		

Sample information

Standard: Atropine 4.84 N%
Standard weight: 5.0 - 6.0 mg
Sample weight: 50 - 60 mg
OxyTune® Category: E (Delta 3)

Note

Set fixed Oxygen Injection Time at 10 seconds for standard.



Analytical - Nitrogen/Protein

Food

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Molasses

Nitrogen determination

MOLASSES - YEAST

Sample	N%		
Molasses	1.80	1.81	1.80
Yeast	6.55	6.52	6.54

Sample information

Standard:	Acetanilide	10.36 N%
Standard weight:		30 - 40 mg
Sample weight:	Yeast	200 - 300 mg
	Molasses	50 - 60 mg
OxyTune® Category:	Yeast	B
	Molasses	E (Delta 3)

Analytical - Nitrogen/Protein

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Mushroom Soup

N/Protein determination

MUSHROOM SOUP

N%	RSD%	Protein%	RSD%
6.4038		40.0238	
6.4022	0.0140	40.0137	0.0141
6.4023		40.0144	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	40 - 50 mg	
Sample weight:	60 - 80 mg	

Note

Select Category A (Thermo Scientific OxyTune®) for sample analyses.
The 6.25 factor was used to calculate the Protein content.

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Pasta Topping

N/Protein determination

CURED MEATS - EGGPLANT - PASTA TOPPING

Sample	N%	Protein%
Spinach <i>pesto</i> pasta topping	0.934	5.837
	0.968	6.052
	0.942	5.887
Pesto pasta topping	0.777	4.854
	0.797	4.980
	0.768	4.802
	0.787	4.918
	0.752	4.697
	0.768	4.800
5042 NNP	0.0078	0.0487
	0.0076	0.0473
	0.0077	0.0483
	0.0079	0.0496
	0.0078	0.0487
5042 NNC	0.036	0.226
	0.035	0.217
	0.036	0.228
Eggplants	0.141	0.880
	0.144	0.900
Bacon	3.314	20.710
	3.125	19.534
	3.040	18.999

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	100 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category:	Pesto	G
	Other samples	B

Comment

Pesto pasta topping is constituted of basil, pine-kernels, cheese and oil.



Analytical - Nitrogen/Protein

Food

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Pasta

N/Protein determination

BARLEY - PASTA

Sample	N%	Protein%	RSD%	No. of run
Barley (1° day)	1.44	9.02	0.789	14
Barley (2° day)	1.44	9.00	0.567	10
Pasta	1.95	12.16	0.874	85

Sample information

Standard: Thermo Scientific Pasta Reference Material 1.93 N%
Standard weight: 200 mg
Sample weight: 200 - 300
OxyTune® Category: B

Note

Samples have been treated in a rotary mill, 1 mm granulometry.

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Pasta

N/Protein determination

THERMO SCIENTIFIC PASTA REFERENCE MATERIAL

N/Protein Determination by Single Combustion/Reduction Reactor										
Day	1		2		3		4		5	
Determination	N%	Prot.%	N%	Prot.%	N%	Prot.%	N%	Prot.%	N%	Prot.%
	2.17	13.57	2.20	13.75	2.18	13.63	2.18	13.63	2.18	13.63
	2.17	13.56	2.19	13.67	2.19	13.69	2.18	13.62	2.18	13.63
	2.17	13.56	2.21	13.79	2.18	13.63	2.19	13.68	2.17	13.56
	2.16	13.48	2.20	13.76	2.18	13.63	2.19	13.70	2.18	13.63
	2.17	13.57	2.20	13.75	2.18	13.63	2.20	13.74	2.19	13.69
	2.17	13.57	2.20	13.77	2.17	13.56	2.20	13.73	2.18	13.63
	2.18	13.61	2.20	13.72	2.17	13.56	2.19	13.70	2.18	13.63
	2.19	13.69	2.20	13.74	2.18	13.63	2.19	13.71	2.19	13.69
	2.19	13.68	2.19	13.70	2.18	13.63	2.21	13.79	2.18	13.63
	2.18	13.61	2.19	13.71	2.18	13.63	2.19	13.66	2.18	13.63
Average	2.18	13.61	2.20	13.74	2.18	13.63	2.19	13.70	2.18	13.63
RSD %	0.64	0.67	0.29	0.25	0.26	0.28	0.42	0.36	0.31	0.35

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 -70 mg
Sample weight: 130 - 140 mg

Note

Select OxyTune® Categories as follows: @ 20 seconds for Aspartic acid, Category A for Pasta Ref. Mat. The 6.25 factor was used to calculate the Protein content and K factor as calibration.



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
- Mushroom Soup
- Pasta Topping
- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Snacks and Biscuit

N/Protein determination

SNACKS

Sample	N%	RSD%	Protein %	RSD%
Snack 1	0.122	0.471	0.760	0.570
	0.123		0.757	
	0.123		0.768	
Snack 2	0.680	1.097	4.252	1.048
	0.689		4.309	
	0.695		4.341	
Snack 3	1.536	0.637	9.601	0.648
	1.536		9.597	
	1.553		9.707	
Snack 4	1.225	0.263	7.659	0.284
	1.219		7.620	
	1.220		7.623	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 180 - 200 mg Snack 1
200 - 210 mg Snack 2 and 4
150 - 170 mg Snack 3

Note

Select Category C (OxyTune®) for snack 1, Category B (OxyTune®) for snack 2, a new Category (OxyTune®) with a Delta 3.6 for snacks 3 and 4.
The 6.25 factor was used to calculate the Protein content.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
- Mushroom Soup
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- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Snacks and Biscuit

N/Protein determination

BISCUIT

N%	RSD%	Protein%	RSD%
1.19	0.98	7.41	0.87
1.17		7.31	
1.19		7.43	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 190 - 210 mg

Note

Select Category A (OxyTune®) for sample analysis.
Protein factor used to calculate the protein content was 6.25.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
- Mushroom Soup
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- Tahine (Sesame seed)
- Whey Protein

Snacks and Biscuit

N/Protein determination

BISCUIT

N/Protein Determination by Single Combustion / Reduction Reactor			
N%	RSD%	Protein%	RSD%
1.20	0.97	7.51	0.91
1.20		7.48	
1.18		7.38	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 60 - 70 mg
Sample weight: 135 - 145 mg

Note

Select Category A (OxyTune®) for sample analysis.
Protein factor used to calculate the protein content was 6.25.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
- Mushroom Soup
- Pasta Topping
- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Snacks and Biscuit

N/Protein determination

BISCUIT (20% FAT)

N%	RSD%	Protein%	RSD%
1.15	1.31	7.17	1.52
1.16		7.26	
1.18		7.39	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg Aspartic acid
Sample weight: 70 - 80 mg

Note

Select Category A (OxyTune®).
The 6.25 factor was used to calculate the Protein content.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
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- Snacks and Biscuit
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- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Starch

N/Protein determination

ANIMAL FEED - BARLEY - COCOA - FLOUR - MILK POWDER - SOY - STARCH - WHEAT

Sample	N%		Protein%	
Cocoa	3.71	3.72	23.21	23.26
Wheat	1.99	2.00	12.43	12.48
Fodder plant	2.53	2.56	15.83	16.00
Soy	5.91	5.88	36.95	36.74
Barley	1.43	1.42	8.93	8.90
Flour	1.24	1.24	7.76	7.76
Animal food	7.87	7.86	49.17	49.15
Milk powder	4.25	4.24	26.57	26.53
Starch	0.043	0.047	0.269	0.296

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 80 mg
Sample weight: Cocoa/milk powder 100 - 200 mg
Other samples 200 - 300 mg
OxyTune® Category: A

Note

Samples have been treated in a rotary mill, 1 mm granulometry.

Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
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- Pasta Topping
- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Starch

N/Protein determination

STARCH

Sample	N%	RSD%
1	0.2531	0.6479
	0.2558	
	0.2561	
2	0.3963	0.6442
	0.3991	
	0.3940	
3	0.3589	0.8013
	0.3563	
	0.3532	
4	0.3029	0.6112
	0.3012	
	0.3049	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 10 - 12 mg
Sample weight: 100 - 140 mg

Note

Use as Oxygen Injection Time for the standard at 10 seconds, while for the samples at 30 seconds.

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- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
- Mushroom Soup
- Pasta Topping
- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Starch

N/Protein determination

STARCH

Sample	N%	Protein%	RSD%
1	0.0546	0.3409	0.5256
	0.0551	0.3445	
	0.0548	0.3426	
2	0.0371	0.2322	0.8299
	0.0366	0.2285	
	0.0370	0.2312	
3	0.0129	0.0804	2.2977
	0.0126	0.0789	
	0.0123	0.0768	
4	0.0476	0.2975	0.2530
	0.0474	0.2962	
	0.0474	0.2962	

Sample information

Standard: Atropine 4.84 N%
Standard weight: 10 - 12 mg
Sample weight: 100 - 140 mg
OxyTune® Category: B

Note

Due to the low content of N in these samples, it is necessary to evaluate the blank value (empty tin container).

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Analytical - Nitrogen/Protein

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- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
- Mushroom Soup
- Pasta Topping
- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Sugar Solutions

Nitrogen determination

SUGAR SOLUTIONS

Sample	ppm N	RSD%
Urea Water Solution 93 ppm N	94	
	96	4.931
	86	
	95	
Sugar Solution 1	122	
	125	4.253
	115	
Sugar Solution 2	58	
	67	7.663
	60	
Sugar Solution 3	85	
	82	2.972
	87	
Sugar Solution 4	37	
	40	6.741
	35	
Sugar Solution 5	110	
	108	1.063
	108	

Sample information

Standard:

Urea Water Solution

100 ppm N

Standard weight:

80 - 100 µl

Sample weight:

80 - 100 µl



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
- Mushroom Soup
- Pasta Topping
- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Tahine (Sesame seed)

N/Protein determination

TAHINE (SESAME SEEDS)

Sample	N%	RSD%	Protein %	RSD%
Tahine (Sesame Seeds)	4.003	0.151	25.019	0.150
	3.996		24.972	
	3.991		24.945	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 70 - 80 mg

Note

Select a new Category (OxyTune®) with a Delta 3.
The 6.25 factor was used to calculate the Protein content.



Analytical - Nitrogen/Protein

Food

- Bouillon Powder
- Candy
- Cereal Flakes
- Cheese
- Chocolate and Cocoa
- Dietary Fiber (Celite)
- Egg Albumin
- Eggplants
- Enzymes mixed With Flour
- Flour
- Food
- Food Ingredients
- Infant Food
- Meat Products
- Milk Products
- Molasses
- Mushroom Soup
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- Pasta
- Snacks and Biscuit
- Starch
- Sugar Solutions
- Tahine (Sesame seed)
- Whey Protein

Whey Protein

N/Protein determination

WHEY PROTEIN

Sample	N%	RSD%	Protein %	RSD%
1	3.85	0.29	24.04	0.27
	3.83		23.91	
	3.84		23.99	
2	0.634	1.17	3.96	1.06
	0.631		3.94	
	0.620		3.88	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 60 - 70 mg
Sample weight: 200 - 250 mg

Note

Select Category A (OxyTune®) for sample analysis.
The protein factor used to calculate the protein content was 6.25.



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Analytical - Nitrogen/Protein

Geological

- Soils

Soils

Nitrogen determination

SOILS

Sample	N%		
A	0.693	0.744	0.753
B	0.288	0.294	0.288
C	0.131	0.136	0.136
D	0.280	0.275	0.279
E	0.275	0.272	
F	0.087	0.079	
G	0.203	0.202	
H	0.285	0.271	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 mg	
Sample weight:	200 - 300 mg	
OxyTune® Category	C	

Note

The geological material has been ground by ball mill.
The samples can be analyzed "as received" or dried (105°C, 2 hours).



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Analytical - Nitrogen/Protein

Human/Animal

- Carcass - Urine
- Fecal
- Urine

Carcass - Urine

N/Protein determination

CARCASS - URINE

Sample	N%				Protein%			
Urine A	0.421	0.416	0.421	0.423	2.634	2.597	2.632	2.644
Urine B	0.310	0.312	0.305	0.314	1.935	1.953	1.908	1.962
Carcass A	6.306	6.424	6.351	6.573	39.414	40.148	39.693	41.081
Carcass B	4.972	5.034	4.945	4.943	31.073	31.462	30.906	30.895

Sample information

Standard:	Urine	Urea Water Solution	0.7 N%
	Carcass	Acetanilide	10.36 N%
Standard amount:	Urine	Urea Water Solution	100 µl
	Carcass	Acetanilide	40 mg
Sample weight:	Urine	100 µl (by manual injection)	
	Carcass	100 - 200 mg	
Oxygen Injection Time:	Urine	8 sec	
	Carcass	20 - 40 sec	

Note

The urine samples can be introduced by Manual Injection Device (p/n 190 04138) or by automatically using the liquid autosampler at 8 seconds after start.



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Analytical - Nitrogen/Protein

Human/Animal

- Carcass - Urine
- Fecal
- Urine

Fecal

N/Protein determination

FECAL SAMPLES

Sample	N%	Protein%	RSD%
A	0.013	0.083	2.95
B	0.009	0.058	1.42
C	0.021	0.129	0.35
D	0.017	0.105	2.63
E	0.019	0.116	0.19
F	0.009	0.054	2.04

Sample information

Standard: Aspartic acid
Standard weight: 5.0 - 10 mg
Sample weight: 50 - 150 mg

10.52 N%

Note

Data are the average of duplicate analyses.



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Analytical - Nitrogen/Protein

Human/Animal

- Carcass - Urine
- Fecal
- Urine

Urine

N/Protein determination

CARCASS - URINE

Sample	N%				Protein%			
Urine A	0.421	0.416	0.421	0.423	2.634	2.597	2.632	2.644
Urine B	0.310	0.312	0.305	0.314	1.935	1.953	1.908	1.962
Carcass A	6.306	6.424	6.351	6.573	39.414	40.148	39.693	41.081
Carcass B	4.972	5.034	4.945	4.943	31.073	31.462	30.906	30.895

Sample information

Standard:	Urine	Urea Water Solution	0.7 N%
	Carcass	Acetanilide	10.36 N%
Standard amount:	Urine	Urea Water Solution	100 µl
	Carcass	Acetanilide	40 mg
Sample weight:	Urine	100 µl (by manual injection)	
	Carcass	100 - 200 mg	
Oxygen Injection Time:	Urine	8 sec	
	Carcass	20 - 40 sec	

Note

The urine samples can be introduced by Manual Injection Device (p/n 190 04138) or by automatically using the liquid autosampler at 8 seconds after start.



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Analytical - Nitrogen/Protein

Human/Animal

- Carcass - Urine
- Fecal
- Urine

Urine

N/Protein determination

URINE

Sample	N%	Protein%	RSD%
A	0.78	4.90	2.01
B	0.53	3.31	1.24
C	0.43	2.72	0.77
D	0.69	4.31	0.61
E	0.74	4.60	0.56
F	1.34	8.35	0.66

Sample information

Standard: Urea Water Solution 1 N%
Standard volume: 80 µl
Sample volume: 80 µl

Note

Data are the average of quadruplicate analyses.
Samples can be introduced using the Manual Injection Device (p/n 190 04138) or by liquid autosampler at 8 seconds after the start.

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Analytical - Nitrogen/Protein

Material Characterization

- Coconut Shell

Coconut Shell

Nitrogen determination

COCONUT SHELL

N%	RSD%
0.102	1.96
0.100	
0.104	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard volume:	50 -60 mg	
Sample volume:	150 - 200 mg	

Note

Set category A (OxyTune®) for sample.
The sample adsorb humidity, it was dried at 105°C for 2 hours.



Analytical - Nitrogen/Protein

Pharmaceutical

- Collagen
- Pharmaceutical Tablets
- Nicotinic

Collagen

Nitrogen determination

COLLAGEN

Sample	N%	RSD%
1	0.5961	2.8705
	0.6050	
	0.6299	
2	0.6666	1.9595
	0.6412	
	0.6512	
3	0.6011	3.7473
	0.5988	
	0.6397	

Analytical conditions

Helium Carrier Gas 150 ml/min
Oxygen 300 ml/min
Oxygen Injection Time 15 sec
Sample Delay Time 10 sec

Sample information

Standard: Atropine 4.84 N%
Standard weight: 5.0 - 6.0 mg
Sample weight: 70 - 100 mg

Note

Samples were weighed in tin containers (p/n 252 08000).
Swift sample preparation is vital as weight loss can be observed on the microbalance display.



Analytical - Nitrogen/Protein

Pharmaceutical

- Collagen
- Pharmaceutical Tablets
- Nicotinic

Pharmaceutical Tablets

Nitrogen determination

PHARMACEUTICAL TABLETS

N%	Average N%	RSD%
1.0701		
1.0511		
1.1293		
1.1229		
1.1019	1.1015	2.1952
1.1181		
1.1152		
1.0978		
1.1016		
1.1068		

Analytical conditions

Standard: Atropine 4.84 N%
Standard weight: 60 mg
Sample weight: 200 - 300 mg

Analytical conditions

Oxygen Injection Time 60 seconds, sample delay 8 seconds.

Note

The samples must be cut into small pieces before weighing.



Analytical - Nitrogen/Protein

Pharmaceutical

- Collagen
- Pharmaceutical Tablets
- Nicotinic

Nicotinic

Nitrogen determination

NICOTINIC ACID (11.38 N%)

N%	RSD%
11.36	0.24
11.39	
11.40	
11.39	
11.42	
11.41	
11.41	
11.33	
11.36	
11.37	

Analytical conditions

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 100 mg
Sample weight: 50 - 100 mg

Note

Oxygen Injection Time 30 seconds.



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Analytical - Nitrogen/Protein

Sauces

- Pesto Sauce
- Soy Sauce
- Soy and Fish Asian Sauces

Pesto Sauce

Nitrogen determination

PESTO SAUCE

N%	RSD%	Protein %	RSD%
0.95	0.62	5.94	0.63
0.94		5.87	
0.95		5.91	

Sample information

Standard: Aspartic acid 10.52 N%
 Standard weight: 50 - 60 mg
 Sample weight: 100 - 120 mg

Note

Set a new category (OxyTune®, δ 3.3) for samples.
 The sample must be weighed in Tin disk 35 mm diam. (p/n 252 08018).
 The 6.25 factor was used to calculate the Protein content.



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Analytical - Nitrogen/Protein

Sauces

- Pesto Sauce
- Soy Sauce
- Soy and Fish Asian Sauces

Soy Sauce

Nitrogen determination

SOY SAUCE

Sample	N%	Protein %	RSD%
1	0.6135	3.8346	0.384
	0.6134	3.8339	
	0.6176	3.8598	
2	0.8181	5.1132	0.144
	0.8207	5.1293	
	0.8186	5.1161	
	0.8190	5.1188	
	0.8206	5.1287	

Sample information

Standard:

Aspartic acid

10.52 N%

Standard weight:

50 - 100 mg

Sample weight:

100 - 200 mg

OxyTune® Category:

B

Note

Sample was absorbed on about 30 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 375530).



Analytical - Nitrogen/Protein

Sauces

- Pesto Sauce
- Soy Sauce
- Soy and Fish Asian Sauces

Soy and Fish Asian Sauces

Nitrogen determination

SOY AND FISH ASIAN SAUCES

Sample Name	N%	RSD%	Prot.%	RSD%
Soy sauce 1	0.91	0.49	5.69	0.29
	0.91		5.66	
	0.90		5.66	
	0.91		5.66	
	0.91		5.69	
Soy sauce 2	0.48	1.15	2.99	1.55
	0.48		2.99	
	0.47		2.93	
	0.48		3.03	
	0.47		2.92	
Soy sauce 3	2.23	0.38	13.92	0.36
	2.21		13.83	
	2.21		13.80	
	2.22		13.90	
	2.22		13.85	
Fish sauce 1	1.40	0.78	8.74	0.72
	1.40		8.74	
	1.39		8.69	
	1.42		8.86	
	1.40		8.74	
Fish sauce 2	0.85	0.53	5.31	0.43
	0.84		5.25	
	0.85		5.29	
	0.85		5.30	
	0.85		5.29	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 - 70 mg
Sample weight: 200 - 300 mg

Note

Select Category B (OxyTune®) for sample analysis.
Asian sauces were weighed in tin containers adsorbed on 30-40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) inert material.
The protein factor used to calculate the protein content was 6.25.

Analytical - Nitrogen/Protein

Sauces

- Pesto Sauce
- Soy Sauce
- Soy and Fish Asian Sauces

Soy and Fish Asian Sauces

Nitrogen determination

SOY AND FISH ASIAN SAUCES

N/Protein Determination by Single Combustion / Reduction Reactor				
Sample Name	N%	RSD%	Prot. %	RSD%
Soy sauce 1	0.91	0.99	5.68	0.72
	0.90		5.65	
	0.89		5.59	
	0.91		5.69	
	0.91		5.68	
Soy sauce 2	0.47	1.50	2.96	1.01
	0.48		2.98	
	0.46		2.90	
	0.47		2.94	
	0.47		2.95	
Soy sauce 3	2.20	0.25	13.72	0.33
	2.21		13.83	
	2.20		13.76	
	2.20		13.75	
	2.21		13.81	
Fish sauce 1	1.40	0.64	8.77	0.81
	1.40		8.77	
	1.38		8.61	
	1.39		8.70	
	1.40		8.77	
Fish sauce 2	0.83	0.53	5.19	0.49
	0.84		5.23	
	0.84		5.23	
	0.84		5.24	
	0.84		5.26	

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 60 - 70 mg
Sample weight: 130 - 140 mg

Note

Select Category B (OxyTune®) for sample analysis.
Asian sauces were weighed in tin containers adsorbed on 30-40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) inert material.
The protein factor used to calculate the protein content was 6.25.

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Flowers

Nitrogen determination

BEANS - EGGPLANT - FLOWERS - FRUIT - GRASS - PLANTS - WHEAT

Sample	N%
Carrots (root)	1.019
Sprouts	3.409
Broad beans (bark)	2.466
Mango tree (leaves)	1.311
Summer wheat	2.123
Parsley	3.956
Chervil	4.368
Clover (honey-stalk)	1.277
Chives	3.739
Rose (plant) A	1.913
Rose (plant) B	1.700
Rose (plant) C	1.494
Aubergine (plant)	1.556
Grass (GR 94)	2.864
Medlar (fruit)	0.465

Sample information

Standard:	Tomato Leaves Reference Materia (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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Flowers

Nitrogen determination

BARLEY- FLOWERS - GRASS - MAIZE - OIL PALM - WHEAT

Sample	N%
Rose (plant) 4	1.283
Sprouts 2	1.884
Rose (plant) 5	1.349
Oil palm (leaf) 1	2.571
Wheat (straw)	0.448
Oil palm (leaf) 2	2.655
Maize (plant) 1	1.843
Grass	2.482
Gladiolus (bulb)	1.074
Maize (plant) 2	1.516
Acacia (leaf)	4.227
Grass (mixture)	3.348
Wheat (grain) 1	1.288
Strawberry (plant)	1.814
Barley (grain) 1	1.833

Sample information

Standard:	Tomato Leaves	
	Reference Materia (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	200 mg	
OxyTune® Category:	A	

Note

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Forage

Nitrogen determination

FORAGE

N%	RSD%
1.10	0.91
1.11	
1.09	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	50 - 100 mg	
Sample weight:	190 - 200 mg	

Note

Select Category B (OxyTune®) for sample analysis.



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Forage

Nitrogen determination

FORAGE

N%	RSD%
1.09	0.53
1.08	
1.09	

Sample information

Standard:	Aspartic acid	10.52 N%
Standard weight:	60 - 70 mg	
Sample weight:	125 - 140 mg	

Note

Select Category B (OxyTune®) for sample analysis.



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Fruit

Nitrogen determination

BEANS - EGGPLANT - FLOWERS - FRUIT - GRASS - PLANTS - WHEAT

Sample	N%
Carrots (root)	1.019
Sprouts	3.409
Broad beans (bark)	2.466
Mango tree (leaves)	1.311
Summer wheat	2.123
Parsley	3.956
Chervil	4.368
Clover (honey-stalk)	1.277
Chives	3.739
Rose (plant) A	1.913
Rose (plant) B	1.700
Rose (plant) C	1.494
Aubergine (plant)	1.556
Grass (GR 94)	2.864
Medlar (fruit)	0.465

Sample information

Standard:	Tomato Leaves Reference Materia (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

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Grass

Nitrogen determination

BEANS - EGGPLANT - FLOWERS - FRUIT - GRASS - PLANTS - WHEAT

Sample	N%
Carrots (root)	1.019
Sprouts	3.409
Broad beans (bark)	2.466
Mango tree (leaves)	1.311
Summer wheat	2.123
Parsley	3.956
Chervil	4.368
Clover (honey-stalk)	1.277
Chives	3.739
Rose (plant) A	1.913
Rose (plant) B	1.700
Rose (plant) C	1.494
Aubergine (plant)	1.556
Grass (GR 94)	2.864
Medlar (fruit)	0.465

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

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Grass

Nitrogen determination

BARLEY- FLOWERS - GRASS - MAIZE - OIL PALM - WHEAT

Sample	N%
Rose (plant) 4	1.283
Sprouts 2	1.884
Rose (plant) 5	1.349
Oil palm (leaf) 1	2.571
Wheat (straw)	0.448
Oil palm (leaf) 2	2.655
Maize (plant) 1	1.843
Grass	2.482
Gladiolus (bulb)	1.074
Maize (plant) 2	1.516
Acacia (leaf)	4.227
Grass (mixture)	3.348
Wheat (grain) 1	1.288
Strawberry (plant)	1.814
Barley (grain) 1	1.833

Sample information

Standard:	Tomato Leaves	
	Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	200 mg	
OxyTune® Category:	A	

Note

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Grass

Nitrogen determination

BARLEY - GRASS - MAIZE - OATS - OIL PALM - SAW DUST - WHEAT

Sample	N%
Oil palm (leaf) 3	2.705
Oats (straw)	0.736
Wheat (grain) 2	1.932
Farine de Lucerne (animal food)	2.554
Summer barley (grain)	1.964
Spinach	4.582
Yam	1.694
Grass (GR 94) 2	2.864
Rose (Plant) 6	1.295
Barley (grain) 2	1.719
Oil palm (leaf) 4	2.566
Maize (plant) 3	1.268
Barley (straw)	0.433
Saw-dust (forest trees)	0.508
Maize	1.821

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

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Oil Palm

Nitrogen determination

BARLEY- FLOWERS - GRASS - MAIZE - OIL PALM - WHEAT

Sample	N%
Rose (plant) 4	1.283
Sprouts 2	1.884
Rose (plant) 5	1.349
Oil palm (leaf) 1	2.571
Wheat (straw)	0.448
Oil palm (leaf) 2	2.655
Maize (plant) 1	1.843
Grass	2.482
Gladiolus (bulb)	1.074
Maize (plant) 2	1.516
Acacia (leaf)	4.227
Grass (mixture)	3.348
Wheat (grain) 1	1.288
Strawberry (plant)	1.814
Barley (grain) 1	1.833

Sample information

Standard:

Tomato Leaves
Reference Material (NIST SRM. 1573) 3.03 N%

Standard weight:
80 mg

Sample weight:
200 mg

OxyTune® Category:
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Note

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Oil Palm

Nitrogen determination

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Sample	N%
Oil palm (leaf) 3	2.705
Oats (straw)	0.736
Wheat (grain) 2	1.932
Farine de Lucerne (animal food)	2.554
Summer barley (grain)	1.964
Spinach	4.582
Yam	1.694
Grass (GR 94) 2	2.864
Rose (Plant) 6	1.295
Barley (grain) 2	1.719
Oil palm (leaf) 4	2.566
Maize (plant) 3	1.268
Barley (straw)	0.433
Saw-dust (forest trees)	0.508
Maize	1.821

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

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Oil Seed

Nitrogen determination

BEANS - OIL SEED - PLANTS

Sample	N%		
Beans	5.24	5.27	5.28
Oil seed rape	3.74	3.72	3.71
Kale leaf	2.37	2.37	2.38

Sample information

Standard: Acetanilide 10.36 N%
Standard weight: 30 - 40 mg
Sample weight: 100 - 200 mg
OxyTune® Category: A

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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Plants

Nitrogen determination

BEANS - EGGPLANT - FLOWERS - FRUIT - GRASS - PLANTS - WHEAT

Sample	N%
Carrots (root)	1.019
Sprouts	3.409
Broad beans (bark)	2.466
Mango tree (leaves)	1.311
Summer wheat	2.123
Parsley	3.956
Chervil	4.368
Clover (honey-stalk)	1.277
Chives	3.739
Rose (plant) A	1.913
Rose (plant) B	1.700
Rose (plant) C	1.494
Aubergine (plant)	1.556
Grass (GR 94)	2.864
Medlar (fruit)	0.465

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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Nitrogen determination

PLANTS

Sample	N%		
A	0.390	0.414	0.420
B	1.963	1.989	1.986
C	1.852	1.907	1.864
D	1.780	1.784	1.767
E	0.678	0.686	0.683
F	2.772	2.771	2.831
G	4.160	4.121	4.150
H	1.387	1.288	1.304
J	2.799	2.786	2.715
K	1.629	1.565	1.611
L	1.518	1.498	1.467
M	3.443	3.398	3.437

Sample information

Standard: Aspartic acid 10.52 N%
Standard weight: 50 mg
Sample weight: 100 - 200 mg
OxyTune® Category: A

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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Nitrogen determination

BEANS - OIL SEED - PLANTS

Sample	N%		
Beans	5.24	5.27	5.28
Oil seed rape	3.74	3.72	3.71
Kale leaf	2.37	2.37	2.38

Sample information

Standard: Acetanilide 10.36 N%
Standard weight: 30 - 40 mg
Sample weight: 100 - 200 mg
OxyTune® Category: A

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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Nitrogen determination

PLANTS

Sample	N%	RSD%
1	0.680	0.10
	0.679	
2	1.82	0.78
	1.80	
3	2.55	0.28
	2.56	
4	3.39	0.42
	3.41	
5	4.60	0.31
	4.58	
6	3.90	0.15
	3.89	
	3.90	
7	3.48	0.44
	3.46	
	3.45	
8	1.73	0.66
	1.75	
	1.75	

Sample information

Standard: Aspartic acid 10.52 N%

Standard weight: 50 - 80 mg

Sample weight: 200 - 250 mg

Note

Select Category B (OxyTune®) for plants samples.
Samples were homogenized by a ball mill.



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Saw Dust

Nitrogen determination

BARLEY - GRASS - MAIZE - OATS - OIL PALM - SAW DUST - WHEAT

Sample	N%
Oil palm (leaf) 3	2.705
Oats (straw)	0.736
Wheat (grain) 2	1.932
Farine de Lucerne (animal food)	2.554
Summer barley (grain)	1.964
Spinach	4.582
Yam	1.694
Grass (GR 94) 2	2.864
Rose (Plant) 6	1.295
Barley (grain) 2	1.719
Oil palm (leaf) 4	2.566
Maize (plant) 3	1.268
Barley (straw)	0.433
Saw-dust (forest trees)	0.508
Maize	1.821

Sample information

Standard:	Tomato Leaves Reference Material (NIST SRM. 1573)	3.03 N%
Standard weight:	80 mg	
Sample weight:	100 - 200 mg	
OxyTune® Category:	A	

Note

Samples have been treated in a rotary mill after drying (1 mm granulometry).



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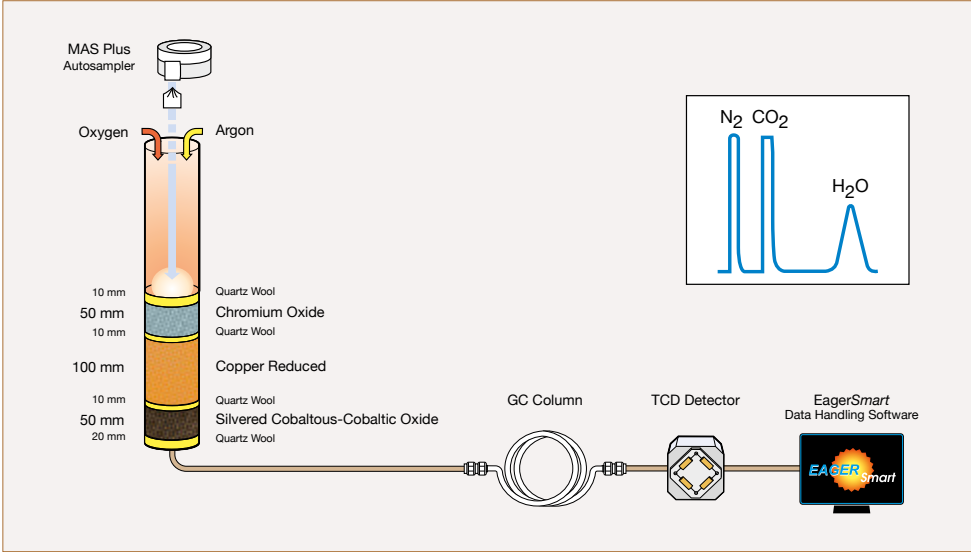
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ANALYTICAL CONFIGURATIONS - CHN DETERMINATION



Analytical conditions		
Pressure (kPa)	Ar	400
Pressure (kPa)	Oxygen	300
Flow (ml/min)	Ar measurement	70
	Ar reference	70
	Oxygen	250
Temperature (°C)	Left	950
	Right	0
	Oven	95 (GC column inside the oven)
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	
Cycle (Run Time)	800 sec	

List of consumables	p/n
Chromium oxide (25 g)	338 22900
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 35312
Quartz wool (5 g)	338 22200
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Multiseparation column (PTFE, 2 m, 6x5 mm)	260 08220

Note
The EagerSmart Data Handling Software provides the option AGO (Argon Gas Option) which allows the modification of the Argon carrier flow during the run to optimize the analysis according to the sample matrix.



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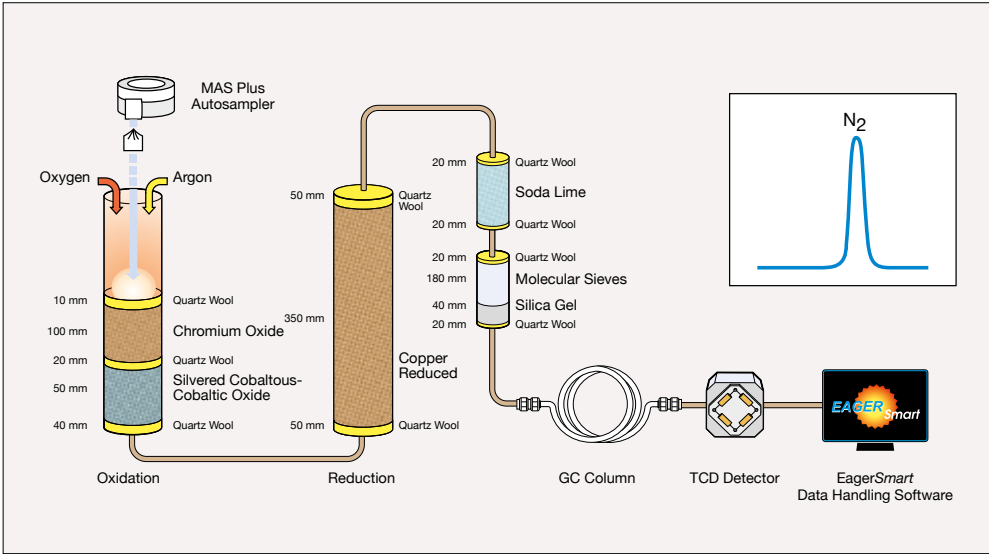
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ANALYTICAL CONFIGURATIONS - N Org determination



Analytical conditions		
Pressure (kPa)	Ar	300
Pressure (kPa)	Oxygen	300
Flow (ml/min)	Ar measurement	50
	Ar reference	50
	Oxygen	300
Temperature (°C)	Left	950
	Right	840
	Oven	50 (GC column inside the oven)
Oxygen Injection Time	7 sec	
Sample Delay Time	12 sec	
Cycle (Run Time)	700 - 800 sec	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Silvered cobaltous -cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 35312
Soda lime (100 g)	338 35235
Silicagel plus indicator (100 g)	338 40035
Quartz wool (5g)	338 22200
Molecular sieve 3A(100g)	338 01801
Chromosorb WAW (25 g)	338 37530
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Adsorption trap (large)	281 13064
Nitrogen separation column (PTFE, 1.0 m, 8x6 mm)	260 70004

Note
The EagerSmart Data Handling Software provides the option AGO (Argon Gas Option) which allows the modification of the Argon carrier flow during the run to optimize the analysis according to the sample matrix.



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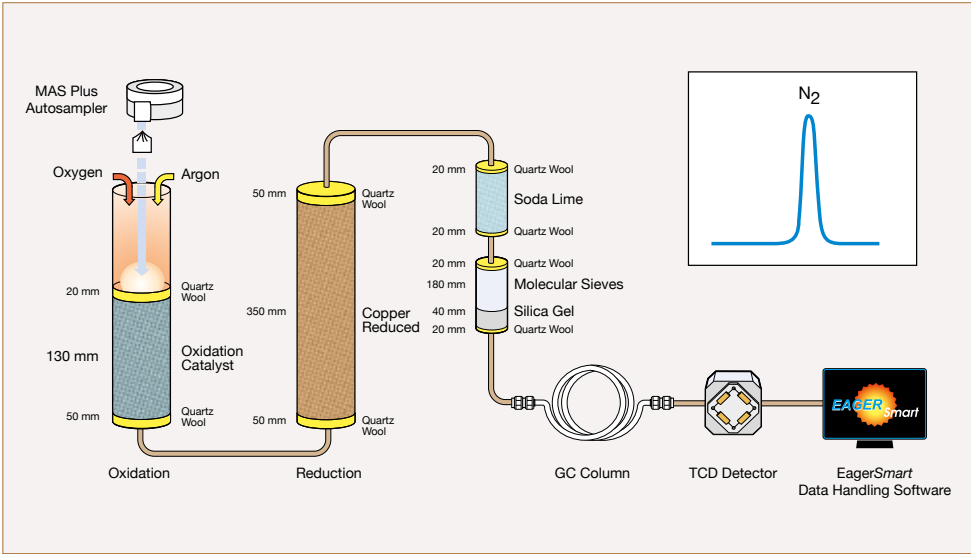
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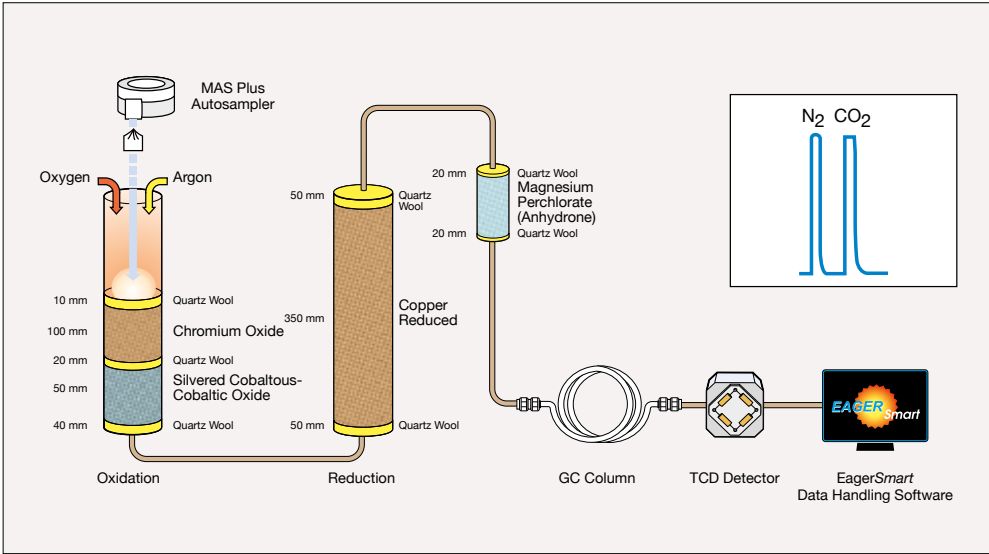
Analytical conditions		
Pressure (kPa)	Ar	300
Pressure (kPa)	Oxygen	300
Flow (ml/min)	Ar measurement	60
	Ar reference	60
	Oxygen	300
Temperature (°C)	Left	950
	Right	840
	Oven	50 (GC column inside the oven)
Oxygen Injection Time	20 sec	
Sample Delay Time	12 sec	
Cycle (Run Time)	700 - 800 sec	

List of consumables	p/n
Oxidation catalyst (40 g)	338 40000
High quality copper (50 g)	338 35312
Quartz wool (5 g)	338 22200
Soda lime (100 g)	338 35235
Molecular sieve (100 g)	338 01801
Silicagel plus indicator (100 g)	338 40035
Prepacked HPAR reactor	468 02008
HPAR crucible	252 05011
Empty HPAR reactor	468 20075
Adsorption trap (large)	281 13064
Nitrogen separation column (PTFE; 1m; 8x6 mm)	260 70004

Note
The EagerSmart Data Handling Software provides the option AGO (Argon Gas Option) which allows the modification of the Argon carrier flow during the run to optimize the analysis according to the sample matrix.



ANALYTICAL CONFIGURATIONS - NC Org determination



Analytical conditions		
Pressure (kPa)	Ar	400
Pressure (kPa)	Oxygen	300
Flow (ml/min)	Ar measurement	50
	Ar reference	50
	Oxygen	250
Temperature (°C)	Left	950
	Right	840
	Oven	95 (GC column inside the oven)
Oxygen Injection Time	7 sec	
Sample Delay Time	12 sec	
Cycle (Run Time)	700 - 800 sec	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 35312
Magnesium perchlorate (Anhydrous) 100 g	338 21900
Quartz wool (5 g)	338 22200
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Adsorption trap (small)	281 13104
Multiseparation column (SS, 5 m, 6x5 mm)	

Note
The EagerSmart Data Handling Software provides the option AGO (Argon Gas Option) which allows the modification of the Argon carrier flow during the run to optimize the analysis according to the sample matrix.



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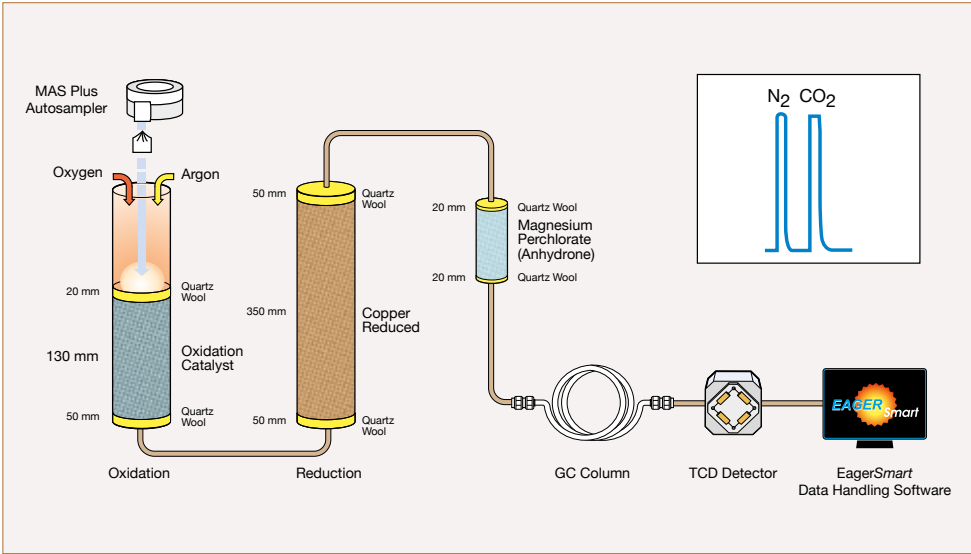
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ANALYTICAL CONFIGURATIONS - NC Soils determination



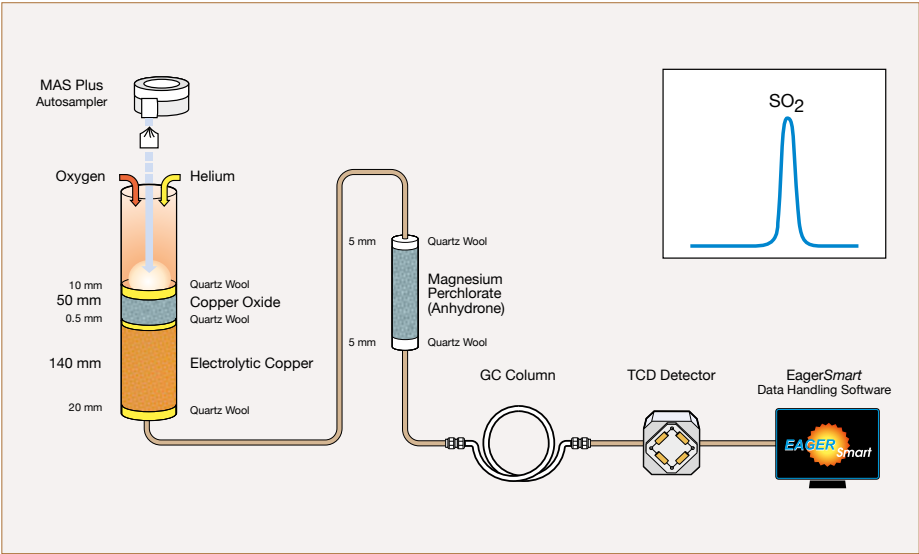
Analytical conditions		
Pressure (kPa)	Ar	400
Pressure (kPa)	Oxygen	300
Flow (ml/min)	Ar meas.	60
	Ar reference	60
	Oxygen	250
Temperature (°C)	Left	950
	Right	840
	Oven	95 (GC column inside the oven)
Oxygen Injection Time	10 - 20 sec	
Sample Delay Time	12 sec	
Cycle (Run Time)	800 - 900 sec	

List of consumables	p/n
Oxidation catalyst (40 g)	338 40000
High quality copper (50 g)	338 35312
Magnesium perchlorate (Anhydron) 100 g	338 21900
Quartz wool	338 22200
Prepacked HPAR reactor	468 02008
HPAR crucible	252 05011
Empty quartz reactor (set of 2)	468 20070
Adsorption trap (small)	281 13104
Multiseparation column (SS, 5 m, 6x5 mm)	260 07950

Note
The EagerSmart Data Handling Software provides the option AGO (Argon Gas Option) which allows the modification of the Argon carrier flow during the run to optimize the analysis according to the sample matrix.
The Oxygen Injection Time can be change according to the matrix.



ANALYTICAL CONFIGURATIONS - SULFUR DETERMINATION



Analytical conditions		
Pressure (kPa)	Ar	350
	Oxygen	350
Flow (ml/min)	Ar measurement	80
	Ar reference	80
	Oxygen	250
Temperature (°C)	Left	950
	Right	0
	Oven	60
Cycle (Run Time)	500 sec	
Oxygen Injection Time	5 sec	
Sample delay Time	12 sec	

List of consumables	p/n
Copper oxide (50 g)	338 21710
Electrolytic copper (70 g)	338 35313
Vanadium pentoxide (1 g)	338 37510
Magnesium perchlorate (Anhydrous) 100 g	338 21900
Quartz wool (5 g)	338 22200
Pre-packed quartz reactor for CHNS/NCS	468 02015
Empty quartz reactor (set of 2)	468 20070
Quartz crucible	252 04510
Adsorption trap (small)	281 13104
Sulfur separation column (PTFE, 0.8 m, 6x5 mm)	260 07800

Note
The EagerSmart Data Handling Software provides the option “AGO” (Argon Gas Option) through which allows the modification of the Argon carrier Flow during the run to optimize the analysis according to the sample matrix.
The polarity of the TCD detector is set in positive.



PERFORMANCE TEST - ANALYTICAL VALIDATION TEST OF CHN ANALYSIS

Sequence of analysis and theoretical values

Run	Sample name	Type	Weight (mg)	Theoretical values			Acceptable range (±)		
				N%	C%	H%	N	C	H
1	Nicotinamide	STD	3.020	22.94	59.01	4.95	± 0.20	± 0.30	± 0.08
2		STD	3.213						
3		STD	3.269						
4		STD	3.378						
5		STD	3.545						
6	CEDFNI	UNK	3.344	20.14	51.79	5.07	± 0.20	± 0.30	± 0.08
7		UNK	3.395						
8		UNK	3.305						
9		UNK	3.315						
10		UNK	3.384						

Experimental CHN data of CEDFNI

Nitrogen			Carbon			Hydrogen		
%	Average %	RSD%	%	Average %	RSD%	%	Average %	RSD%
20.28	20.21	0.49	51.71	51.74	0.26	5.12	5.10	0.32
20.07			51.63			5.10		
20.16			51.59			5.11		
20.32			51.83			5.08		
20.24			51.92			5.09		

Note
The response of the system using argon as carrier gas was evaluated analyzing Nicotinamide as standard to calibrate the instrument using Linear Fit as calibration method and CEDFNI (cyclohexanone-2,4-dinitrophenylhydrazone) as unknown.
The AGO (Argon Gas Option) used was 0/30/170.



PERFORMANCE TEST - REPEATABILITY AND ACCURACY OF CHN ANALYSIS

Sequence of standards for the Linear Fit calibration

Run	Sample name	Type	Weight (mg)	N%	C%	H%
1	Atropine	STD	2.200	4.84	70.56	8.01
2		STD	2.548			
3		STD	2.989			
4	Acetanilide	STD	2.140	10.36	71.09	6.71
5		STD	2.528			
6		STD	2.968			
7	Nicotinamide	STD	2.240	22.94	59.01	4.95
8		STD	2.551			
9		STD	2.939			
10	Aspartic Acid	STD	3.725	10.52	36.09	5.30
11		STD	4.025			
12		STD	4.312			

CHN theoretical values and accepted range of pure organic standards

Standard	Nitrogen		Carbon		Hydrogen	
	%	Acceptable range	%	Acceptable range	%	Acceptable range
Acetanilide	10.36	± 0.10	71.09	± 0.30	6.71	± 0.10
Atropine	4.84	± 0.07	70.56	± 0.30	8.01	± 0.10
Nicotinamide	22.94	± 0.22	59.01	± 0.30	4.95	± 0.08
Aspartic Acid	10.52	± 0.10	36.09	± 0.30	5.30	± 0.08
CEDFNI*	20.14	± 0.20	51.79	± 0.30	5.07	± 0.08
Methionine	9.39	± 0.10	40.25	± 0.30	7.43	± 0.10
Sulfanilamide	16.27	± 0.16	41.84	± 0.30	4.68	± 0.07
Benzoic Acid	NA	NA	68.85	± 0.30	4.95	± 0.08
BBOT**	6.51	± 0.10	72.53	± 0.30	6.09	± 0.10



PERFORMANCE TEST - REPEATABILITY AND ACCURACY OF CHN ANALYSIS

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Repeatability and accuracy of pure organic standards.

Run	Sample name	Weight (mg)	N%	RSD%	C%	RSD%	H%	RSD%
1	Atropine	2.561	4.84	0.21	70.29	0.18	8.01	0.13
2		2.706	4.85		70.54		7.98	
3		2.791	4.86		70.55		8.00	
4	Acetanilide	2.654	10.28	0.10	71.35	0.05	6.72	0.09
5		2.862	10.27		71.34		6.72	
6		2.733	10.26		71.28		6.73	
7	Nicotinamide	2.924	22.86	0.11	59.02	0.27	4.98	0.53
8		2.792	22.93		58.74		4.93	
9		2.666	22.91		59.02		4.97	
10	Aspartic Acid	3.908	10.56	0.09	36.13	0.42	5.34	0.19
11		3.795	10.48		36.03		5.32	
12		3.952	10.54		36.33		5.33	
13	CEDFNI*	3.292	20.27	0.79	52.01	0.05	5.12	0.29
14		3.348	20.26		52.02		5.09	
15		3.395	19.95		52.06		5.10	
16	Benzoic Acid	2.094	0	-	69.06	0.09	4.95	0.64
17		2.029	0		69.01		5.00	
18		2.107	0		69.14		5.01	
19	Cystine	4.007	11.70	0.29	29.85	0.28	4.99	0.41
20		4.122	11.69		29.88		5.03	
21		4.141	11.63		29.72		5.02	
22	Methionine	3.974	9.43	0.05	40.51	0.05	7.40	0.43
23		4.251	9.42		40.53		7.39	
24		4.123	9.43		40.49		7.34	
25	BBOT**	1.707	6.60	0.93	72.56	0.15	6.14	0.00
26		1.781	6.47		72.78		6.14	
27		1.740	6.53		72.70		6.14	

* CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone

** BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

Note

Instrument calibration was performed with atropine, acetanilide and aspartic acid standards (STD) using Linear Fit as calibration method. Several pure organic standards in a large range of concentration were analyzed as unknown. The AGO (Argon Gas Option) used was 0/30/170.



PERFORMANCE TEST - ANALYTICAL VALIDATION TEST OF N ANALYSIS

Sequence of analysis and theoretical values

Run	Sample name	Type	Weight (mg)	Theoretical N%	Acceptable Range N%
1	CEDFNI	STD	3.354	20.14	19.94 - 20.34
2		STD	5.016		
3		STD	4.550		
4	Acetanilide	UNK	6.496	10.36	10.26 - 10.46
5		UNK	7.069		
6		UNK	5.995		
7		UNK	6.625		
8		UNK	6.176		

Experimental Nitrogen data of Acetanilide

N%	Average N%	RSD%
10.35	10.36	0.55
10.45		
10.35		
10.36		
10.29		

Note
The response of the system using argon as carrier gas was evaluated analyzing CEDFNI (cyclohexanone-2,4-dinitrophenylhydrazone) as standard to calibrate the instrument using Linear Fit as calibration method and acetanilide as unknown.
The AGO (Argon Gas Option) used was 10/60/200.



PERFORMANCE TEST - ANALYTICAL VALIDATION TEST OF N LUBRICANT ANALYSIS

Sequence of analysis and theoretical values

Run	Sample name	Type	Weight (mg)	Theoretical N%	Acceptable Range N%
1	Atropine	STD	20.738	4.84	4.77 - 4.91
2		STD	19.369		
3		STD	20.052		
4	Thermo Scientific Lubricant Reference Material	UNK	32.762	1.181	1.071 - 1.291
5		UNK	32.051		
6		UNK	35.749		
7		UNK	33.711		
8		UNK	35.235		

Experimental Nitrogen data of Thermo Scientific Lubricant Reference Material

N%	Average N%	RSD%
1.161	1.186	1.297
1.181		
1.192		
1.194		
1.200		

Note
The response of the system using argon as carrier gas was evaluated analyzing Atropine as standard to calibrate the system using K factor as calibration method and the Thermo Scientific Lubricant Reference Material analyzed as unknown.
The AGO (Argon Gas Option) used was 30/80/200.



PERFORMANCE TEST - DAY BY DAY REPRODUCIBILITY (N LUBRICANT CONFIGURATION)

Day by day reproducibility in N determination using argon as carrier gas

Run Day	February Date	Sample	N%	Av. N%	RSD %	Sample	N%	Av. N%	RSD %
1	10	Atropine	4.868	4.87	0.560	Lubricant	1.178	1.186	0.999
2	11		4.894				1.177		
3	12		4.888				1.178		
4	13		4.885				1.188		
5	14		4.895				1.182		
6	17		4.886				1.184		
7	18		4.900				1.198		
8	19		4.836				1.187		
9	20		4.893				1.204		
10	21		4.816				1.188		
11	24		4.895				1.182		
12	25		4.789				1.195		

Note
The stability of the system using argon as carrier gas was verified though the analysis of 19 - 21 mg of Atropine standard (4.84 N%, accepted range 4.79 - 4.91 N%) and 30 - 35 mg of Thermo Scientific Lubricant Reference Material (accepted range 1.184 - 1.224 N%) analyzed as unknown for 12 days.
Calibration was performed with 19 - 21 mg of Atropine using K factor as calibration method.
During the 12 days different maintenance were performed as follows: in day 3 the argon cylinder was replacement, in day 8 oxygen cylinder was replaced while in day 11 the crucible was cleaned and the CO₂ and H₂O traps filling were replaced.
Every evening and every weekend the instrument remain in Stand-By mode to reduce the consume of argon gas.



PERFORMANCE TEST - ANALYTICAL VALIDATION TESTS OF NC ANALYSIS (TEST 1)

Sequence of analysis and theoretical values

Run	Sample name	Type	Weight (mg)	Theoretical			
				N%	C%	N%	C%
1	CEDFNI	STD	1.316	20.14	51.79	19.94 - 20.34	51.49 - 52.09
2		STD	2.555				
3		STD	4.227				
4		STD	5.898				
5		STD	7.885				
7	Acetanilide	UNK	4.219	10.36	71.09	10.26 - 10.46	70.79 - 71.39
8		UNK	4.734				
9		UNK	4.464				
10		UNK	4.391				
11		UNK	4.891				

Experimental NC data of Acetanilide

N%	Average N%	RSD%	C%	Average C%	RSD%
10.31	10.25	0.47	71.27	71.23	0.14
10.29			71.17		
10.34			71.34		
10.40			71.08		
10.34			71.19		

Note
The response of the system using argon as carrier gas was evaluated analyzing CEDFNI (cyclohexanone-2,4-dinitrophenylhydrazone) as standard to calibrate the instrument using Linear Fit as calibration method and acetanilide as unknown.
The AGO (Argon Gas Option) used was 10/60/200.



PERFORMANCE TEST - ANALYTICAL VALIDATION TESTS OF NC ANALYSIS (TEST 2)

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Sequence of analysis and theoretical values

Run	Sample name	Type	Weight (mg)	Theoretical		Acceptable range	
				N%	C%	N%	C%
1	Atropine	STD	3.990	4.84	70.56	4.77 - 4.91	70.26 - 70.86
2		STD	5.183				
3	Acetanilide	STD	4.367	10.36	71.09	10.26 - 10.46	70.69 - 71.39
4		STD	4.942				
5	Nicotinamide	STD	4.119	22.94	59.01	22.72 - 23.16	58.71 - 59.31
6		STD	4.909				
7	CEDFNI	UNK	4.235	20.14	51.79	19.94 - 21.34	51.39 - 52.09
8	CEDFNI	UNK	4.780				
9	CEDFNI	UNK	4.152				
10	CEDFNI	UNK	4.820				
11	CEDFNI	UNK	5.317				

Experimental NC data of CEDFNI

N%	Average N%	RSD%	C%	Average C%	RSD%
20.26	20.23	0.33	51.52	51.68	0.23
20.27			51.78		
20.28			51.58		
20.12			51.75		
20.22			51.75		

Note

The response of the system using argon as carrier gas was evaluated analyzing atropine, acetanilide and Nicotinamide as standard to calibrate the instrument using Linear Fit as calibration method and CEDFNI (cyclohexanone-2,4-dinitrophenylhydrazone) as unknown.
The AGO (Argon Gas Option) used was 10/60/200.



PERFORMANCE TEST - ANALYTICAL VALIDATION TEST OF NC SOILS ANALYSIS

Sequence of analysis and theoretical values

Run	Sample name	Type	Weight (mg)	Theoretical N%		Acceptable range	
				N%	C%	N%	C%
1	Aspartic acid	STD	4.946	10.52	36.09	10.42 - 10.62	35.81 - 36.36
2		STD	4.770				
3		STD	4.476				
4	Thermo Scientific Lubricant Reference Material	UNK	85.521	0.21	2.29	0.01	0.07
5		UNK	93.640				
6		UNK	92.110				
7		UNK	83.891				
8		UNK	90.097				

Experimental NC data of thermo Scientific Soil Reference Material

N%	Average N%	RSD%	C%	Average C%	RSD%
0.213	0.212	0.776	2.234	2.247	0.620
0.213			2.255		
0.212			2.246		
0.212			2.267		
0.209			2.235		

Note
The response of the system using argon as carrier gas was evaluated analyzing aspartic acid as standard to calibrate the instrument using Linear Fit as calibration method and Thermo Scientific Soil Reference Material as unknown.
The AGO (Argon Gas Option) used was 25/55/250.



PERFORMANCE TEST - REPEATABILITY AND ACCURACY (NC SOILS CONFIGURATION)

Sequence of standards for the Linear Fit calibration

Run	Sample name	Type	Weight (mg)	N%	C%
1	Atropine	STD	14.049	4.84	4.84
2		STD	15.062		
3	Acetanilide	STD	14.027	10.36	71.09
4		STD	15.031		
5	Aspartic Acid	STD	14.062	10.52	36.09
6		STD	15.181		
7	Nicotinamide	STD	14.005	22.94	59.01
8		STD	15.038		
9	Imidazol	STD	13.937	41.15	52.93
10		STD	15.256		

NC theoretical values and accepted range of pure organic standards

Standard	Nitrogen		Carbon	
	%	Acceptable range	%	Acceptable range
Atropine	4.84	± 0.07	70.56	± 0.30
Acetanilide	10.36	± 0.10	71.09	± 0.30
Aspartic Acid	10.52	± 0.10	36.09	± 0.30
Nicotinamide	22.94	± 0.22	59.01	± 0.30
Imidazole	41.15	± 0.30	52.93	± 0.30
CEDFNI*	20.14	± 0.20	51.79	± 0.30
BBOT**	6.51	± 0.10	72.53	± 0.30
Cystine	11.66	± 0.12	29.99	± 0.28
Methionine	9.39	± 0.10	40.25	± 0.30
Sulfanilamide	16.27	± 0.16	41.84	± 0.30
EDTA***	9.59	± 0.10	41.15	± 0.30

* CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone
** BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene
*** EDTA: EthyleneDiamineTetraAcetic acid



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PERFORMANCE TEST - REPEATABILITY AND ACCURACY (NC SOILS CONFIGURATION)

Repeatability and accuracy of pure organic standards.

Run No.	Sample name	Weight (mg)	Experimental			
			N%	RSD%	C%	RSD%
1	Atropine	14.143	4.90	0.14	70.58	0.20
2		15.110	4.89		70.38	
3	Acetanilide	14.024	10.44	0.07	71.12	0.27
4		15.029	10.43		70.85	
5	Aspartic Acid	14.001	10.42	0	36.08	0.46
6		15.065	10.42		36.32	
7	Nicotinamide	13.976	22.88	0.19	59.15	0.26
8		15.018	22.82		58.93	
9	Imidazol	13.987	41.10	0.07	52.80	0.09
10		14.944	41.06		52.73	
11	CEDFNI*	14.049	19.98	0.18	52.11	0.45
12		14.936	20.03		51.78	
13	BBOT**	13.889	6.42	0.76	72.80	0.06
14		14.950	6.49		72.86	
16	Cystine	16.061	11.61	0.12	29.84	0.38
17		16.988	11.63		30.00	
18	Sulphanilamide	14.123	16.12	0.09	42.12	0.02
19		15.019	16.14		42.13	
20	Methionine	13.912	9.38	0.30	40.43	0.19
21		15.102	9.42		40.54	
26	EDTA***	15.102	9.51	0.22	41.31	0
27		14.089	9.54		41.31	

* CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone

** BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

*** EDTA: EthyleneDiamineTetraAcetic acid

Note

Instrument calibration was performed with atropine, acetanilide, aspartic acid, nicotinamide and imidazole as standards (STD) using Linear Fit as calibration method. Several pure organic standards in a large range of concentration were analyzed in duplicate as unknown.

The AGO (Argon Gas Option) used was 25/55/250.



PERFORMANCE TEST - REPEATABILITY IN ONE WORKING DAY (NC SOILS CONFIGURATION)

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NC repeatability of 30 runs of Aspartic acid in one working day

Run No.	In Time	Type	Weight (mg)	N%	Average N% - RSD%	C%	Average C% - RSD%
1	11:23	UNK	14.470	10.48	10.47 / 0.32	36.13	36.15 / 0.41
2	11:37	UNK	14.844	10.50		36.07	
3	12:01	UNK	15.173	10.51		35.96	
4	12:15	UNK	14.776	10.45		36.14	
5	12:28	UNK	15.379	10.45		36.06	
6	12:41	UNK	15.672	10.46		36.06	
7	12:55	UNK	14.921	10.45		36.31	
8	13:08	UNK	15.704	10.51		36.08	
9	13:22	UNK	15.654	10.45		36.11	
10	13:35	UNK	15.067	10.45		36.21	
11	13:48	UNK	15.440	10.45		36.22	
12	14:02	UNK	14.572	10.47		36.33	
13	14:15	UNK	15.375	10.42		36.27	
14	14:35	UNK	14.278	10.44		36.30	
15	14:49	UNK	14.692	10.50		36.18	
16	15:02	UNK	14.968	10.50		36.30	
17	15:16	UNK	14.656	10.47		36.42	
18	15:29	UNK	15.796	10.49		36.18	
19	15:42	UNK	14.551	10.43		36.29	
20	16:47	UNK	14.473	10.42		36.07	
21	17:01	UNK	14.546	10.55		35.98	
22	17:18	UNK	15.450	10.52		35.83	
23	17:35	UNK	15.017	10.51		35.90	
24	17:51	UNK	14.703	10.48		36.06	
25	18:08	UNK	15.440	10.47		35.92	
26	18:25	UNK	13.856	10.43		36.39	
27	18:42	UNK	14.962	10.43		36.08	
28	18:58	UNK	15.010	10.44		36.18	
29	19:15	UNK	14.727	10.43		36.26	
30	19:32	UNK	15.752	10.45		36.16	

Note

The sequence of 30 analyses in one working day was performed with about 14 - 15 mg of aspartic acid (10.52 N%, 36.09 C%) analyzed as standard (STD), using K factor as calibration method, and as unknown (UNK). The AGO (Argon Gas Option) used was 25/55/250.



PERFORMANCE TEST - DAY BY DAY REPEATABILITY (NC SOILS CONFIGURATION)

NC day by day repeatability

Run No.	In Time	Type	Weight (mg)	N%	C%
1	19 June	By-Pass	-	-	-
2		By-Pass	-	-	-
3		STD	14.288	10.52	36.09
4		STD	15.090	10.52	36.09
5		STD	14.665	10.52	36.09
6		UNK	14.818	10.49	36.24
7	20 June	UNK	14.477	10.52	35.99
8		UNK	14.261	10.52	36.03
9	23 June	UNK	14.728	10.43	35.82
10		UNK	14.190	10.46	35.83
11	24 June	UNK	14.803	10.44	36.06
12		UNK	14.098	10.51	35.97
13	25 June	UNK	14.746	10.52	36.11
14		UNK	14.458	10.52	36.19
15	26 June	UNK	14.103	10.53	36.17
16		UNK	14.912	10.54	36.19
17	27 June	UNK	14.810	10.52	36.29
18		UNK	14.924	10.53	36.18
19	30 June	UNK	14.526	10.43	35.99
20		UNK	14.992	10.42	36.12

Note
The system was calibrated using the K factor as calibration method. The data obtained are according to the technical specification (10.42 - 10.62 N% range, 35.79 - 36.39 C% range). During the night the instrument was in Stand-By mode from 20:00 pm to 6:00 am.
Normally analysis were performed during the day: the first around 10:00 am and the second around 02.00 pm.
The AGO (Argon Gas Option) used was 25/55/250.



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PERFORMANCE TEST - ANALYTICAL VALIDATION TEST OF SULFUR ANALYSIS

Sequence of analysis and theoretical values

Run	Sample name	Type	Weight (mg)	Theoretical S%	Acceptable Range
1	Methionine	Std	3.010	21.49	21.29 - 21.69
2	Methionine	Std	3.215		
3	Methionine	Std	3.523		
4	Sulfanilamide	UNK	3.562	18.62	18.42 - 18.82
5	Sulfanilamide	UNK	4.026		
6	Sulfanilamide	UNK	4.099		
7	Sulfanilic acid	UNK	3.099	18.51	18.31 - 18.71
8	Sulfanilic acid	UNK	2.855		
9	Sulfanilic acid	UNK	3.056		

Experimental Sulfur data of sulfanilamide and sulfanilic acid

Sulfanilamide			Sulfanilic acid		
S%	Average S%	RSD%	S%	Average S%	RSD%
18.79	18.74	0.44	18.49	18.57	0.46
18.62			18.69		
18.80			18.53		

Note
The response of the system using argon as carrier gas was evaluated analyzing 3 - 3.5 mg methionine as standard to calibrate the instrument using K factor as calibration method. Sulfanilamide (3.5 - 4 mg) and sulfanilic acid (2.8 - 3 mg) were analyzed as unknown. The AGO (Argon Gas Option) used was 5/35/100. All compounds were weighed with about 10 mg vanadium pentoxide (V₂O₅) (p/n 338 37510).



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PERFORMANCE TEST - REPEATABILITY AND ACCURACY OF SULFUR ANALYSIS

Standards Information

Standard	Type	Sample Weight (mg)	Theoretical S%	Acceptable Range
Methionine	Std	3 - 3.5	21.49	21.29 - 21.69
BBOT	UNK	2.8 - 3	7.44	7.34 - 7.54
Sulfamethazine	UNK	3 - 3.5	11.52	11.40 - 11.64
Sulfanilic acid	UNK	3 - 3.5	18.51	18.31 - 18.71
Sulfanilamide	UNK	3.8 - 4	18.62	18.42 - 18.82
Cystine	UNK	3.8 - 4.2	26.69	26.44 - 26.94

Sulfur repeatability and accuracy

Compound	BBOT	Sulfamethazine	Sulfanilic acid	Sulfanilamide	Cystine
Element	S%	S%	S%	S%	S%
Data	7.44	11.46	18.63	18.55	26.79
	7.42	11.44	18.61	18.51	26.72
	7.51	11.57	18.50	18.51	26.77
	7.39	11.47	18.40	18.43	26.80
	7.51	11.44	18.65	18.71	26.81
	7.51	11.60	18.56	18.55	26.49
	7.51	11.58	18.66	18.72	26.62
	7.43	11.54	18.42	18.67	26.81
	7.50	11.61	18.67	18.67	26.57
	7.54	11.57	18.57	18.80	26.48
Average	7.48	11.53	18.57	18.61	26.69
Std.Dev.	0.0575	0.0681	0.0978	0.1180	0.1339
RSD%	0.77	0.59	0.53	0.63	0.50

Note

The instrument calibration was performed with 3 - 3.5 mg methionine as standard to calibrate the instrument using K factor as calibration method. Several pure organic standards in a large range of concentration were analyzed 10 Times as unknown. The AGO (Argon Gas Option) used was 5/35/100. All compounds were weighed with about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).



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FLOURS

Analytical Conditions for standards and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine	14 - 15	60	60	250	20	25-55-250	95	12	900
EDTA	14 - 15	60	60	250	20	25-55-250	95	12	900
Aspartic acid	14 - 15	60	60	250	20	25-55-250	95	12	900
Flours	15 - 16	60	60	250	20	25-55-250	95	12	900

NC data of Flours

Sample	N%	Av. N%	RSD%	C%	Av. C%	RSD%
Wheat Flour	1.48			39.52		
	1.50	1.48	1.35	39.87	39.77	0.73
	1.46			39.92		
Rice Flour	1.55			43.20		
	1.54	1.54	1.28	43.56	43.41	0.35
	1.53			43.47		
Barley Flour	1.82			43.60		
	1.77	1.81	0.92	43.77	43.61	0.34
	1.85			43.47		
Soy Bean Meal	7.83			45.28		
	7.79	7.81	0.79	45.55	42.28	0.80
	7.80			45.01		

Note

The calibration was performed with 14 - 15 mg of atropine, EDTA (EthyleneDiamineTetraAcetic acid) and aspartic acid using Linear Fit as calibration method.



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Oatmeal Reference Material

NC determination

OATMEAL REFERENCE MATERIAL

Analytical Conditions for standards and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine	14 - 15	60	60	250	20	25-55-250	95	12	900
EDTA	14 - 15	60	60	250	20	25-55-250	95	12	900
Aspartic acid	14 - 15	60	60	250	20	25-55-250	95	12	900
Oatmeal Ref. Mat.	15 - 16	60	60	250	20	25-55-250	95	12	900

Expected N% of Oatmeal Reference Materials

Sample Description	Supplier Specification			
	N%	Uncertainty (±)	C%	Uncertainty (±)
Oatmeal Reference Material	1.48	1.48	1.48	39.52

NC data of Oatmeal Reference Material

N%	Av. N%	RSD%	C%	RSD%
1.98			45.61	
1.94	1.95	1.16	45.42	0.26
1.87			45.22	

Note

The calibration was performed with 14 - 15 mg of atropine, EDTA (EthyleneDiamineTetraAcetic acid) and aspartic acid using Linear Fit as calibration method.



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THERMO SCIENTIFIC PASTA REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
BBOT (7.44 S%)	2 - 3	80	80	250	10	5-35-100	60	12	500
TFS Pasta Ref. Mat.	18 - 20	80	80	250	10	5-35-100	60	12	500

Sulfur data of Thermo Scientific Pasta Reference Material

Weight (mg)	S%	Average S%	Std. Dev.	RSD%
18.572	0.129	0.129	0.0011	1.04
19.575	0.131			
19.776	0.130			
19.102	0.129			
19.333	0.128			

Note

Set argon and oxygen pressure at 350 kPa and Oxygen Injection Time at 10 seconds. A 0.80 m GC column (p/n 260 07800) installed into the oven was used for the analysis. The polarity of TCD detector was set as positive and Gain x 10 was used to amplify the signal. The calibration was performed with BBOT using K factor as calibration method. Standard and sample were weighed with about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510). The certified sulfur data of Pasta Ref. Mat. was 0.136 S% (accepted range 0.126 - 0.146 S%).



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Spirulina Algae

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SPIRULINA ALGAE REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
BBOT (7.44 S%)	2 - 3	80	80	250	5	5-35-100	60	12	500
Spirulina Algae Ref. Mat.	4 - 4.5	80	80	250	5	5-35-100	60	12	500

Sulfur data of Thermo Scientific Pasta Reference Material

Weight (mg)	S%	Average S%	Std. Dev.	RSD%
4.555	0.589	0.589	0.0064	0.98
4.470	0.580			
4.008	0.590			
3.501	0.589			
4.101	0.598			

Note

Set argon and oxygen pressure at 350 kPa. A 0.80 m GC column (p/n 260 07800) installed into the oven was used for the analysis.
The polarity of TCD detector was set as positive.
The calibration was performed with BBOT using K factor as calibration method.
Standard and sample were weighed with about 10 mg vanadium pentoxide (V₂O₅) (p/n 338 37510).
The certified sulfur data of Spirulina Algae Ref. Mat. was 0.60 S% (accepted range 0.57 - 0.63 S%).



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COALS (1/2)

Analytical Conditions for standards and samples analysis

Sample	Weight (mg)	Carrier flow (ml/min)	Ref flow (ml/min)	Oxy flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine	1 - 4	70	70	280	11	0 - 36 - 170	95	12	800
BBOT*	1 - 4	70	70	280	11	0 - 36 - 170	95	12	800
Coal	3 - 3.3	70	70	280	11	0 - 36 - 170	95	12	800

CHN data of Coals

Sample	Weight (mg)	N%	RSD%	C%	RSD%	H%	RSD%
A	3.167	1.95	0.73	88.18	0.24	3.85	0.13
	3.327	1.94		87.73		3.84	
	3.317	1.92		87.73		3.85	
	2.914	1.95		87.90		3.85	
B	3.393	1.16	0.50	82.35	0.21	4.28	0.58
	3.214	1.17		82.56		4.25	
	3.188	1.17		82.16		4.28	
	3.334	1.16		82.48		4.23	
C	3.350	1.07	0.47	80.01	0.10	4.45	0.22
	3.352	1.06		79.96		4.45	
	3.469	1.07		80.13		4.44	
	3.471	1.07		80.11		4.43	
D	3.390	1.74	0.66	78.28	0.17	4.28	0.45
	3.310	1.76		78.32		4.24	
	3.278	1.76		78.15		4.26	
	3.379	1.74		78.02		4.28	
E	3.296	0.806	1.02	65.50	0.27	4.44	0.13
	3.152	0.825		65.88		4.44	
	3.428	0.811		65.78		4.45	
	3.219	0.818		65.86		4.45	
F	3.342	1.17	1.12	80.08	0.09	4.28	0.51
	3.289	1.14		80.21		4.23	
	3.410	1.15		80.04		4.27	
	3.339	1.16		80.10		4.26	

Note

The calibration was performed with atropine and BBOT as standards using Linear Fit as calibration method. These coal samples were evaluated in duplicate in two series of analysis and the data were compared to the Official Method ASTM D 5373 requirements.



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COALS (2/2)

ASTM D5373 Concentration Range and Limit of Repeatability accepted

Element	Concentration Range (%)	Repeatability Limit (r)
Nitrogen	0.69 to 1.57	0.11
Carbon	48.6 to 90.6	0.64
Hydrogen	0.14 to 5.16	0.16

CHN differences according to ASTM D5373

Serie	Element	Coal samples											
		A		B		C		D		E		F	
		%	Diff	%	Diff	%	Diff	%	Diff	%	Diff	%	Diff
1	C	88.18	0.45	82.35	0.21	80.01	0.05	78.28	0.04	65.50	0.38	80.08	0.13
		87.73		82.56		79.96		78.32		65.88		80.21	
	H	3.85	0.01	4.28	0.03	4.45	0.00	4.28	0.04	4.44	0.00	4.28	0.05
		3.84		4.25		4.45		4.24		4.44		4.23	
	N	1.95	0.01	1.16	0.01	1.07	0.01	1.74	0.02	0.81	0.02	1.17	0.03
		1.94		1.17		1.06		1.76		0.83		1.14	
2	C	87.73	0.17	82.16	0.32	80.13	0.02	78.15	0.13	65.78	0.08	80.04	0.06
		87.90		82.48		80.11		78.02		65.86		80.10	
	H	3.85	0.00	4.28	0.05	4.44	0.01	4.26	0.02	4.45	0.00	4.27	0.01
		3.85		4.23		4.43		4.24		4.45		4.26	
	N	1.92	0.03	1.17	0.01	1.07	0.00	1.76	0.02	0.81	0.01	1.15	0.01
		1.95		1.16		1.07		1.74		0.82		1.16	

Repeatability Limit (r)

The value below which the absolute difference between two test results calculated to a dry basis of separate and consecutive test determinations, carried out on the same sample, in the same laboratory, by the same operator, using the same apparatus.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

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Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine	1.0 - 4	70	70	280	11	0 - 36 - 170	95	12	800
BBOT*	1.0 - 4	70	70	280	11	0 - 36 - 170	95	12	800
Coals Ref. Mat.	3.0 - 3.3	70	70	280	11	0 - 36 - 170	95	12	800

Expected values of Coals Reference Materials

Reference Material	N%	Uncertainty	C%	Uncertainty	H%	Uncertainty
Coal 1	1.11	0.08	62.99	0.85	3.81	0.43
Coal 2	1.02	0.12	68.67	0.98	4.55	0.34

CHN data of Coals Reference Materials

Sample	Weight (mg)	N%	RSD%	C%	RSD%	H%	RSD%
Coal 1	3.083	1.09	0.91	62.75	0.34	3.89	0.69
	3.432	1.11		63.18		3.89	
	3.243	1.11		62.80		3.91	
	3.201	1.09		63.18		3.85	
	3.105	1.10		63.13		3.85	
Coal 2	3.378	1.04	1.45	68.61	0.22	4.80	0.70
	3.003	1.04		68.60		4.73	
	3.408	1.07		68.38		4.79	
	3.183	1.03		68.41		4.73	
	3.059	1.04		68.25		4.75	

Note

The calibration was performed with atropine and BBOT as standards using Linear Fit as calibration method. The percentages varies from batch to batch.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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LUBRICANTS

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Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine standard (4.84 N%)	13 - 14	60	60	300	@ 20 sec	30-80-200	50	12	600-800
TF Lubricant Ref. Mat.	36 - 37	60	60	300	@ 20 sec	30-80-200	50	12	600-800
ALA 0902 (0.561 N%)	9 - 35	60	60	300	@ 20 sec	30-80-200	50	12	600-800
Lubricant	30 - 35	60	60	300	@ 20 sec	30-80-200	50	12	600-800

Sample	N%	Average N%	RSD%
1	0.454	0.455	0.34
	0.455		
	0.457		
2	0.495	0.497	1.74
	0.489		
	0.506		
3	0.529	0.526	0.67
	0.522		
	0.526		
4	0.191	0.194	1.19
	0.195		
	0.195		
5	0.148	0.152	2.18
	0.148		
	0.153		
6	0.645	0.65	1.05
	0.648		
	0.658		

Note

The calibration was performed with Atropine, ALA 0902 (ASTM Round Robin Test Lubricant) and Thermo Scientific Lubricant Reference Material using Linear Fit as calibration method.



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ASTM LUBRICANTS

Analytical Conditions for standard and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine standard (4.84 N%)	13 - 14	60	60	300	@ 20 sec	30-80-200	50	12	600-800
TF Lubricant Ref. Mat.	36 - 37	60	60	300	@ 20 sec	30-80-200	50	12	600-800
ALA 0902 (0.561 N%)	9.0 - 35	60	60	300	@ 20 sec	30-80-200	50	12	600-800
ASTM Lubricant	30 - 35	60	60	300	@ 20 sec	30-80-200	50	12	600-800

Sample	N%	Average N%	RSD%
ALA 0702	26	0.708	0.669 - 0.769
ALA 0706	31	0.788	0.748 - 0.848
ALA 0802	25	0.701	0.650 - 0.747
ALA 0902	31	0.561	0.500 - 0.606
ALA 1102	32	0.931	0.854 - 0.974

Nitrogen data of ASTM Lubricants

Sample	N%	Average N%	RSD%
ALA 0702	0.710	0.719	1.20
	0.721		
	0.727		
ALA 0706	0.784	0.781	0.63
	0.783		
	0.775		
ALA 0802	0.718	0.712	1.01
	0.708		
	0.714		
ALA 0902	0.574	0.578	0.61
	0.571		
	0.568		
ALA 1102	0.947	0.946	0.54
	0.950		
	0.940		

ASTM information

ASTM organize periodic comparison of test results and calculated statistical parameters with the laboratories participants in the petrochemical and analytical community worldwide to help the analytical laboratories monitor their performance in conducting ASTM methods. The participating laboratories receive different lubricants samples by year and analyze the samples according to the own procedures. The Sample Code include the name ALA follow by the year and the month in which the sample was analyzed and evaluated by ASTM.

Note

The calibration was performed with Atropine, ALA 0902 and Thermo Scientific Lubricant Reference Material using Linear Fit as calibration method. Reference Material using Linear Fit as calibration method.



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THERMO SCIENTIFIC LUBRICANT REFERENCE MATERIAL

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine standard	19 - 21	60	60	300	@ 20 sec	30-80-200	50	12	600-800
Lubricant	30 - 35	60	60	300	@ 20 sec	30-80-200	50	12	600-800

Nitrogen data of Lubricants Thermo Scientific Reference Material

N%	Average N%	RSD%
1.082	1.083	0.978
1.089		
1.091		
1.069		
1.066		
1.087		
1.093		
1.071		
1.093		
1.091		

Note

The certified N% is 1.12 and the uncertainty is ± 0.10 . The N% varies from batch to batch. K factor was used as calibration method.



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Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
BBOT (7.44 S%)	2.0 - 3.0	80	80	250	5	5-35-100	60	12	500
TFS Lubricant Ref. Mat.	2.5 - 3.0	80	80	250	5	5-35-100	60	12	500

Sulfur data of Thermo Scientific Lubricant Reference Material

Weight (mg)	S%	Average S%	Std. Dev.	RSD%
2.925	2.57	2.54	0.0192	0.76
2.648	2.53			
3.043	2.53			
2.121	2.52			
3.031	2.54			

Note

Set argon and oxygen pressure at 350 kPa. A 0.80 m GC column (p/n 260 07800) installed into the oven was used for the analysis.

The polarity of TCD detector was set as positive.

The calibration was performed with BBOT using K factor as calibration method.

The BBOT was weighed with about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

The certified sulfur data of Lubricant Reference Material was 2.54 S% (accepted range 2.43 - 2.65 S%) (the value varies from batch to batch).



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Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
TS Soil Ref. Mat.	50-230	60	60	250	15	25-55-250	95	12	800
1	150-170	60	60	250	15	25-55-250	95	12	800
2	30 - 40	60	60	250	15	25-55-250	95	12	800
3	190 - 220	60	60	250	15	25-55-250	95	12	800

NC data of Soils

Sample	N%	RSD%	C%	RSD%
1	0.2266	1.49	1.9641	0.19
	0.2265		1.9589	
	0.2282		1.9578	
	0.2219		1.9668	
	0.2205		1.9632	
2	0.4839	0.84	9.7291	1.21
	0.4844		9.7401	
	0.4820		9.7804	
	0.4769		9.7587	
	0.4757		9.7383	
3	0.0746	0.71	1.4033	0.69
	0.0742		1.4184	
	0.0736		1.3963	
	0.0733		1.3951	
	0.0740		1.4100	

Note

Set argon and oxygen pressure at 420 kPa. A 5 m GC column (p/n 260 07950) was used for the analysis. The calibration was performed with Thermo Scientific Soil Reference Material (0.21 N%, ±0.01; 2.29 C%, ±0.07) using Linear Fit as calibration method.



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Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
TS Soil Ref. Mat.	100 - 260	60	60	250	15	25-55-250	95	12	800
1	280 - 300	60	60	250	15	25-55-250	95	12	800
2	180 - 210	60	60	250	15	25-55-250	95	12	800

NC data of Soils

Sample	N%	RSD%	C%	RSD%
1	0.0538	0.92	0.9480	0.37
	0.0546		0.9465	
	0.0545		0.9441	
	0.0542		0.9475	
	0.0534		0.9536	
2	0.0442	0.99	0.6219	0.21
	0.0443		0.6224	
	0.0453		0.6227	
	0.0445		0.6196	
	0.0443		0.6226	

Note

Set argon and oxygen pressure at 420 kPa. A 5 m GC column (p/n 260 07950) was used for the analysis
The calibration was performed with Sandy Soil Reference Material (0.07 N%, ±0.01; 0.83 C%, ±0.05) using Linear Fit as calibration method.

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SOIL REFERENCE MATERIALS

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
TS Soil Ref. Mat.	20 - 50	70	70	250	5	0 - 30 - 170	95	12	800
Benzoic acid	1.0 - 3	70	70	250	5	0 - 30 - 170	95	12	800
Low Organic Content Soil	40 - 50	70	70	250	5	0 - 30 - 170	95	12	800
Medium Organic Content Soil	30 - 40	70	70	250	5	0 - 30 - 170	95	12	800
Loamy Soil	30 - 40	70	70	250	5	0 - 30 - 170	95	12	800
Chalky Soil	25 - 30	70	70	250	5	0 - 30 - 170	95	12	800

Expected values of Soil Reference Materials

Reference Material Description	Specification			
	N%	Uncertainty (±)	C%	Uncertainty (±)
Low Organic Content Soil	0.133	0.023	1.61	0.09
Medium Organic Content Soil	0.27	0.02	3.19	0.07
Loamy Soil	0.27	0.02	2.75	0.12
Chalky Soil	0.35	0.02	5.39	0.09

CHN data of Soil Reference Materials

Reference Material	Weight (mg)	N%	RSD%	C%	RSD%	H%	RSD%
Low Organic Content Soil	48.078	0.116	0.56	1.665	1.08	0.378	2.01
	51.860	0.115		1.653		0.383	
	47.413	0.114		1.630		0.355	
Medium Organic Content Soil	31.443	0.282	1.30	3.160	0.74	0.692	2.83
	33.823	0.275		3.180		0.675	
	30.537	0.277		3.216		0.654	
Loamy Soil	37.536	0.261	1.33	2.823	0.85	0.661	2.10
	34.856	0.265		2.776		0.645	
	31.416	0.268		2.792		0.634	
Chalky Soil	30.631	0.366	1.12	5.375	0.11	0.859	0.55
	26.440	0.363		5.387		0.852	
	25.403	0.358		5.381		0.861	

Note

The calibration was performed with Thermo Scientific Soil Reference Material and benzoic acid using Linear Fit as calibration method. The percentages varies from batch to batch. Hydrogen content is not certified.



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SOILS REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
BBOT (7.44 S%)	2.5 - 3.0	80	80	250	5	5-35-100	60	12	500
TFS Soil Ref. Mat.	75 - 85	80	80	250	5	5-35-100	60	12	500
Loamy Soil Ref. Mat.	60 - 70	80	80	250	5	5-35-100	60	12	500

Sulfur data of soils reference materials

Sample	Weight (mg)	S%	Average S%	Std. Dev.	RSD%
TFS Soil Ref. Mat.	72.673	0.0222	0.0228	0.0010	2.47
	74.926	0.0215			
	74.224	0.0237			
	49.547	0.0225			
	81.742	0.0239			
Loamy Ref. Mat.	57.804	0.0391	0.0391	0.0007	1.68
	66.497	0.0400			
	65.838	0.0382			
	64.258	0.0387			
	62.538	0.0393			

Note

Set argon and oxygen pressure at 350 kPa. A 0.80 m GC column (p/n 260 07800) installed into the oven was used for the analysis.

The polarity of TCD detector was set as positive and Gain x 10 was used to amplify the signal.

The calibration was performed with BBOT using K factor as calibration method

Standard and samples were weighed with about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

The certified sulfur data of TFS Soil Ref. Mat. was 0.0230 S% (accepted range 0.0190 - 0.0270 S%) while for Loamy Ref. Mat. was 0.040 S% (no details of the tolerance).



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Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
TS Soil Ref. Mat.	50 - 200	60	60	250	15	25-55-250	95	12	800
Low Organic Content Soil	150 - 200	60	60	250	15	25-55-250	95	12	800
Low Organic Content Soil	100 - 150	60	60	250	15	25-55-250	95	12	800
Medium Organic Content Soil	100 - 150	60	60	250	15	25-55-250	95	12	800
Loamy Soil	80 - 90	60	60	250	15	25-55-250	95	12	800
Chalky Soil	25 - 30	70	70	250	5	0 - 30 - 170	95	12	800

Expected values of Soil Reference Materials

Reference Material Description	Specification			
	N%	Uncertainty (±)	C%	Uncertainty (±)
Low Organic Content Soil	0.133	0.023	1.61	0.09
Medium Organic Content Soil	0.27	0.02	3.19	0.07
Loamy Soil	0.27	0.02	2.75	0.12
Chalky Soil	0.35	0.02	5.39	0.09

NC data of Soil Reference Materials

Reference Material	Weight (mg)	N%	RSD%	C%	RSD%
Low Organic Content Soil	150 - 200	0.132	0.435	1.64	1.54
		0.133		1.61	
		0.133		1.66	
Medium Organic Content Soil	100 - 150	0.28	0	3.22	0.65
		0.28		3.19	
		0.28		3.18	
Loamy Soil	100 - 150	0.28	0	2.76	1.53
		0.28		2.70	
		0.28		2.68	
Chalky Soil	80 - 90	0.38	1.51	5.33	1.16
		0.38		5.45	
		0.39		5.36	

Note

The calibration was performed with Thermo Scientific Soil Reference Material using Linear Fit as calibration method. The percentages varies from batch to batch.



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THERMO SCIENTIFIC SOIL REFERENCE MATERIAL

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
TS Soil Ref. Mat.	20 - 50	70	70	250	5	0 - 30 - 170	95	12	800
Benzoic acid	1.0 - 3.0	70	70	250	5	0 - 30 - 170	95	12	800
TS Soil Ref. Mat.	20 - 40	70	70	250	5	0 - 30 - 170	95	12	800

CHN data of Thermo Scientific Soil Reference Material

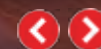
Weight (mg)	N%	RSD%	C%	RSD%	H%	RSD%
37.671	0.209	1.45	2.280	0.95	0.898	0.89
21.001	0.201		2.292		0.926	
28.687	0.220		2.249		0.896	

Note

The calibration was performed with Thermo Scientific Soil Reference Material and benzoic acid using Linear Fit as calibration method.

The certified N% is 0.21 and 2.29 C%. Hydrogen content is not certified.

The percentages varies from batch to batch.



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THERMO SCIENTIFIC SOIL REFERENCE MATERIAL

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	15 - 16	60	60	250	20	25-55-250	95	12	800
TS Soil ref. Mat.	240 - 250	60	60	250	20	25-55-250	95	12	800

NC data of Thermo Scientific Soil Reference Material

W (mg)	N%	C%
250.3	0.193	2.268
250.7	0.194	2.251
244.9	0.189	2.279
240.5	0.181	2.316
252.0	0.192	2.314
253.2	0.191	2.299
244.1	0.188	2.289
247.4	0.194	2.305
244.9	0.190	2.339
246.3	0.195	2.332
Average	0.191	2.299
RSD%	2.146	1.213

Note

The calibration was performed with aspartic acid using K factor as calibration method.

The certified N % is 0.21 and 2.29 C %, the accepted range according to the technical specification is 0.19 - 0.23 N% and 2.27 - 2.31 C%. The percentages varies from batch to batch.



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SANDY SOIL REFERENCE MATERIAL

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
TS Soil Ref. Mat.	20 - 50	70	70	250	5	0 - 30 - 170	95	12	800
Benzoic acid	1.0 - 3.0	70	70	250	5	0 - 30 - 170	95	12	800
Sandy Soil Ref. Mat.	70 - 80	70	70	250	5	0 - 30 - 170	95	12	800

CHN data of Sandy Soil Reference Materials

W (mg)	N%	RSD%	C%	RSD%	H%	RSD%
70.086	0.067	3.15	0.862	1.87	0.205	3.13
72.063	0.069		0.856		0.214	
69.128	0.068		0.867		0.215	
72.088	0.070		0.852		0.205	
71.747	0.068		0.841		0.200	
73.888	0.071		0.856		0.205	
75.038	0.072		0.832		0.200	
72.601	0.073		0.880		0.217	
67.502	0.072		0.874		0.213	
81.822	0.073		0.854		0.202	

Note

The calibration was performed with Thermo Scientific Soil Reference Material and benzoic acid using Linear Fit as calibration method.
The certified values are 0.07 N% (uncertainty ± 0.01) and 0.83 C% (uncertainty ± 0.05). Hydrogen content is not certified.
The percentages varies from batch to batch.

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Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
TS Soil Ref. Mat.	50 - 200	60	60	250	15	25-55-250	95	12	800
Sandy Soil Ref. Mat.	150 - 200	60	60	250	15	25-55-250	95	12	800

NC data of Sandy Soil Reference Materials

N%	RSD %	C%	RSD %
0.0711	1.5085	0.8566	1.7822
0.0683		0.8433	
0.0696		0.8452	
0.0710		0.8680	
0.0699		0.8455	
0.0704		0.8232	
0.0702		0.8419	
0.0704		0.8328	
0.0720		0.8207	
0.0716		0.8265	

Note

The calibration was performed with Thermo Scientific Soil Reference Material using Linear Fit as calibration method. The certified values are 0.07 N% (uncertainty ± 0.01) and 0.83 C% (uncertainty ± 0.05). The percentages varies from batch to batch.



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Inorganic

- Sulfur content

Sulfur content

Sulfur determination

INORGANIC SAMPLES WITH HIGH SULFUR CONTENT

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Cystine (26.69 S%)	3.0 - 3.5	80	80	250	3	5-35-100	60	12	500
Ammonium sulfate	4.5 - 5.0	80	80	250	3	5-35-100	60	12	500
Sulfur powder	1.0 - 1.5	80	80	250	3	5-35-100	60	12	500

Sulfur data of inorganic samples

Sample	Weight (mg)	S%	Average S%	Std. Dev.	RSD%
Ammonium sulfate	5.615	24.38	24.27	0.0932	0.38
	4.953	24.17			
	5.158	24.21			
	5.325	24.19			
	4.699	24.33			
Sulfur powder	1.201	99.85	99.84	0.0942	0.09
	1.394	99.88			
	1.419	99.96			
	1.121	99.79			
	0.928	99.71			

Note

Set argon and oxygen pressure at 350 kPa, and Oxygen Injection Time at 3 seconds. A 0.80 m GC column (p/n 260 07800) installed into the oven was used for the analysis. The polarity of TCD detector was set as positive. The calibration was performed with cystine using K factor as calibration method. Standard and samples were weighed with about 10 mg vanadium pentoxide (V₂O₅) (p/n 338 37510). The theoretical sulfur data of ammonium sulfate is 24.26 S% (accepted range 24.04 - 24.48 S%) while the certified sulfur value for sulfur powder was 99.98 S% (accepted range 99.68 - 100.28 S%).



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Absorbent Fibres

Nitrogen determination

ABSORBENT FIBERS

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
TFS Soil Ref. Mat.	80 - 250	60	60	300	30	30-80-200	50	10	800
Absorbent Fibers	80 - 100	60	60	300	30	30-80-200	50	10	800

Experimental N Data

Sample	N%	RSD%	Sample	N%	RSD%
1	0.393	0.92	3	0.543	0.53
	0.393			0.542	
	0.394			0.539	
	0.387			0.547	
	0.397			0.542	
2	0.575	0.92	4	0.284	0.94
	0.568			0.286	
	0.568			0.288	
	0.580			0.289	
	0.576			0.291	

Note
Set argon and oxygen pressure at 420 kPa.
The 1 m GC column (p/n 260 70004) was used for the analysis.
The calibration was performed with Thermo Scientific Soil Reference Material using Linear Fit as calibration method.
Large tin containers (p/n 252 08000) were used to weigh the samples.



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- Absorbent Fibers
- Lubricant
- Paper

Lubricant

Nitrogen determination

LUBRICANT

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine	14 - 15	60	60	300	20	30-80-200	50	10	650
TFS Lubricant R. M.	30 - 35	60	60	300	20	30-80-200	50	10	650
ALA0902	9.0 - 30	60	60	300	20	30-80-200	50	10	650
Lubricant	28 - 35	60	60	300	20	30-80-200	50	10	650

Experimental N Data

Sample	N%	RSD%	Sample	N%	RSD%
1	0.466	1.44	6	0.772	1.11
	0.455			0.769	
	0.473			0.756	
2	1.39	1.22	7	0.155	1.82
	1.39			0.161	
	1.42			0.155	
3	1.10	1.37	8	1.21	0.96
	1.11			1.19	
	1.13			1.19	
4	0.927	0.70	9	1.54	1.34
	0.915			1.55	
	0.925			1.58	
5	0.359	1.35	10	1.09	1.05
	0.353			1.09	
	0.344			1.11	

Note

Set argon and oxygen pressure at 420 kPa. A 1 m GC column (p/n 260 70004) was used for the analysis. The calibration was performed with atropine (4.84 N%, Thermo Scientific Lubricant Reference Material and ALA0902 (0.561 N%, lubricant for an ASTM Round Robin Test) using Linear Fit as calibration method. Large tin containers (p/n 252 08000) were used to weigh the samples.



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Paper

Nitrogen determination

PAPER

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 60	60	60	300	15	15-50-200	50	12	700
Mixture Aspartic Acid-Glucose	80 - 90	60	60	300	15	15-50-200	50	12	700
Paper >1N%	50 - 60	60	60	300	15	15-50-200	50	12	700
Paper <1N%	80 - 90	60	60	300	15	15-50-200	50	12	700

Nitrogen data of paper samples

Sample	N%	RSD%
1	1.7817	0.694
	1.7671	
	1.7573	
2	0.9549	0.6221
	0.9494	
	0.9431	
3	1.1160	0.7780
	1.0995	
	1.1035	
4	1.2042	0.1869
	1.2019	
	1.2064	
5	1.2439	0.8131
	1.2386	
	1.2582	

Note

For paper samples cotnaining more than 1.0 N%, the calibration was performed with aspartic acid (10.52 N%) using K factor as calibration method.
While for paper sample containing less than 1.0 N%, the calibration was performed with a mixture of aspartic acid and glucose at 1.0 N%



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Sulfur determination

BLADDERWRACK ALGAE REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
BBOT (7.44 S%)	2.0 - 3.0	80	80	250	5	5-35-100	60	12	500
Bladderwrack Algae Ref. Mat.	4.0 - 4.5	80	80	250	5	5-35-100	60	12	500

Sulfur data of Bladderwrack Algae Reference Material

Weight (mg)	S%	Average S%	Std. Dev.	RSD%
4.019	2.30	2.28	0.0205	0.90
3.948	2.25			
3.255	2.28			
3.102	2.28			
4.054	2.30			

Note

Set argon and oxygen pressure at 350 kPa. A 0.80 m GC column (p/n 260 07800) installed into the oven was used for the analysis.

The polarity of TCD detector was set as positive.

The calibration was performed with BBOT using K factor as calibration method. Standard and sample were weighed with about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

The certified sulfur data of Bladderwrack Algae Ref. Mat. was 2.29 S% (accepted range 2.23 - 2.35 S%).



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- Carbon Organic Standards
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Carbon Organic Standards

CHN determination

CARBON ORGANIC STANDARDS (1/2)

Analytical Conditions

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine	2.0 - 3.0	70	70	250	5	0 - 30 - 170	95	12	800
BBOT*	2.0 - 3.0	70	70	250	5	0 - 30 - 170	95	12	800
Tocopherol Nicotinate	2.3 - 2.6	70	70	250	5	0 - 30 - 170	95	12	800
Antracene	2.0 - 2.3	70	70	250	5	0 - 30 - 170	95	12	800
Polyethylene	2.0 - 2.3	70	70	250	5	0 - 30 - 170	95	12	800
Polystyrene	2.0 - 2.3	70	70	250	5	0 - 30 - 170	95	12	800
Fluorene	2.0 - 2.3	70	70	250	5	0 - 30 - 170	95	12	800

Sequence of analysis for calibration

Run	Sample name	Weight (mg)	N%	C%	H%
1	BBOT	3.215	6.51	72.52	6.09
2		2.086			
3		2.521			
4	Atropine	2.048	4.84	70.56	8.01
5		2.974			
6		2.485			

CHN theoretical data of High Carbon Organic Standards

Standard	Nitrogen		Carbon		Hydrogen	
	%	Acceptable range	%	Acceptable range	%	Acceptable range
Tocopherol Nicotinate	2.61	± 0.07	78.46	± 0.30	9.97	± 0.10
Polyethylene	-	-	85.70	± 0.30	14.30	± 0.15
Polystyrene	-	-	92.30	± 0.30	7.70	± 0.10
Antracene	-	-	94.34	± 0.30	5.66	± 0.09
Fluorene	-	-	93.81	± 0.30	6.03	± 0.10



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Carbon Organic Standards

CHN determination

CARBON ORGANIC STANDARDS (2/2)

CHN theoretical data of High Carbon Organic Standards

Run	Standard	W (mg)	Nitrogen		Carbon		Hydrogen	
			%	RSD %	%	RSD %	%	RSD %
1	Tocopherol Nicotinate	2.343	2.60	1.38	78.55	0.11	10.04	0.42
2		2.579	2.65		78.71		9.98	
3		2.457	2.58		78.67		9.96	
4	Polyethylene	2.220	-	-	85.68	0.09	14.31	0.22
5		2.290	-		85.62		14.36	
6		2.383	-		85.78		14.37	
7	Polystyrene	2.160	-	-	92.16	0.19	7.74	0.32
8		1.970	-		92.46		7.77	
9		2.104	-		92.46		7.79	
10	Anthracene	2.178	-	-	94.23	0.19	5.68	0.35
11		2.110	-		94.34		5.66	
12		2.102	-		94.58		5.64	
13	Fluorene	2.128	-	-	93.90	0.13	6.00	0.44
14		1.984	-		93.66		6.04	
15		2.146	-		93.83		6.05	

Note

The calibration was performed with Atropine and BBOT as standards using Linear Fit as calibration method.

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene



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UREA STANDARD

Analytical Conditions

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Imidazole	2.5 - 3.0	70	70	250	5	0 - 30 - 170	95	12	800
Aspartic acid	2.0 - 2.5	70	70	250	5	0 - 30 - 170	95	12	800
Urea	2.5 - 2.8	70	70	250	5	0 - 30 - 170	95	12	800

Sequence of analysis for calibration

Run	Sample name	Weight (mg)	N%	C%	H%
1	Imidazole	2.553	41.15	52.93	5.92
2		3.029			
3		2.220			
4	Aspartic acid	2.077	10.52	36.09	5.30
5		2.419			
6		1.940			

CHN data of Urea (46.65 N%, 20 C%, 6.71 H%)

Run	W (mg)	Nitrogen			Carbon			Hydrogen		
		%	RSD%	Acceptable range	%	RSD%	Acceptable range	%	RSD%	Acceptable range
1	2.369	46.78	0.154	46.36 - 46.96	20.10	0.201	19.80 - 20.20	6.65	0.692	6.61 - 6.81
2	2.701	46.61			20.01			6.63		
3	2.725	46.70			20.03			6.68		
4	2.768	46.61			20.00			6.63		
5	2.747	46.65			20.07			6.74		

Note

The calibration was performed with imidazole for nitrogen determination, aspartic acid for carbon determination and both standards for hydrogen determination, using K factor as calibration method.



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- Alfalfa Reference Material
- Birch Leaf
- Leaves
- Plants
- Wood

Alfalfa Reference Material

CHN determination

ALFALFA REFERENCE MATERIAL

Analytical Conditions for standards and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine	1.5 - 2.0	70	70	250	5	0 - 30 - 170	95	12	800
Aspartic acid	2.0 - 4.0	70	70	250	5	0 - 30 - 170	95	12	800
Alfalfa Ref. Mat.	2.5 - 2.8	70	70	250	5	0 - 30 - 170	95	12	800

CHN data of Alfalfa sample

Weight (mg)	N%	RSD%	C%	RSD%	H%	RSD%
2.765	2.990	0.49	43.598	0.19	6.014	0.25
2.849	3.018		43.710		6.034	
2.771	2.997		43.761		6.005	

Note

The calibration was performed with atropine and aspartic acid using Linear Fit as calibration method. The certified N% is 3.01 (uncertainty ± 0.2). Carbon and hydrogen content are not certified. The percentages aries from batch to batch.

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Alfalfa Reference Material

Sulfur determination

ALFALFA REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
BBOT (7.44 S%)	2.0 - 3.0	80	80	250	5	5-35-100	60	12	500
Alfalfa Ref. Mat.	4.0 - 4.5	80	80	250	5	5-35-100	60	12	500

Sulfur data of Alfalfa Reference Material

Weight (mg)	S%	Average S%	Std. Dev.	RSD%
4.436	0.279	0.282	0.0033	0.99
4.212	0.283			
4.193	0.286			
4.005	0.283			
4.086	0.278			

Note

Set argon and oxygen pressure at 350 kPa.

A 0.80 m GC column (p/n 260 07800) installed into the oven was used for the analysis.

The polarity of TCD detector was set as positive.

The calibration was performed with BBOT using K factor as calibration method.

Standard and sample were weighed with about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510).

The certified sulfur data of Alfalfa Ref. Mat. was 0.27 S% (accepted range 0.23 - 0.31 S%).



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Birch Leaf

Sulfur determination

BIRCH LEAF REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
BBOT (7.44 S%)	2.0 - 3.0	80	80	250	10	5-35-100	60	12	500
Birch Leaf Ref. Mat.	18.0 - 20.0	80	80	250	10	5-35-100	60	12	500

Sulfur data of Birch Leaf Reference Material

Weight (mg)	S%	Average S%	Std. Dev.	RSD%
20.384	0.177	0.175	0.0025	1.44
17.502	0.171			
20.504	0.177			
19.361	0.174			
19.789	0.174			

Note

Set argon and oxygen pressure at 350 kPa and Oxygen Injection Time at 10 seconds. A 0.80 m GC column (p/n 260 07800) installed into the oven was used for the analysis. The polarity of TCD detector was set as positive and Gain x 10 was used to amplify the signal. The calibration was performed with BBOT using K factor as calibration method. Standard and sample were weighed with about 10 mg vanadium pentoxide (V_2O_5) (p/n 338 37510). The certified sulfur data of Birch Leaf Ref. Mat. was 0.172 S% (accepted range 0.162 - 0.182 S%).



Analytical - Classical

Vegetation

- Alfalfa Reference Material
- Birch Leaf
- Leaves
- Plants
- Wood

Leaves

CHN determination

LEAVES REFERENCES MATERIALS

Analytical Conditions for standards and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine	1.5 - 2.0	70	70	250	5	0 - 30 - 170	95	12	800
Aspartic acid	2.0 - 4.0	70	70	250	5	0 - 30 - 170	95	12	800
Leaves Ref. Mat.	2.5 - 2.8	70	70	250	5	0 - 30 - 170	95	12	800

Expected values of Leaves Reference Materials

Reference Material Description	Specification					
	N%	Uncertainty (±)	C%	Uncertainty (±)	H%	Uncertainty (±)
Birch Leaves	2.12	0.06	48.09	0.51	6.55	0.30
Orchard Leaves	2.28	0.04	50.40	0.40	6.22	0.03

CHN data of Birch and Orchard Leaves

Reference Material	Weight (mg)	N%	RSD%	C%	RSD%	H%	RSD%
Birch Leaves	2.472	2.157	0.59	48.120	0.16	6.436	0.12
	2.662	2.136		47.999		6.429	
	2.823	2.159		47.978		6.421	
Orchard Leaves	2.686	2.291	0.20	50.158	0.12	6.248	0.16
	2.430	2.286		50.180		6.232	
	2.883	2.282		50.064		6.251	

Note

The calibration was performed with atropine and aspartic acid using Linear Fit as calibration method.
The percentages varies from batch to batch.
Hydrogen content is not certified.
Orchard leaves was dried at 105°C for 2 hours.



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Plants

NC determination

PLANTS REFERENCES MATERIALS

Analytical Conditions for standards and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Atropine	14 - 15	60	60	250	20	25-55-250	95	12	900
EDTA	14 - 15	60	60	250	20	25-55-250	95	12	900
Aspartic acid	14 - 15	60	60	250	20	25-55-250	95	12	900
Birch Leaves R. M.	15 - 16	60	60	250	20	25-55-250	95	12	900
Orchard Leaves R. M.	15 - 16	60	60	250	20	25-55-250	95	12	900
Alfalfa Ref. Mat.	15 - 16	60	60	250	20	25-55-250	95	12	900

Expected values of Plants Reference Materials

Reference Material Description	N%	Uncertainty (±)	C%	Uncertainty (±)
Birch Leaves	2.12	0.06	48.09	0.51
Orchard Leaves	2.28	0.04	50.40	0.40
Alfalfa	3.01	0.20	n.a.	-

NC data of Plants Reference Materials

Reference Material	Weight (mg)	N%	RSD%	C%	RSD%
Birch Leaves	15 - 16	2.16	0.81	48.32	0.24
		2.13		48.55	
		2.16		48.59	
Orchard Leaves	15 - 16	2.25	0.45	50.11	0.56
		2.24		50.21	
		2.23		50.53	
Birch Leaves	15 - 16	2.98	0.68	43.60	0.42
		2.94		43.59	
		2.96		43.92	

Note

The calibration was performed with atropine and aspartic acid using Linear Fit as calibration method.
The percentages varies from batch to batch. Hydrogen content is not certified. Orchard leaves was dried at 105°C for 2 hours.



Analytical - Classical

Vegetation

- Alfalfa Reference Material
- Birch Leaf
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Wood

CHN determination

WOOD

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
TS Soil Ref. Mat.	6.0 - 15.0	70	70	250	8	0 - 33 - 170	95	12	800 - 900
Nicotinamide	5.0 - 8.0	70	70	250	8	0 - 33 - 170	95	12	800 - 900
Wood	8.0 - 10.0	70	70	250	8	0 - 33 - 170	95	12	800 - 900

Experimental CHN Data

Sample	N%	RSD%	C%	RSD%	H%	RSD%
1	0.315	1.87	45.39	0.07	5.86	0.19
	0.321		45.39		5.89	
	0.319		45.39		5.87	
	0.310		45.43		5.88	
	0.332		45.46		5.88	
2	0.123	2.22	47.65	2.22	6.21	0.82
	0.129		47.59		6.10	
	0.123		47.49		6.11	
	0.119		47.60		6.16	
	0.121		47.51		6.20	

Note

Set argon and oxygen pressure at 420 kPa.
The calibration was performed with Thermo Scientific Soil Reference Material (0.21 N%, 2.29 C%) and nicotinamide using Linear Fit as calibration method.
The percentages of the Soil Reference Material varies from batch to batch.



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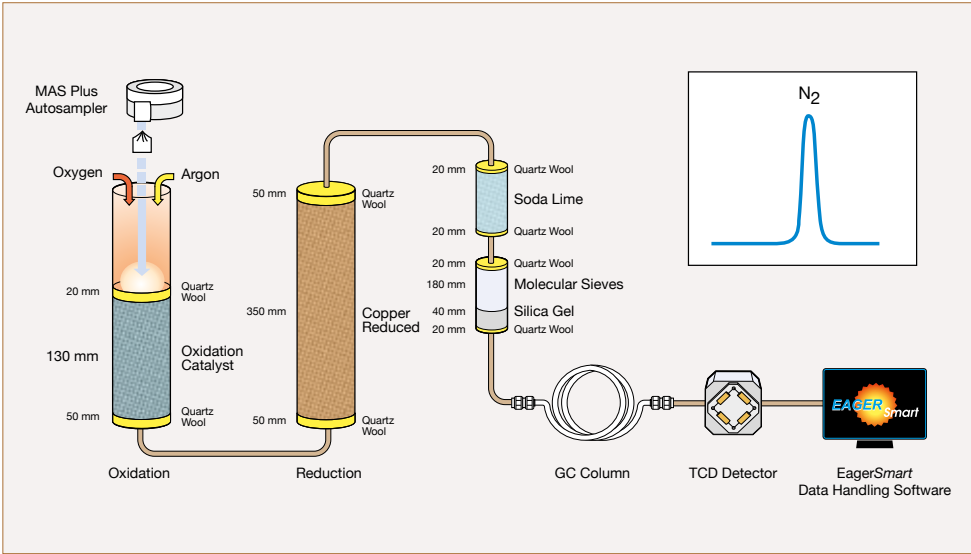
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ANALYTICAL CONFIGURATIONS - N / PROTEIN determination



Analytical conditions		
Pressure (kPa)	Ar	300
Pressure (kPa)	Oxygen	300
Flow (ml/min)	Ar measurement	60
	Ar reference	60
	Oxygen	300
Temperature (°C)	Left	950
	Right	840
	Oven	50 (GC column inside the oven)
Oxygen Injection Time	30 sec	
Sample Delay Time	10 sec	
Cycle (Run Time)	600 - 800 sec	

List of consumables	p/n
Oxidation catalyst (40 g)	338 40000
High quality copper (50 g)	338 35312
Quartz wool (5 g)	338 22200
Soda lime (100 g)	338 35235
Molecular sieve (100 g)	338 01801
Silicagel plus indicator (100 g)	338 40035
Prepacked HPAR reactor	468 02008
HPAR crucible	252 05011
Empty HPAR reactor	468 20075
Adsorption trap (large)	281 13064
Nitrogen separation column (PTFE; 1m; 8x6 mm)	260 70004

Note
The EagerSmart Data Handling Software provides the option “AGO” (Argon Gas Option) through which allows the modification of the Argon carrier flow during the run to optimize the analysis according to the sample.
The Oxygen Injection Time change according to the matrix.



PERFORMANCE TEST - ANALYTICAL VALIDATION TEST OF N/PROTEIN ANALYSIS

Sequence of analysis and theoretical values

Run	Sample name	Type	Weight (mg)	Theoretical value	Acceptable range
				N %	N %
1	Aspartic acid	STD	71.153	10.52	10.42 - 10.62
2		STD	65.895		
3		STD	61.330		
4	Thermo Scientific Pasta Reference Material	UNK	150.734	2.227	2.13 - 2.324
5		UNK	155.144		
6		UNK	157.972		

Experimental Nitrogen data of Thermo Scientific Pasta Reference Material

Nitrogen (%)	Average N %	RSD %
2.20	2.22	0.95
2.21		
2.24		

Note
The response of the system using argon as carrier gas was evaluated analyzing aspartic acid as standard to calibrate the instrument using Linear Fit as calibration method and Thermo Scientific Pasta Reference Material as unknown.
The AGO (Argon Gas Option) used was 30/80/200.



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PERFORMANCE TEST - REPEATABILITY AND ACCURACY (N/PROTEIN CONFIGURATION)

Sequence of standards for the Linear Fit calibration

Sample name	Type	W (mg)	Theoretical N%
Atropine	STD	60.209	4.84
	STD	70.465	
Methionine	STD	60.237	9.39
	STD	70.116	
Nicotinamide	STD	60.200	22.94
	STD	70.831	
Imidazole	STD	60.341	41.15
	STD	70.442	

Nitrogen theoretical values, accepted range, repeatability and accuracy of pure organic standards.

Sample name	Theoretical N%	Accepted Range (±)	Experimental N%
Atropine	4.84	0.07	4.78
Methionine	9.39	0.10	9.36
Nicotinamide	22.94	0.22	22.85
Imidazole	41.15	0.30	40.95
Acetanilide	10.36	0.10	10.40
Aspartic acid	10.52	0.10	10.61
BBOT*	6.51	0.10	6.42
CEDFNI**	20.14	0.20	20.33
Sulfanilamide	16.27	0.16	16.18
EDTA***	9.59	0.10	9.59
Tryptophane	13.71	0.14	13.74
Urea	46.65	0.30	46.69

* BBOT: 2,5-Bis (5-tert-butyl-benzoxazol-2-yl) thiophene

** CEDFNI: cyclohexanone 2,4-dinitrophenylhydrazone

*** EDTA: EthyleneDiamineTetraAcetic acid

Note

Instrument calibration was performed with atropine, methionine, nicotinamide and imidazole as standards (STD) using Linear Fit as calibration method. Several pure organic standards in a large range of concentration were analyzed as unknown. The AGO (Argon Gas Option) used was 30/80/200.



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PERFORMANCE TEST - REPEATABILITY IN ONE WORKING DAY (N/PROTEIN CONFIGURATION)

Nitrogen repeatability of 35 runs of aspartic acid in one working day

No.	Inj Time	Type	Weight (mg)	N%	No.	Inj Time	Type	Weight (mg)	N%	Average N%	RSD%
1	10:36	STD	60.465	10.52	19	15:05	UNK	60.213	10.46	10.50	0.55
2	10:50	STD	60.253	10.52	20	15:19	UNK	60.397	10.42		
3	11:03	STD	60.387	10.52	21	15:32	UNK	60.377	10.48		
4	11:16	UNK	60.320	10.58	22	15:45	UNK	60.340	10.49		
5	11:30	UNK	60.310	10.56	23	15:59	UNK	60.299	10.43		
6	11:57	UNK	60.283	10.62	24	16:12	UNK	60.357	10.46		
7	12:11	UNK	60.216	10.59	25	16:26	UNK	60.410	10.49		
8	12:38	UNK	60.262	10.63	26	16:39	UNK	60.280	10.47		
9	12:51	UNK	60.236	10.53	27	16:52	UNK	60.392	10.50		
10	13:04	UNK	60.349	10.54	28	17:06	UNK	60.010	10.42		
11	13:18	UNK	60.369	10.54	29	17:19	UNK	60.368	10.45		
12	13:31	UNK	60.292	10.51	30	17:33	UNK	60.230	10.45		
13	13:45	UNK	60.361	10.48	31	17:46	UNK	60.347	10.42		
14	13:58	UNK	60.382	10.51	32	17:59	UNK	60.367	10.46		
15	14:11	UNK	60.356	10.48	33	18:13	UNK	60.373	10.50		
16	14:25	UNK	60.257	10.47	34	18:26	UNK	60.294	10.47		
17	14:38	UNK	60.367	10.59	35	18:40	UNK	60.247	10.51		
18	14:52	UNK	60.326	10.44							

Note
The sequence of analyses in one working day was performed with aspartic acid (10.52 N%) analyzed as standard (STD), using K factor as calibration method, and as unknown (UNK). The AGO (Argon Gas Option) used was 30/80/200.



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PERFORMANCE TEST - DAY BY DAY REPEATABILITY (N/PROTEIN CONFIGURATION)

Sample name / Maintenance	Inj Date	Inj Time	Type	Weight (mg)	N%
Aspartic acid	10 May	11:10	STD	56.703	10.52
Aspartic acid		11:23	STD	54.489	10.52
Aspartic acid		12:57	UNK	54.215	10.59
Aspartic acid		15:32	UNK	56.294	10.47
Aspartic acid - new reduction reactor	14 May	12:24	UNK	55.892	10.59
Aspartic acid		12:38	UNK	63.466	10.63
Aspartic acid		12:51	UNK	59.012	10.61
Aspartic acid		13:04	UNK	58.779	10.62
Aspartic acid		14:05	UNK	56.278	10.57
Aspartic acid		16:06	UNK	56.350	10.51
Aspartic acid	15 May	08:35	UNK	60.069	10.50
Aspartic acid		08:49	UNK	62.374	10.55
Aspartic acid - ashes removing	16 May	10:01	UNK	68.577	10.56
Aspartic acid		10:15	UNK	57.017	10.50
Aspartic acid	17 May	09:25	UNK	54.060	10.45
Aspartic acid		09:38	UNK	61.287	10.58
Aspartic acid	20 May	08:38	UNK	59.806	10.60
Aspartic acid		08:52	UNK	52.063	10.59

Note
The system was calibrated using the K factor as calibration method.
The data obtained are according to the technical specification (10.42 - 10.62 N% range).
During the period the maintenance of the instrument was performed changing the reduction reactor and cleaning the ashes from the crucible.
The AGO (Argon Gas Option) used was 30/80/200.



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Nitrogen determination

ALFALFA REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 60	60	60	300	@ 30 sec	30-80-200	50	12	600-800
Alfalfa	100 - 120	60	60	300	B	30-80-200	50	12	600-800

Nitrogen data of Alfalfa sample

Weight (mg)	N%
120.889	3.06
121.957	3.07
119.196	3.09
122.920	3.04
118.133	3.03
110.219	2.99
105.062	2.97
120.706	3.08
119.268	3.09
118.429	3.05
Average N %	3.05
RSD %	1.34

Note

K factor was used as calibration method.

The certified N% is 3.01 and the uncertainty is ± 0.2 . The N% varies from batch to batch.

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N/Protein determination

ALFALFA BIPEA REFERENCE MATERIAL (BIPEA: Bureau InterProfessionnel d'Etudes Analytiques, France)

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 60	60	60	300	@ 30 sec	30-80-200	50	12	600-800
Alfalfa	100 - 140	60	60	300	B	30-80-200	50	12	600-800

BIPEA sample information available

Sample	Moisture	Fat	Carbohydrate	Kjeldahl Protein		Combustion Protein	
	%	%	%	Av. %	Tolerance	Av. %	Tolerance
BIPEA - Dehydrated Alfalfa 3/2009	7.7	-	29.3	14.8	0.6	15.1	0.6

Nitrogen / Protein data of Alfalfa sample

Weight (mg)	N%	Average N%	RSD%	Protein %	Average Protein %	RSD%
146.89	2.47	2.43	1.93	15.46	15.21	1.97
140.875	2.49			15.57		
132.915	2.45			15.34		
120.498	2.41			15.04		
131.468	2.47			15.41		
140.989	2.48			15.49		
101.601	2.37			14.81		
105.795	2.44			15.27		
107.890	2.38			14.87		
112.551	2.37			14.79		

Note

K factor was used as calibration method.
The 6.25 factor was used to calculate the Protein content.



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ANIMAL FEED

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	600-650
Nicotinamide	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	600-650
Feed mixture 1	130 - 145	60	60	300	@ 30 sec	30-80-200	50	10	600-650
Feed mixture 2	130 - 145	60	60	300	@ 30 sec	30-80-200	50	10	600-650
Soybean extract	120 - 135	60	60	300	@ 30 sec	30-80-200	50	10	600-650
Fish meal	120 - 135	60	60	300	@ 30 sec	30-80-200	50	10	600-650

Nitrogen / Protein data

Sample	Day 1				Day 2			
	N%	RSD%	Protein %	RSD%	N%	RSD%	Protein %	RSD%
Feed mixture 1	2.45	0.37	15.30	0.31	2.42	0.87	15.14	0.79
	2.43		15.19					
	2.45		15.29					
	2.44		15.25		2.45		15.31	
	2.45		15.30					
Feed mixture 2	2.73	0.31	17.07	0.29	2.75	0.52	17.22	0.66
	2.74		17.13					
	2.73		17.06					
	2.72		17.02					
	2.74		17.14					
Soybean extract	7.58	0.17	47.40	0.14	7.61	0.09	47.54	0.04
	7.61		47.56					
	7.59		47.45					
	7.58		47.40					
	7.60		47.49					
Fish meal	9.98	0.11	62.36	0.13	9.98	0.21	62.37	0.22
	9.96		62.25					
	9.97		62.34					
	9.97		62.33					
	9.95		62.16					

Note

Set argon and oxygen pressure at 420 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis. The calibration was performed with aspartic acid for feed mixture 1 and 2, and nicotinamide for soybean extract and fish meal, using Linear Fit as calibration method. The 6.25 factor was used to calculate the Protein content. Samples were analyzed in two days.



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ANIMAL FEED (1/2)

Analytical Conditions for standard and sample analysis

Sample	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy Tune Category	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	60	60	300	@ 30 sec	30-80-200	50	12	600-800
Wheat flour	60	60	300	B	30-80-200	50	12	600-800
Mais	60	60	300	@ 30 sec	30-80-200	50	12	600-800
DDGS	60	60	300	B	30-80-200	50	12	600-800
Sunflower	60	60	300	@ 30 sec	30-80-200	50	12	600-800
Soy bean	60	60	300	@ 30 sec	30-80-200	50	12	600-800
Gluten	60	60	300	@ 30 sec	30-80-200	50	12	600-800
Poultry feed	60	60	300	B	30-80-200	50	12	600-800

Note

The weight of aspartic acid is 50 - 60 mg for wheat flour, mais, DDGS and sunflower samples while 120 - 130 mg for soy bean and gluten samples.

K factor was used as calibration method.

The 6.25 factor was used to calculate the Protein content.



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ANIMAL FEED (2/2)

Nitrogen / Protein data of animal feed samples using argon and helium carrier gas

Sample	Argon as carrier gas					Helium as carrier gas				
	Weight (mg)	N%	RSD%	Protein %	RSD%	Weight (mg)	N%	RSD%	Protein %	RSD%
Wheat flour	130- 140	1.91	0.79	11.93	0.87	160 - 200	1.92	0.79	11.98	0.75
		1.93		12.05			1.93		12.06	
		1.94		12.14			1.90		11.88	
Mais 1	130- 140	1.25	0.46	7.84	0.27	150 - 200	1.26	0.46	7.88	0.32
		1.25		7.83			1.26		7.93	
		1.26		7.87			1.27		7.91	
Mais 2	130- 140	1.48	0.39	9.24	0.31	150 - 200	1.50	0.38	9.41	0.38
		1.49		9.29			1.50		9.39	
		1.49		9.29			1.49		9.34	
DDGS	130- 140	4.79	0.55	29.92	0.64	150 - 160	4.79	0.31	29.92	0.38
		4.78		29.85			4.80		30.03	
		4.83		30.21			4.77		29.80	
Sunflower 1	130- 140	6.02	0.62	37.62	0.65	170 - 200	6.10	0.25	38.15	0.31
		6.08		38.01			6.07		37.91	
		6.09		38.08			6.09		38.07	
Sunflower 2	130- 140	5.69	0.53	35.54	0.58	170 - 200	5.65	0.37	35.31	0.37
		5.75		35.95			5.61		35.05	
		5.71		35.68			5.64		35.22	
Soy bean	130- 140	8.11	0.71	50.66	0.70	170 - 180	7.98	0.31	49.87	0.34
		8.08		50.51			8.03		50.21	
		8.00		49.99			8.01		50.06	
Gluten 1	130- 140	9.31	0.22	58.20	0.24	170 - 180	9.34	0.16	58.36	0.14
		9.27		57.92			9.33		58.33	
		9.28		58.02			9.31		58.21	
Gluten 2	130- 140	9.31	0.38	58.18	0.40	170 - 180	9.32	0.28	58.28	0.25
		9.35		58.44			9.37		58.55	
		9.28		57.98			9.36		58.50	
Poultry feed 1	130- 140	2.91	1.22	18.18	1.22	150 - 160	2.95	1.09	18.43	1.13
		2.98		18.62			2.96		18.53	
		2.96		18.48			2.90		18.13	
Poultry feed 2	130- 140	4.31	1.14	26.96	1.11	150 - 160	4.37	0.82	27.30	0.91
		4.39		27.43			4.35		27.17	
		4.30		26.87			4.42		27.65	

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FEED FOR SOW BIPEA REFERENCE MATERIAL (BIPEA: Bureau InterProfessionnel d'Etudes Analytiques, France)

Analytical Conditions for standard and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 60	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Feed for Sow	100 - 120	60	60	300	B	30-80-200	50	12	600 - 800

BIPEA sample information available

Sample	Moisture	Fat	Carbohydrate	Kjeldahl Protein		Combustion Protein	
	%	%	%	Av. %	Tolerance	Av. %	Tolerance
BIPEA - Feed for Sow 3/2009	9.8	2.8	48.7	16.0	0.6	16.2	0.6

Nitrogen / Protein data of Feed for Sow sample

Weight (mg)	N%	Average N%	RSD%	Protein %	Average Protein %	RSD%
104.982	2.67	2.65	1.02	16.71	16.56	1.09
113.482	2.67			16.67		
121.082	2.66			16.63		
104.415	2.60			16.22		
110.131	2.63			16.41		
102.359	2.67			16.72		
100.145	2.67			16.66		
102.627	2.67			16.71		
101.503	2.61			16.32		
105.418	2.65			16.55		

Note

K factor was used as calibration method.
The 6.25 factor was used to calculate the Protein content.



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INSECT ANIMAL FEED (1/2)

Analytical Conditions for standard and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Nicotinamide	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	650
Blood Worm	120 -130	60	60	300	@ 30 sec	30-80-200	50	10	650
Midge Larva	125 - 135	60	60	300	@ 30 sec	30-80-200	50	10	650
Barley Pests	125 -135	60	60	300	@ 30 sec	30-80-200	50	10	650
Mealworms	120 - 135	60	60	300	@ 30 sec	30-80-200	50	10	650
Mealworms Pow.	125 - 135	60	60	300	@ 30 sec	30-80-200	50	10	650
Cricket Flour	125 - 140	60	60	300	@ 30 sec	30-80-200	50	10	650
Maggot Powder (Fly Larva)	125 - 135	60	60	300	@ 30 sec	30-80-200	50	10	650

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INSECT ANIMAL FEED (2/2)

Nitrogen / Protein data

Sample	N%	RSD%	Protein %	RSD%
Blood Worm	7.28	0.85	45.52	0.83
	7.29		45.56	
	7.38		46.15	
	7.41		46.29	
	7.40		46.26	
Midge Larva	7.69	0.37	48.09	0.33
	7.72		48.26	
	7.76		48.48	
	7.71		48.21	
	7.69		48.09	
Barley Pests	7.96	0.55	49.76	0.56
	8.03		50.21	
	8.00		49.97	
	7.93		49.57	
	7.93		49.56	
Mealworms	9.03	0.37	56.43	0.37
	9.03		56.43	
	8.95		55.92	
	9.01		56.29	
	8.99		56.20	
Mealworms Powder	8.55	0.51	53.47	0.47
	8.54		53.38	
	8.64		53.97	
	8.60		53.78	
	8.62		53.86	
Cricket Flour	10.94	0.57	68.37	0.58
	11.04		68.97	
	10.96		68.51	
	11.07		69.21	
	10.93		68.29	
Maggot Powder (Fly Larva)	8.65	0.44	54.05	0.43
	8.73		54.54	
	8.68		54.25	
	8.64		53.97	
	8.64		54.02	

Note

Set argon and oxygen pressure at 420 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.

The calibration was performed with nicotinamide using K factor as calibration method.

The 6.25 factor was used to calculate the Protein content.

The sample must be weighed in Tin disk 35 mm diam. (p/n 252 08018).



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Hyperproteic Ref. Mat.

N/Protein determination

HYPERPROTEIC POWDER BIPEA REF. MAT. (BIPEA: Bureau InterProfessionnel d'Etudes Analytiques, Paris, France)

Analytical Conditions for standard and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	100 - 120	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Hyperproteic powder	100 - 120	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800

BIPEA sample information available

Sample	Moisture	Fat	Carbohydrate	Kjeldahl Protein		Combustion Protein	
	%	%	%	Av. %	Tolerance	Av. %	Tolerance
BIPEA - Hyperproteic Powder 1/2008	NA	0.8	NA	85.4	34.4	86.4	3.5

Nitrogen /Protein data of Hyperproteic Powder sample

N%	Average N%	RSD%	Protein %	Average Protein %	RSD%
13.53	13.63	0.42	84.59	85.22	0.42
13.56			84.74		
13.67			85.42		
13.62			85.10		
13.69			85.57		
13.66			85.36		
13.60			85.02		
13.63			85.21		
13.71			85.72		
13.67			85.43		

Note

K factor was used as calibration method.

The 6.25 factor was used to calculate the Protein content.



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Soy Bean Meal

N/Protein determination

SOY BEAN MEAL REFERENCE MATERIAL

Analytical Conditions for standard and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Aspartic acid	130	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Soy Bean meal	50-100	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Soy Bean meal	130-190	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800

Nitrogen / Protein data of Soy Bean Meal Reference Material (50 - 100 mg)

Nitrogen / Protein data of Soy Bean Meal Reference Material (50 - 100 mg)						
Weight (mg)	N%	Av. N%	RSD%	Protein %	Av. Protein %	RSD%
64.62	7.56	7.52	0.327	47.23	47.02	0.332
62.21	7.49			46.78		
60.01	7.52			46.98		
63.49	7.55			47.17		
58.97	7.51			46.93		
55.60	7.54			47.15		
63.94	7.54			47.14		
70.33	7.55			47.20		
59.15	7.49			46.83		
67.22	7.53			47.09		
70.81	7.50			46.90		
72.46	7.55			47.18		
93.49	7.49			46.81		
100.91	7.51			46.93		
101.76	7.51			46.92		

Nitrogen / Protein data of Soy Bean Meal Reference Material (130 - 190 mg)						
Weight (mg)	N%	Av. N%	RSD%	Protein %	Av. Protein %	RSD%
130.48	7.50	7.50	0.077	46.86	46.87	0.077
132.67	7.51			46.91		
129.90	7.50			46.84		
140.57	7.49	7.49	0.534	46.81	46.81	0.513
141.41	7.53			47.05		
140.28	7.45			46.57		
161.30	7.48	7.52	0.682	46.73	47.02	0.703
160.29	7.51			46.95		
162.44	7.58			47.38		
170.53	7.47	7.50	0.407	46.66	46.88	0.413
171.02	7.53			47.06		
171.22	7.51			46.91		
182.89	7.49	7.53	0.413	46.81	47.09	0.417
182.54	7.56			47.23		
180.50	7.55			47.22		
91.57	7.54			47.12		

Note

Aspartic acid at 50 - 70 mg is used to calibrate the system when the weight of sample is 50 - 100 mg, otherwise a weight of about 130 mg of aspartic acid will be used when the weight of sample is 130 - 190 mg.

K factor was used as calibration method. The 6.25 factor was used to calculate the Protein content.

The certified N% is 7.5 and the uncertainty declared by the supplier is 0.05. The N% varies from batch to batch.



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Whey Protein

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WHEY PROTEIN

Analytical Conditions for standard and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	60 - 70	60	60	300	@ 30 sec	30-80-200	50	10	600 - 650
Whey protein	130 - 140	60	60	300	@ 30 sec	30-80-200	50	10	600 - 650

Nitrogen / Protein data

Sample	N%	RSD%	Protein %	RSD%
1	3.86	0.25	24.15	0.25
	3.86		24.12	
	3.85		24.04	
	3.85		24.06	
	3.83		23.96	
	3.85		24.07	
	3.86		24.15	
	3.84		24.02	
	3.85		24.04	
	3.85		24.04	
2	0.617	0.62	3.85	0.62
	0.615		3.85	
	0.613		3.83	
	0.610		3.81	
	0.610		3.81	
	0.610		3.81	
	0.609		3.80	
	0.616		3.85	
	0.606		3.79	
	0.606		3.79	

Note

Set argon and oxygen pressure at 420 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis. The calibration was performed with aspartic acid using K factor as calibration method. The 6.25 factor was used to calculate the Protein content.



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WATER (UREA WATER SOLUTION)

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	3.0 - 4.0	60	60	300	@ 10 sec	30-80-200	50	12	600 - 800
Urea water solution	150 - 200	60	60	300	@ 10 sec	30-80-200	50	12	600 - 800

Nitrogen data of Urea water solutions

Weight (mg)	N%	Average N%	RSD%
190.00	0.195	0.197	2.343
167.30	0.197		
174.46	0.207		
148.96	0.193		
161.33	0.201		
152.53	0.194		
143.11	0.195		
160.00	0.196		

Note

Urea water solutions was adsorbed on about 40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530).
K factor was used as calibration method.



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Ammonium and Urea

Nitrogen determination

AMMONIUM CHLORIDE, AMMONIUM SULPHATE AND UREA STANDARDS

Analytical Conditions for standard and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Thermo Scientific Urea	90 - 100	60	60	300	@ 10 sec	10-60-200	50	12	700
Ammonium Chloride	150 - 160	60	60	300	@ 10 sec	10-60-200	50	12	700
Ammonium Sulphate	190 - 200	60	60	300	@ 10 sec	10-60-200	50	12	700

Standards information

Sample	Theoretical N%	Uncertainty (±%)
Thermo Scientific Urea standard	46.65	0.30
Ammonium Chloride	26.18	0.25
Ammonium Sulphate	21.20	0.21

Experimental Nitrogen data of standards

Standard	Thermo Scientific Urea	Ammonium Chloride	Ammonium Sulfate
Element	N%	N%	N%
	46.63	26.45	21.36
	46.46	26.37	21.27
	46.44	26.42	21.25
	46.65	26.32	21.31
	46.57	26.20	21.42
	46.60	26.35	21.34
	46.36	26.41	21.32
	46.34	26.32	21.38
	46.33	26.42	21.33
	46.48	26.34	21.40
Average N %	46.49	26.36	21.34
RSD %	0.26	0.27	0.25

Note

K factor was used as calibration method.



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Inorganic Fertilizers

Nitrogen determination

INORGANIC FERTILIZERS (1/2)

Analytical Conditions for standard and sample analysis

Sample	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy Tune Category	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Thermo Scientific Urea	60	60	300	@ 10 sec	10-60-200	50	12	700
Inorganic fertilizers	60	60	300	@ 10 sec	10-60-200	50	12	700

Sample information

Sample No.	Mixture composition
1	Urea
2	Urea, biammonium phosphate, ammonium sulphate, monobasic calcium phosphate, bibasic calcium phosphate, calcium phosphate, zinc oxide, potassium chloride
3	Biammonium phosphate
4	Urea, biammonium phosphate, ammonium sulphate, monobasic calcium phosphate, bibasic calcium phosphate, calcium phosphate, zinc oxide, magnesium oxide, calcium carbonate, boron
5	Urea, biammonium phosphate, ammonium sulphate, monobasic calcium phosphate, bibasic calcium phosphate, calcium phosphate, magnesium oxide, calcium carbonate, potassium chloride, boron
6	Urea, biammonium phosphate, ammonium sulphate, monobasic calcium phosphate, bibasic calcium phosphate, calcium phosphate, magnesium oxide, calcium carbonate, potassium chloride, boron
7	Potassium carbonate, potassium nitrate, monobasic potassium phosphate, ammonium sulphate, iron EDTA, copper EDTA, zinc EDTA, boron



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Inorganic Fertilizers

Nitrogen determination

INORGANIC FERTILIZERS (2/2)

Standard and fertilizer sample weight for Test A and B

Test	Urea Standard	Inorganic fertilizer	
	Weight (mg)	Sample No.	Weight (mg)
A	95 - 100	1	92 - 95
		2	170 - 190
		3	200 - 210
		4	190 - 200
		5	200 - 230
		6	260 - 280
		7	260 - 300
B	45 - 50	1	43 - 50
		2	91 - 100
		3	105 - 113
		4	93 - 100
		5	176 - 183
		6	183 - 190
		7	165 - 184

Nitrogen data of Test A and B

Sample No.	Test A			Test B		
	N%	Average N%	RSD%	N%	Average N%	RSD%
1	46.68	46.68	0.14	46.50	46.69	0.37
	46.74			46.75		
	46.61			46.83		
2	23.34	23.33	0.43	23.06	22.69	0.37
	23.23			22.90		
	23.43			22.93		
3	18.31	18.30	0.20	18.63	18.52	0.62
	18.33			18.40		
	18.26			18.53		
4	22.04	22.05	0.05	21.72	21.77	0.76
	22.06			21.96		
	22.06			21.64		
5	10.36	10.44	0.72	10.50	10.44	0.58
	10.45			10.45		
	10.51			10.38		
6	11.06	11.01	0.56	10.69	10.71	0.16
	10.94			10.72		
	11.02			10.72		
7	15.34	15.16	1.05	15.44	15.32	0.68
	15.08			15.24		
	15.05			15.29		

Note

The calibration was performed with Thermo Scientific urea standard using K factor as calibration method.

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Beer

Nitrogen determination

BEER

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Urea water solution	250	60	60	300	5 sec	10-60-200	50	8	650
Beer	250	60	60	300	5 sec	10-60-200	50	8	650

Nitrogen data

Beer 1		Beer 2		Beer 3		Beer 4	
ppm N	RSD%	ppm N	RSD%	ppm N	RSD%	ppm N	RSD%
1048	0.41	924	0.66	921	0.61	953	0.62
1040		932		906		961	
1051		920		916		956	
1046		936		917		952	
1050		931		914		951	
1052		919		906		944	
1045		923		906		945	
1039		919		912		958	
1047		924		916		961	
1045		920		907		953	

Note

Set argon and oxygen pressure at 420 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.
The calibration was performed with urea water solution (1000 ppm N) using K factor as calibration method.
Beer were degassed by shaken before the analysis. Standard and samples were injected manually by the Manual Injection kit (p/n 190 04138).

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Beer

N/Protein determination

DRIED BAKERS YEAST

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Nicotinamide or Aspartic Acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	800
Dried Bakers Yeast	120 - 135	60	60	300	@ 30 sec	30-80-200	50	10	800

Nitrogen data

Day 1				Day 2			
N%	RSD%	Protein %	RSD%	N%	RSD%	Protein %	RSD%
7.24	0.23	45.25	0.24	7.20	0.24	45.00	0.25
7.24		45.24		7.21		45.04	
7.24		45.24		7.24		45.27	
7.23		45.19		7.23		45.17	
7.25		45.28		7.24		45.28	
7.22		45.13		7.25		45.30	
7.25		45.32		7.23		45.17	
7.23		45.17		7.26		45.37	
7.24		45.25		7.24		45.27	
7.26		45.39		7.24		45.26	
7.26		45.39		7.26		45.39	
7.25		45.30		7.22		45.12	
7.26		45.39		7.22		45.13	
7.24		45.24		7.25		45.32	
7.23		45.18		7.26		45.35	
7.22		45.14		7.25		45.30	
7.20		45.00		7.22		45.14	
7.26		45.39		7.22		45.14	
7.26		45.35		7.22		45.14	
7.26		45.39		7.22		45.12	
7.21		45.05		7.24		45.27	
7.25		45.31		7.25		45.31	
7.26		45.36		7.23		45.18	
7.26		45.40		7.24		45.26	
7.22		45.11		7.25		45.29	
7.23		45.20		7.25		45.34	
7.22		45.15		7.24		45.24	
7.25		45.33		7.24		45.23	
7.25		45.30		7.22		45.12	
7.25		45.28		7.21		45.08	

Note

Set argon and oxygen pressure at 350 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis. The calibration was performed with nicotinamide or aspartic acid using K factor as calibration method. The 6.25 factor was used to calculate the Protein content.



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Biscuit

N/Protein determination

BISCUIT

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	800
Biscuit	125 - 140	60	60	300	@ 30 sec	30-80-200	50	10	800

Nitrogen / Protein data

N%	RSD%	Protein %	RSD%
1.20	0.84	7.47	0.64
1.19		7.45	
1.18		7.38	

Note

Set argon and oxygen pressure at 350 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.

The calibration was performed with aspartic acid using K factor as calibration method.

The 6.25 factor was used to calculate the Protein content.



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Cereal Flakes

N/Protein determination

CEREAL FLAKES

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 60	60	60	300	@ 30 sec	30-80-200	50	10	800
Honey cereals	137 - 138	60	60	300	@ 30 sec	30-80-200	50	10	800
Corn cereals	138 - 139	60	60	300	@ 30 sec	30-80-200	50	10	800
Chocolate cereals	130 - 140	60	60	300	@ 30 sec	30-80-200	50	10	800

Nitrogen / Protein data

Sample	N%	RSD%	Protein %	RSD%
Honey cereals	1.25	0	7.82	0.13
	1.25		7.81	
	1.25		7.80	
Corn cereals	0.84	0.68	5.27	0.29
	0.85		5.30	
	0.85		5.29	
Chocolate cereals	1.29	0.77	8.07	0.81
	1.31		8.20	
	1.30		8.12	

Note

Set argon and oxygen pressure at 350 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.

The calibration was performed with aspartic acid using K factor as calibration method.

The 6.25 factor was used to calculate the Protein content.



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Cheese

N/Protein determination

PARMESAN CHEESE

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	800
Parmesan cheese	125 - 135	60	60	300	@ 30 sec	30-80-200	50	10	800

Nitrogen / Protein data

N%	RSD%	Protein %	RSD%
5.55	0.45	34.72	0.43
5.60		34.99	
5.60		35.01	
5.55		34.70	
5.57		34.79	

Note

Set argon and oxygen pressure at 350 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.

The calibration was performed with aspartic acid using K factor as calibration method. The 6.25 factor was used to calculate the Protein content.



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Flours

N/Protein determination

FLOURS REFERENCE MATERIALS

Analytical Conditions for standard and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Wheat Flour	140-150	60	60	300	B	30-80-200	50	12	600 - 800
Rice Flour	130-150	60	60	300	B	30-80-200	50	12	600 - 800
Barley Flour	140-150	60	60	300	B	30-80-200	50	12	600 - 800
Oatmeal	150	60	60	300	B	30-80-200	50	12	600 - 800

Expected Nitrogen values of Flour Reference Materials

Sample Description	Specification	
	N%	Uncertainty (±)
Wheat Flour Reference Material	1.36	0.25
Rice Flour Reference Material	1.38	0.05
Barley Flour Reference Material	1.90	0.04
Oatmeal Reference Material	1.90	0.10
Soy Bean Meal Reference Material	7.50	0.05

Experimental Nitrogen data of standards

Sample	Wheat Flour		Rice Flour		Barley Flour		Oatmeal	
	Determination	N%	Protein %	N%	Protein %	N%	Protein %	N%
		1.37	8.57	1.36	8.49	1.89	11.80	1.88
		1.36	8.51	1.37	8.59	1.91	11.94	1.88
		1.34	8.36	1.40	8.73	1.91	11.91	1.86
		1.35	8.41	1.40	8.74	1.91	11.95	1.90
		1.36	8.52	1.40	8.75	1.94	12.10	1.86
		1.36	8.49	1.38	8.65	1.91	11.91	1.85
		1.33	8.28	1.38	8.65	1.87	11.66	1.92
		1.36	8.51	1.38	8.62	1.89	11.80	1.87
		1.33	8.30	1.41	8.83	1.90	11.89	1.92
		1.36	8.52	1.39	8.69	1.92	11.97	1.89
Average		1.35	8.45	1.39	8.67	1.90	11.89	1.88
RSD %		1.034	1.210	1.130	1.106	0.997	0.997	1.302

Note

K factor was used as calibration method. The 6.25 factor was used to calculate the Protein content.
The N% varies from batch to batch.



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Food

N/Protein determination

INSECT FOOD (1/2)

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Nicotinamide	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	650
Tenebrio Beetle	120 - 130	60	60	300	@ 30 sec	30-80-200	50	10	650
Sigillatus Crickets	120 - 135	60	60	300	@ 30 sec	30-80-200	50	10	650
Tenebrio Beetle Barbecue	120 - 130	60	60	300	@ 30 sec	30-80-200	50	10	650
Tenebrio Beetle Salsa	120 - 135	60	60	300	@ 30 sec	30-80-200	50	10	650
Pasta with Worms	125 - 135	60	60	300	@ 30 sec	30-80-200	50	10	650
Worm Chocolate	80 - 95	60	60	300	@ 30 sec	30-80-200	50	10	650
Crispy Silkworms	125 - 135	60	60	300	@ 30 sec	30-80-200	50	10	650
Crispy Small Crickets	125 - 130	60	60	300	@ 30 sec	30-80-200	50	10	650
Silkworm Chrysalis	130 - 135	60	60	300	@ 30 sec	30-80-200	50	10	650

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N/Protein determination

INSECT FOOD (2/2)

Nitrogen / Protein data

Sample	N%	RSD%	Protein %	RSD%
Tenebrio Beetle	9.00	0.48	56.28	0.48
	9.06		56.62	
	9.01		56.33	
	8.99		56.19	
	9.09		56.84	
Sigillatus Crickets	9.00	0.61	56.24	0.60
	9.06		56.63	
	9.07		56.67	
	9.12		56.99	
	9.14		57.10	
Tenebrio Beetle Barbecue	8.51	0.36	53.20	0.39
	8.44		52.74	
	8.46		52.87	
	8.46		52.90	
	8.43		52.66	
Tenebrio Beetle Salsa	8.70	0.45	54.40	0.42
	8.70		54.38	
	8.76		54.72	
	8.79		54.92	
	8.75		54.66	
Pasta with Worms	3.54	0.81	22.13	0.73
	3.59		22.42	
	3.52		22.03	
	3.55		22.21	
	3.52		22.03	
Worm Chocolate	2.33	0.95	14.55	0.97
	2.37		14.83	
	2.39		14.92	
	2.36		14.77	
	2.35		14.67	
Crispy Silkworms	7.92	0.45	49.52	0.44
	7.99		49.95	
	7.94		49.65	
	8.00		50.03	
	7.99		49.92	
Crispy Small Crickets	9.08	0.43	56.75	0.41
	9.07		56.67	
	9.01		56.33	
	9.03		56.43	
	8.99		56.19	
Silkworm Chrysalis	8.76	0.69	54.73	0.67
	8.67		54.22	
	8.74		54.63	
	8.79		54.95	
	8.65		54.08	

Note

Set argon and oxygen pressure at 420 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis. The calibration was performed with nicotinamide using K factor as calibration method. The 6.25 factor was used to calculate the Protein content. The sample must be weighed in Tin disk 35 mm diam. (p/n 252 08018).



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N/Protein determination

SPIRULINA ALGAE

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Nicotinamide	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	650
Spirulina Algae	120 -140	60	60	300	@ 30 sec	30-80-200	50	10	650

Nitrogen / Protein data

N%	RSD%	Protein %	RSD%
10.80	0.30	67.47	0.30
10.77		67.31	
10.82		67.65	
10.75		67.18	
10.81		67.56	
10.83		67.69	
10.74		67.13	
10.78		67.37	
10.75		67.20	
10.81		67.57	

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Infant Food

N/Protein determination

INFANT FOOD (1/2)

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 60	60	60	300	@ 30 sec	30-80-200	50	12	700
Urea water solution (0.46 N%)	260 - 270	60	60	300	C	30-80-200	50	12	700
Infant Food (powders)	110 - 115	60	60	300	A	30-80-200	50	12	700
Infant Food (liquid)	220 - 270	60	60	300	C	30-80-200	50	12	700

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Infant Food

N/Protein determination

INFANT FOOD (2/2)

Nitrogen data of infant food samples

Infant Food	Ref No.	N%	Protein %	RSD%
Powder	1	2.31	14.76	0.85
		2.30	14.68	
		2.34	14.93	
	2	2.14	13.66	0.76
		2.16	13.78	
		2.13	13.57	
	3	2.75	17.54	0.43
		2.77	17.65	
		2.74	17.50	
	4	2.42	15.45	0.34
		2.41	15.41	
		2.40	15.34	
	5	1.57	10.03	0.60
		1.57	10.00	
		1.59	10.12	
	6	4.87	31.06	0.23
		4.86	30.99	
		4.85	30.91	
	7	2.52	16.06	0.71
		2.50	15.97	
		2.48	15.84	
	8	1.67	10.68	0.90
		1.65	10.53	
		1.64	10.49	
	9	2.46	15.67	0.72
		2.48	15.81	
		2.44	15.59	
	10	2.06	13.15	0.55
		2.04	13.04	
		2.07	13.18	
	11	1.65	10.56	0.18
		1.66	10.59	
		1.65	10.55	
Liquid	12	0.219	1.40	3.35
		0.214	1.36	
		0.205	1.31	
	13	0.475	3.03	1.86
		0.477	3.04	
		0.461	2.94	

Note

Urea water solution and liquid infant food samples were adsorbed on about 40 - 50 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530). K factor was used as calibration method. The 6.38 factor was used to calculate the Protein content.



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Malt

N/Protein determination

MALT

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	600 - 650
Malt	130 - 140	60	60	300	@ 30 sec	30-80-200	50	10	600 - 650

Nitrogen / Protein data

Sample	N%	RSD%	Protein %	RSD%
1	1.70	0.59	10.62	0.70
	1.71		10.70	
	1.69		10.57	
	1.71		10.69	
	1.69		10.53	
2	1.55	0.84	9.71	0.91
	1.54		9.60	
	1.54		9.65	
	1.56		9.74	
	1.57		9.83	
3	1.76	0.95	11.03	1.01
	1.75		10.95	
	1.74		10.87	
	1.74		10.89	
	1.78		11.14	

Note

Set argon and oxygen pressure at 420 kPa.

A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.

The calibration was performed with aspartic acid using Linear Fit as calibration method.

The 6.25 factor was used to calculate the Protein content.



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Milk

Nitrogen determination

MILK

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	20 - 30	60	60	300	@ 20 sec	30-80-200	50	12	600 - 800
Milk	60 - 120	60	60	300	@ 20 sec	30-80-200	50	12	600 - 800

Nitrogen data of milk

Weight (mg)	N%	Average N%	RSD%
120.09	0.442	0.458	5.148
110.64	0.465		
113.17	0.492		
119.00	0.477		
79.00	0.430		
64.65	0.432		
93.20	0.465		

Note

Milk was adsorbed on about 40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530). K factor was used as calibration method.

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Milk

N/Protein determination

MILK

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	800
Milk	100 - 125	60	60	300	@ 30 sec	30-80-200	50	10	800

Nitrogen / Protein data

N%	RSD%	Protein %	RSD%
0.51	1.12	3.20	0.54
0.52		3.23	
0.51		3.20	

Note

Set argon and oxygen pressure at 350 kPa.
A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.
The calibration was performed with aspartic acid using K factor as calibration method.
Milk sample was weighed in tin containers adsorbed on 30-40 mg of Chromosorb WAW (30 - 60 mesh) (p/n 338 37530) inert material.
The 6.38 factor was used to calculate the Protein content.

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Pasta

N/Protein determination

PASTA REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Pasta	150-160	60	60	300	B	30-80-200	50	12	600 - 800

Nitrogen / Protein data

N %	Average N%	RSD%	Protein %	Average Protein %	RSD%
2.21	2.21	0.542	13.81	13.81	0.535
2.23			13.94		
2.19			13.69		
2.20			13.75		
2.22			13.87		
2.21			13.81		
2.20			13.75		
2.22			13.87		
2.21			13.81		
2.20			13.75		

Note

K factor was used as calibration method.

The 6.25 factor was used to calculate the Protein content.

The certified N% is 2.227 and the acceptable range according to the technical specification is 2.207 - 2.247 N%.

The N% varies from batch to batch.



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Soy

N/Protein determination

SOY BEAN AND SOY MEAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Nicotinamide	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	800
Soy bean	120 - 140	60	60	300	@ 30 sec	30-80-200	50	10	800
Soy meal	120 - 140	60	60	300	@ 30 sec	30-80-200	50	10	800

Nitrogen / Protein data

Sample Nature	Sample Code	N%	RSD%	Protein %	RSD%
Soy bean	1	5.74	0.27	35.89	0.21
		5.72		35.78	
		5.75		35.92	
	2	5.67	0.27	35.45	0.24
		5.68		35.51	
		5.65		35.34	
	3	5.76	0.10	36.00	0.04
		5.77		36.03	
		5.76		36.01	
Soy meal	4	7.73	0.13	48.29	0.14
		7.72		48.28	
		7.71		48.17	
	5	7.19	0.35	44.96	0.31
		7.21		45.06	
		7.24		45.24	
	6	7.63	0.08	47.68	0.06
		7.64		47.74	
		7.63		47.70	
	7	7.78	0.22	48.60	0.18
		7.75		48.44	
		7.75		48.45	
	8	8.32	0.21	52.00	0.22
		8.32		52.02	
		8.29		51.81	
	9	8.06	0.21	50.35	0.26
		8.09		50.58	
		8.06		50.36	
	10	8.32	0.26	49.88	0.25
		8.32		49.82	
		8.29		50.06	

Note

Set argon and oxygen pressure at 420 kPa. A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis. The calibration was performed with nicotinamide using K factor as calibration method. The 6.25 factor was used to calculate the Protein content.



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Soy

N/Protein determination

SOY AND FISH ASIAN SAUCES

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 60	60	60	300	@ 30 sec	30-80-200	50	10	800
Soy sauce 1	130 - 150	60	60	300	@ 30 sec	30-80-200	50	10	800
Soy sauce 2	125 - 140	60	60	300	@ 30 sec	30-80-200	50	10	800
Soy sauce 3	120 - 125	60	60	300	@ 30 sec	30-80-200	50	10	800
Fish sauce 1	130 - 145	60	60	300	@ 30 sec	30-80-200	50	10	800
Fish sauce 2	120 - 135	60	60	300	@ 30 sec	30-80-200	50	10	800

Nitrogen / Protein data

Sample	N%	RSD%	Protein %	RSD%
Soy sauce 1	0.91	0.60	5.66	0.34
	0.91		5.67	
	0.91		5.69	
	0.90		5.64	
	0.90		5.65	
Soy sauce 2	0.46	0.97	2.89	0.93
	0.47		2.92	
	0.46		2.85	
	0.46		2.90	
	0.46		2.91	
Soy sauce 3	2.20	0.41	13.74	0.50
	2.20		13.77	
	2.22		13.89	
	2.20		13.73	
	2.21		13.84	
Fish sauce 1	1.38	0.97	8.63	0.90
	1.38		8.60	
	1.38		8.62	
	1.38		8.59	
	1.41		8.78	
Fish sauce 2	0.83	0.66	5.18	0.81
	0.82		5.12	
	0.82		5.10	
	0.82		5.11	
	0.83		5.19	

Note

Set argon and oxygen pressure at 350 kPa.

A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.

The calibration was performed with aspartic acid using K factor as calibration method.

The 6.25 factor was used to calculate the Protein content.



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SOIL REFERENCE MATERIALS

Analytical Conditions for standard and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 60	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Low Organic Content Soil	300-350	60	60	300	C	30-80-200	50	12	600 - 800
Medium Organic Content Soil	300-350	60	60	300	C	30-80-200	50	12	600 - 800
Loamy Soil	300-350	60	60	300	C	30-80-200	50	12	600 - 800
Chalky Soil	300-350	60	60	300	C	30-80-200	50	12	600 - 800

Expected Nitrogen values of Soil Reference Materials

Sample Description	Specification	
	N%	Uncertainty
Low Organic Content Soil	0.133	0.023
Medium Organic Content Soil	0.27	0.02
Loamy Soil	0.27	0.01
Chalky Soil	0.35	0.01

Experimental Nitrogen data of standards

Sample Description	Weight (mg)	N%	Average N%	RSD%
Low Organic Content Soil	351.931	0.117	0.114	2.321
	307.521	0.113		
	340.210	0.112		
Medium Organic Content Soil	285.120	0.264	0.262	1.443
	336.816	0.258		
	322.010	0.265		
Loamy Soil	322.020	0.265	0.268	0.119
	326.020	0.271		
	340.567	0.268		
Chalky Soil	254.416	0.337	0.358	5.173
	326.987	0.365		
	350.471	0.372		

Note

K factor was used as calibration method.
The N% varies from batch to batch.



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THERMO SCIENTIFIC SOIL REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 60	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Soil	250 - 350	60	60	300	C	30-80-200	50	12	600 - 800

Nitrogen data of Thermo Scientific Soil Reference Material

Weight (mg)	N%	RSD%
250.224	0.20	2.55
260.746	0.20	
270.494	0.19	
300.714	0.19	
310.893	0.19	
320.423	0.19	
270.794	0.19	
280.101	0.19	
290.134	0.19	
300.844	0.19	
320.242	0.20	
350.896	0.20	

Note

K factor was used as calibration method.

The certified N % is 0.21 and the accepted range according to the technical specification is 0.19 - 0.23 N%.

The N% varies from batch to batch.



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SANDY SOIL REFERENCE MATERIAL

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Mix EDTA /Glucose	200	60	60	300	@ 42 sec	30-80-200	50	12	600 - 800
Sandy Soil	400	60	60	300	@ 42 sec	30-80-200	50	12	600 - 800

Nitrogen / Protein data

Weight (mg)	N%	Average N%	RSD%
408.698	0.0700	0.0707	1.8848
402.849	0.0711		
398.636	0.0703		
409.065	0.0707		
408.650	0.0691		
412.241	0.0718		
403.313	0.0694		
401.651	0.0692		
400.316	0.0718		
400.420	0.0732		

Note

Mixture with EDTA (9.59 N%) and glucose was prepared in a range of concentration between 500 - 1000 ppm N to calibrate the instrument.

The Sandy soil is weighed in tin disk (35 mm diameter).

K factor was used as calibration method.

The certified N% is 0.07 and the uncertainty is 0.01.

The N% varies from batch to batch.



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Forage

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FORAGE

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	800
Forage	118 - 132	60	60	300	@ 30 sec	30-80-200	50	10	800

Nitrogen / Protein data

N%	RSD%
1.10	0.91
1.11	
1.09	

Note

Set argon and oxygen pressure at 350 kPa.

A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.

The calibration was performed with aspartic acid using K factor as calibration method.



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LEAVES REFERENCES MATERIALS

Analytical Conditions for standard and samples analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 60	60	60	300	@ 30 sec	30-80-200	50	12	600 - 800
Birch Leaves	150 - 200	60	60	300	@ 30sec	30-80-200	50	12	600 - 800
Orchard Leaves	100 - 150	60	60	300	@ 30sec	30-80-200	50	12	600 - 800

Expected Nitrogen values of Soil Reference Materials

Sample Description	Specification	
	N%	Uncertainty (±)
Birch Leaves	2.12	0.06
Orchard Leaves	2.28	0.04

Birch and Orchard Leaves

Sample	Birch Leaves		Orchard Leaves	
	Weight (mg)	N%	Weight (mg)	N%
	203.77	2.11	100.46	2.24
	162.55	2.12	120.53	2.24
	162.34	2.11	120.21	2.26
	165.10	2.13	140.23	2.30
	165.08	2.12	140.32	2.25
	169.53	2.14	140.34	2.28
	170.05	2.13	150.60	2.31
	150.80	2.11	140.39	2.26
	153.99	2.11	140.20	2.30
	160.78	2.11	139.63	2.29
Average N %		2.12		2.27
RSD %		0.519		1.156

Note

K factor was used as calibration method.
The N% varies from batch to batch. Orchard leaves was dried at 105°C for 2 hours.



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Nitrogen determination

PLANTS

Analytical Conditions for standards and sample analysis

Sample	Weight (mg)	Carrier Flow (ml/min)	Ref Flow (ml/min)	Oxy Flow (ml/min)	Oxy. Inj. Time (sec)	AGO On-Off-Flow	Oven (C°)	Sample Delay (sec)	Cycle Time (sec)
Aspartic acid	50 - 70	60	60	300	@ 30 sec	30-80-200	50	10	600 - 800
Plant	130 - 140	60	60	300	@ 30 sec	30-80-200	50	10	600 - 800

Nitrogen data

Sample	N%	RSD%
1	3.86	0.30
	3.86	
	3.98	
2	3.44	0.29
	3.43	
	3.45	
3	1.72	0.34
	1.72	
	1.71	

Note

Set argon and oxygen pressure at 420 kPa.

A 1 m GC column (p/n 260 70004) installed outside the oven was used for the analysis.

The calibration was performed with aspartic acid using K factor as calibration method.



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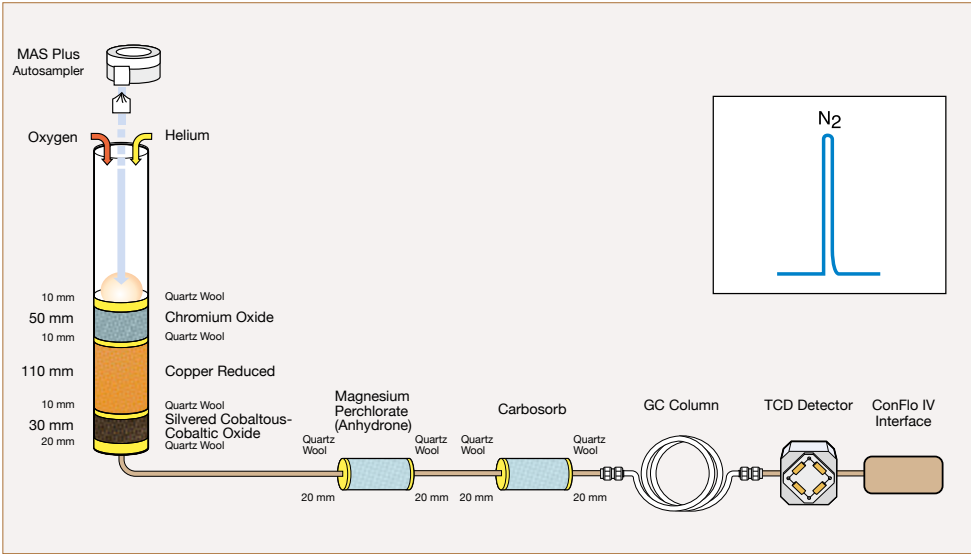
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ANALYTICAL CONFIGURATIONS - N-ONLY DETERMINATION (SINGLE REACTOR)



Analytical conditions		
Set pressure through the pressure regulators on the front panel		
Parameters	By using pressure regulator only	By using EFCt control
Helium	100 kPa to obtain 80 ml/min	250 kPa
Oxygen	150 kPa	250 kPa

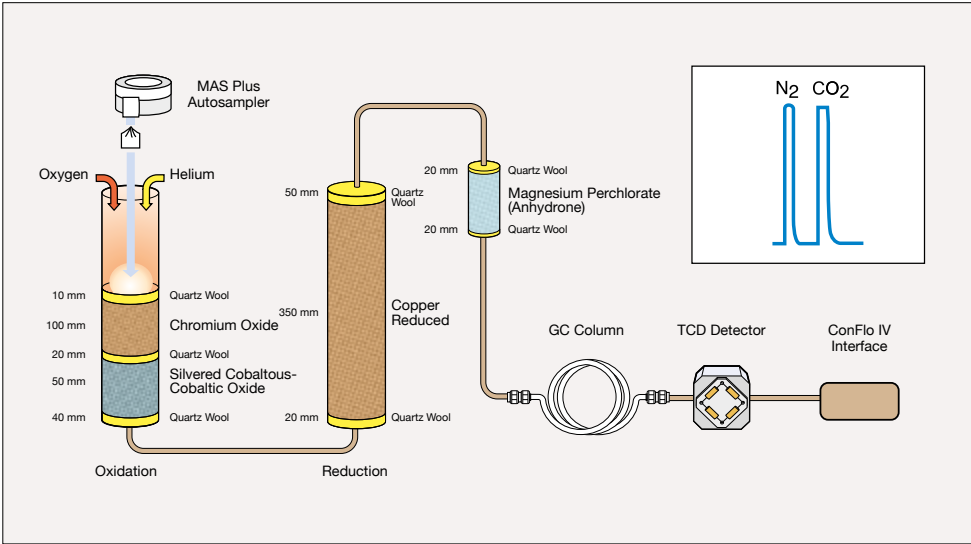
Set Flow through Thermo Scientific Eager Xperience Data Handling Software		
Parameters	By using pressure regulator only	By using EFCt control
Helium as carrier gas	300 ml/min	80 ml/min
Helium as reference gas	250 ml/min	250 ml/min
Oxygen	250 ml/min	250 ml/min

List of consumables	p/n
Chromium oxide (25 g)	338 22900
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
Reduced Copper (100 g)	338 35300
Quartz wool (5q)	338 22200
Magnesium Perchloride (Anhydrous, 100 g)	338 21900
Empty quartz reactor (set of 2)	468 20070
Prepacked oxidation reactor NC determination	468 20076
Prepacked reduction reactor NC determination	468 20077
Adsorption filter for IRMS / HT	281 13102
IRMS Separation Column (ss; 3 m; 6 x 5 mm)	260 08205

Note
The analytical conditions reported here below are general parameters used for the Thermo Scientific FLASH 2000 coupled to IRMS. Please refer to the relative conditions suggested according to the application.



ANALYTICAL CONFIGURATIONS - NC DETERMINATION



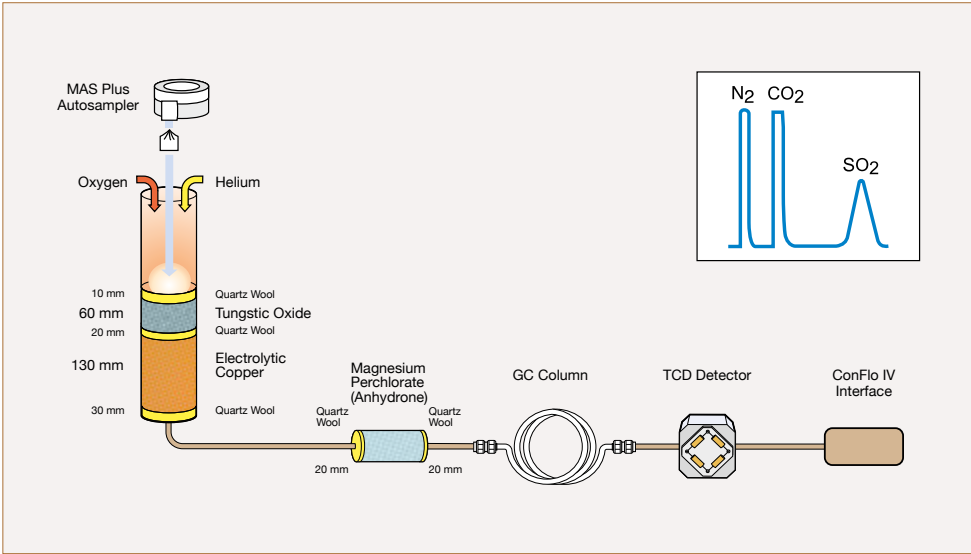
Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	250
Flow (ml/min)	He carrier	180
	He reference	70
	Oxygen	250
Temperature (°C)	Left furnace	1020
	Right furnace	650
	GC Oven	70
Cycle (Run Time)	480 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Chromium oxide (25 g)	338 22900
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 35312
Reduced Copper (100 g)	338 35300
Quartz wool (5 g)	338 22200
Magnesium Perchloride (Anhydrous, 100 g)	338 21900
Empty quartz reactor (set of 2)	468 20070
Prepacked reactor NC determination (Argon sealed)	468 02009
Adsorption filter for IRMS / HT	281 13102
IRMS Separation Column (ss; 3 m; 6 x 5 mm)	260 08205

Note
The analytical conditions reported here below are general parameters used for the Thermo Scientific FLASH 2000 coupled to IRMS. Please refer to the relative conditions suggested according to the application.



ANALYTICAL CONFIGURATIONS - NCS DETERMINATION



Analytical conditions		
Set pressure through the pressure regulators on the front panel		
Parameters	By using pressure regulator only	By using EFCt control
Helium	100 kPa to obtain 80 ml/min	250
Oxygen	150 kPa	250

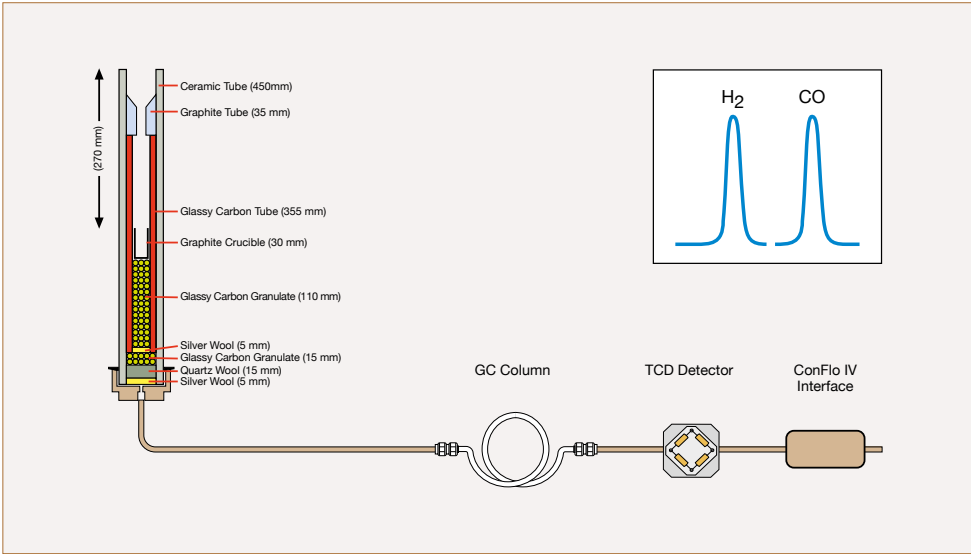
Set Flow through Thermo Scientific Eager Xperience Data Handling Software		
Parameters	By using pressure regulator only	By using EFCt control
Helium as carrier gas	300 ml/min	100
Helium as reference gas	250 ml/min	250
Oxygen	250 ml/min	250

List of consumables	p/n
Quartz wool (5 g)	338 22200
Tungsten oxide (25 g)	338 24600
Electrolytic copper (80 g)	338 35314
Magnesium Perchloride (Anhydrous, 100 g)	338 21900
Prepacked reactor NCS determination	468 02021
Adsorption filter for IRMS / HT	281 13102
Vanadium Pentoxide	338 37510
Sulfinert Separation Column (2 m)	128 9970

Note
The analytical conditions reported here below are general parameters used for the Thermo Scientific FLASH 2000 coupled to IRMS. Please refer to the relative conditions suggested according to the application.



ANALYTICAL CONFIGURATIONS - OH DETERMINATION



Analytical conditions		
Set pressure through the pressure regulators on the front panel		
Parameters	By using pressure regulator only	By using EFCt control
Helium	300 kPa to obtain 80 ml/min	250 kPa
Oxygen	0 kPa	0 kPa

Set Flow through Thermo Scientific Eager Xperience		
Parameters	By using pressure regulator only	By using EFCt control
Helium as carrier gas	300 ml/min	80 ml/min
Helium as reference gas	250 ml/min	250 ml/min
Oxygen	0 ml/min	0 ml/min

List of consumables	p/n
Carbosorb (CO2 adsorber) for O/H (50 g)	338 35236
O/H Separation Column (SS; 1 m; 6x5 mm)	260 07900
Glassy Carbon Granulate	1117401*
Silver wool	1117430*
Graphite crucible	1117332*
Reactor Flash HT (containing ceramic tube, glassy carbon tube, graphite tube)	1197480*

- Note**
- The analytical conditions reported here below are general parameters used for the Thermo Scientific FLASH 2000 coupled to IRMS. Please refer to the relative conditions suggested according to the application
 - The HT pyrolysis chemicals for O/H determination constituted to ceramic reactor, glassy carbon reactor, graphite crucible, glassy carbon granulate, silver wool, etc., can be ordered directly from Thermo Fisher Scientific GmbH, Bremen, Germany.
- *Thermo Scientific consumables can be ordered from Thermo Fisher Scientific, Hanna-Kunath-Str. 11, 28199 Bremen, Germany



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Nitrogen, Carbon and Sulfur isotope determination

BIRD FEATHERS

Information

The Thermo Scientific FlashEA 1112 and the Thermo Scientific ConFlo IV were connected through the smartEA option.

The IRMS system used was a Thermo Scientific *DELTA V* Plus with a universal triple collector.

For the simultaneous NCS determination, the Pre-packed Reactor (p/n 468 02005) was used.

Tubing in the FlashEA 1112 and the connection to the Thermo Scientific ConFlo IV interface is made of 1/16" Sulfinert capillary.

Thermo Scientific Flash EA 1112 IRMS parameters

Reactor Temperature 1020°C	Oven Temperature 70°C
Helium Carrier Flow 80 ml/min	Analysis Time 320 sec
Thermo Scientific MAS 200R Autosampler	

NCS isotope ratio data

Amount (mg)	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	$\delta^{34}\text{S}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) Std. Dev.	Mean $\delta^{13}\text{C}$ (‰) Std. Dev.	Mean $\delta^{34}\text{S}$ (‰) Std. Dev.
1.148	7.60	-15.42	5.42	7.71 0.10	-15.53 0.09	5.23 0.17
1.002	7.75	-15.58	5.13			
1.065	7.78	-15.57	5.14			

Note

For more information see Thermo Scientific Application Note 30194

(Simultaneous N, C and S Isotope Ratio Determination on a *DELTA V* Isotope Ratio MS using a Flash Elemental Analyzer)



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Sulfur isotope determination

BIRD FEATHERS

Thermo Scientific EA 1108 parameters	
Combustion Temperature 1030°C	Oven Temperature 60°C
Helium Pressure (kPa) 60	Helium Carrier Flow 90 ml/min
Oxygen Pressure (kPa) 70	Analysis Time 820 sec
Sampling Delay 15 sec	Thermo Scientific AS 200 Autosampler

IRMS information

- Thermo Scientific ConFlo III conditions: Helium pressure 0.95 bar; reference SO₂ at 0.5 bar
- Thermo Scientific DELTA Plus XP2
- Thermo Scientific Isodat NT 2.0

Sample information

Standard:	NBS 127, NBS 123, IAEA S1, IAEA S2, IAEA S3
Standard weight:	0.51 mg
Sample weight:	3.6 mg

Sulfur data of bird feathers

Average of δ ³⁴ Sulfur of 10 det.:	18.113 ‰
Std. Dev.:	0.150

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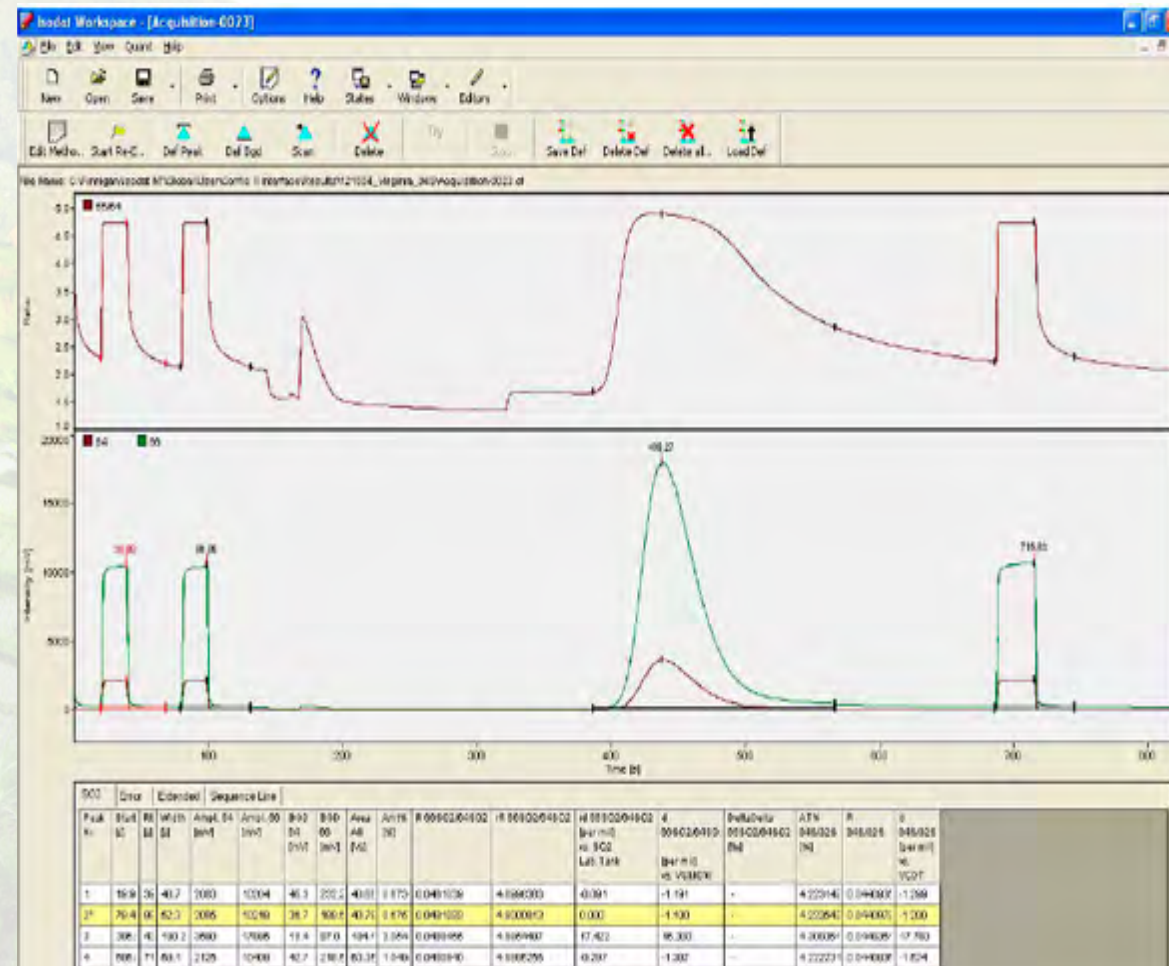
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Sulfur isotope determination

BIRD FEATHERS

Sulfur chromatogram



Thanks to Centros Científicos y Tecnológicos, Laboratorio de Isótopos Estables, Universidad de Barcelona, Spain.

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Nitrogen and Carbon isotope determination

BIRD FEATHERS

Thermo Scientific EA 1108 parameters		
Combustion Temperature 900°C	Reduction Temperature 680°C	Oven Temperature 45°C
Helium Pressure (kPa) 200	Helium Carrier Flow 120 ml/min	Helium Reference Flow 150 ml/min
Oxygen Pressure (kPa) 400	Oxygen Flow 250 ml/min	Oxygen Injection Time 5 sec
Sampling Delay 15 sec	Analysis Time 320 sec	Thermo Scientific AS 200 Autosampler

IRMS information

- Thermo Scientific ConFlo IV conditions: N₂ 3 bar, He 1 bar, CO₂ 3bar
- Thermo Scientific DELTA V Plus2
- Thermo Scientific ISODAT 3.02

Sample information

Standard:	Casein
Standard weight:	0.5 mg
Sample weight:	0.5 mg

NC isotope data

Amount (mg)	δ ¹⁵ N (‰)	δ ¹³ C (‰)	Mean δ ¹⁵ N (‰) Std. Dev.	Mean δ ¹³ C (‰) Std. Dev.
0.24	5.28	-23.48	5.20	-23.52
0.21	5.11	-23.56		

Thanks to Federica Camin and Luca Ziller, Fondazione Edmund Mach, CRI-DQAN, San Michele all'Adige, (TN), Italy

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Nitrogen and carbon isotope determination

BIRD FEATHERS

FLASH 2000 IRMS parameters		
Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 40°C
Helium Pressure (kPa) 100	Helium Carrier Flow 300 ml/min	Helium Reference Flow 250 ml/min
Oxygen Pressure (kPa) 300	Oxygen Flow 250 ml/min	Oxygen Injection Time 4 sec
Sampling Delay 21 sec	Analysis Time 50 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III conditions: CO₂ / N₂ 1 bar²
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 2.5 Software Suite

Sample information

Standard:	Acetanilide
Standard weight:	0.27 - 0.30 mg
Sample weight:	0.3 - 0.5 mg

NC isotope data

Sample	Amount (mg)	δ ¹⁵ N	δ ¹³ C (‰)	Mean δ ¹⁵ N (‰) Std. Dev.	Mean δ ¹³ C (‰) Std. Dev.
Bird feathers 1	0.2970	15.319	-18.633	13.948 1.242	-19.161 0.546
	0.3430	13.626	-19.724		
	0.3618	12.898	-19.125		
Bird feathers 2	0.627	9.425	-19.008	10.017 0.526	-19.134 0.357
	0.662	10.194	-18.857		
	0.600	10.432	-19.536		
Penguins feathers	0.4589	6.782	-17.545	7.824 0.947	-17.923 0.328
	0.4929	8.060	-18.141		
	0.3630	8.631	-18.082		



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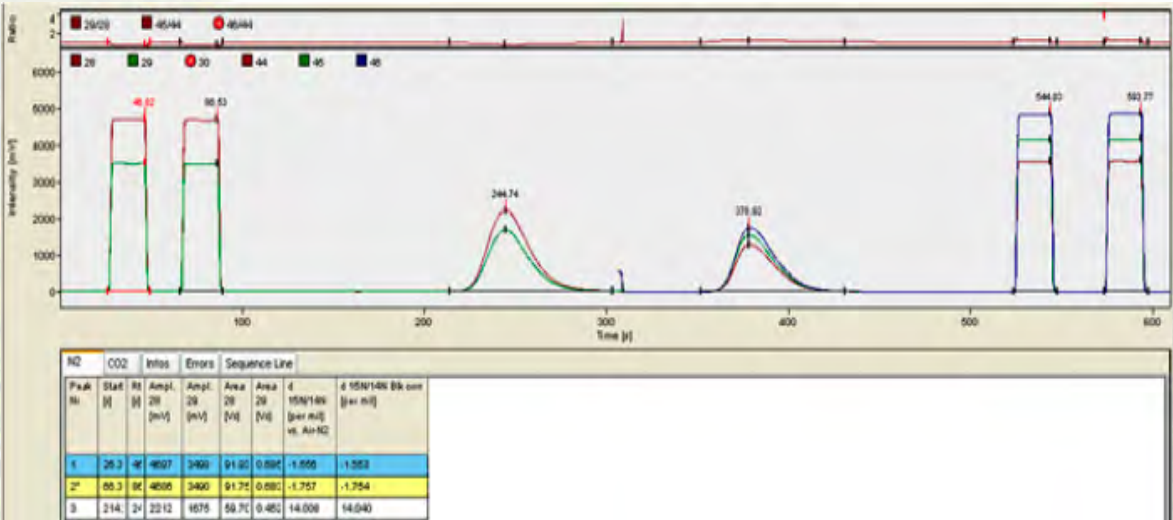
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Nitrogen and carbon isotope determination

BIRD FEATHERS

Chromatogram of bird blood



Thanks to Cristina Grela Docal, IMAR - CMA, Dept. of Life Sciences, University of Coimbra, Coimbra, Portugal.

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Nitrogen isotope determination

BIRD BLOOD

FLASH 2000 IRMS parameters		
Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 40°C
Helium Pressure (kPa) 100	Helium Carrier Flow 300 ml/min	Helium Reference Flow 250 ml/min
Oxygen Pressure (kPa) 300	Oxygen Flow 250 ml/min	Oxygen Injection Time 4 sec
Sampling Delay 21 sec	Analysis Time 500 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III conditions: CO₂ / N₂ 1 bar
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 2.5 Software Suite2

Sample information

Standard: Acetanilide
Standard weight: 0.27 - 0.30 mg
Sample weight: 0.3 mg

NC isotope data

Amount (mg)	δ ¹⁵ N (‰)	δ ¹³ C (‰)	Mean δ ¹⁵ N (‰) Std. Dev.	Mean δ ¹³ C (‰) Std. Dev.
0.4081	9.633	20.074	9.658 0.052	-19.994 0.139
0.4242	9.624	-20.074		
0.4532	9.719	-19.833		

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Nitrogen and Carbon isotope determination

COLLAGEN (FROM HUMAN AND ANIMAL BONE)

FLASH 1112 IRMS Parameters		
Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 40°C
Helium Pressure (kPa) 250	Helium Carrier Flow 100 ml/min	Helium Reference Flow 250 ml/min
Oxygen Pressure (kPa) 300	Oxygen Flow 250 ml/min	Oxygen Injection Time 10 sec
Sampling Delay 14 sec	Analysis Time 600 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 1.5 bar CO₂ / N₂, He 0.6 bar
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 3.0 Software Suite2

Sample information

Standard:	Nicotinamide	R041, IAEA-N-2,IAEA-CH-6, Fish (in house QC std)
Standard weight:	0.50 - 0.60 mg Nicotinamide, 0.45 - 0.55 mg R041 0.30 - 0.40 mg IAEA-N-2 0.55 - 0.65 mg IAEA-CH-6 0.90 - 1.10 mg Fish (QC)	
Sample weight:	0.8 - 1.10 mg	

Sample pre-treatment

Based on method by Brown et al. 1998, using a Vivaspin® filter cleaning method introduced by Bronk Ramsey et al (2004). Mild acid and alkali solutions were used to remove inorganic and natural organic post depositional contaminants. For collagen extraction and gelatinization were used acidified water and heated to dissociate the amino acids from the bone matrix.

NC isotope data

Weight (ug)	δ ¹⁵ N (‰)	δ ¹³ C (‰)	Mean δ ¹⁵ N (‰) Std. Dev.	Mean δ ¹³ C (‰) Std. Dev.
1.280	9.161	-21.451	9.196 0.030	-21.462 0.010
1.097	9.214	-21.464		
1.156	9.212	-21.471		

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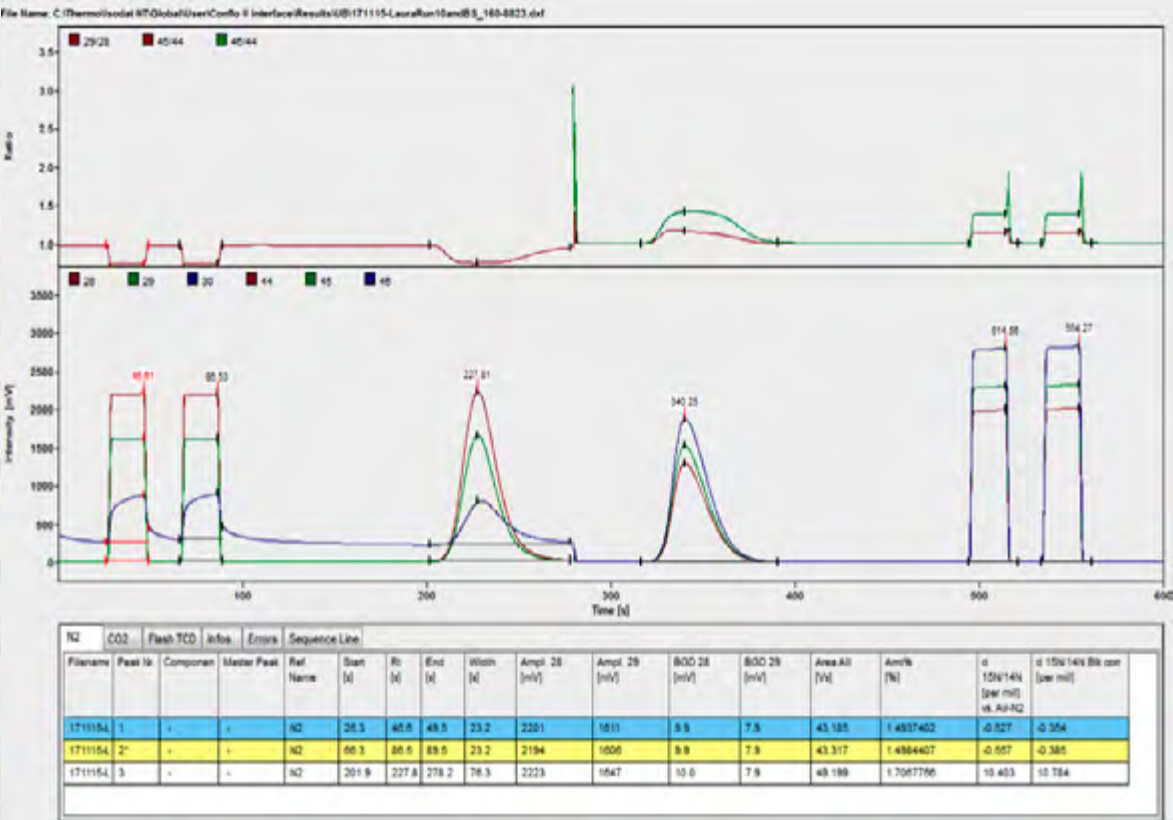
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Nitrogen and Carbon isotope determination

COLLAGEN (FROM HUMAN AND ANIMAL BONE)

Chromatogram of collagen



Thanks to Dr. Michelle Thompson, Queens University Belfast, Paleoecology Centre, 42 Fitzwilliam Street, Belfast, UK, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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FEATHERS (FREEZE DRIED)

FLASH 2000 HT Parameters

Combustion Temperature 1020°C	Helium Carrier Flow 150 ml/min	Helium Reference Flow 100 ml/min
Helium Pressure (kPa) 250	Oxygen Flow 250 ml/min	Oxygen Injection Time 2 sec
Oxygen Pressure (kPa) 150	Analysis Time 450 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 7 sec	Oven Temperature 70°C	

IRMS information

- Thermo Scientific ConFlo IV: dynamic dilution, no dilution for N, 50 % dilution for C
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 3.0 Software Suite2

Sample information

Standard:	Commercial Casein
Standard weight:	0.2 mg both for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios
Sample weight:	0.4 - 0.5 mg for N, 0.2 mg for C

Sample pre-treatment

The evaluation of the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios were carried out on the freeze-dried feathers samples. Raw feathers were firstly freeze-dried and subsequently grinded by means of a commercial blender and stored in sealed containers in a desiccator until analyzed. The day of the analysis, about 0.2 mg or 2.0 mg of sample were directly weighed into tin containers for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ evaluation.

NC isotope data

Weight (ug)	$\delta^{15}\text{N}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) Std. Dev.	Weight (ug)	$\delta^{13}\text{C}$ (‰)	Mean $\delta^{13}\text{C}$ (‰) Std. Dev.
0.40	4.75	4.72 0.04	0.21	-21.28	-21.34 0.07
0.38	4.73		0.18	-21.42	
0.41	4.67		0.20	-21.33	



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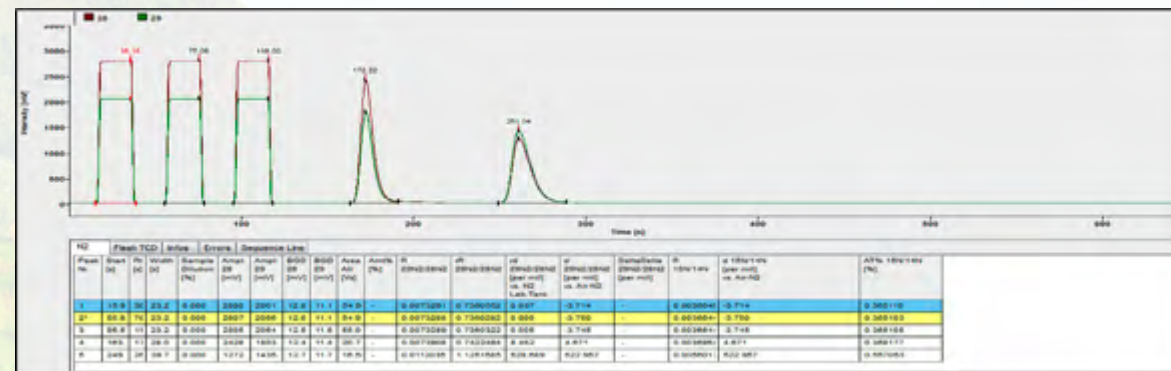
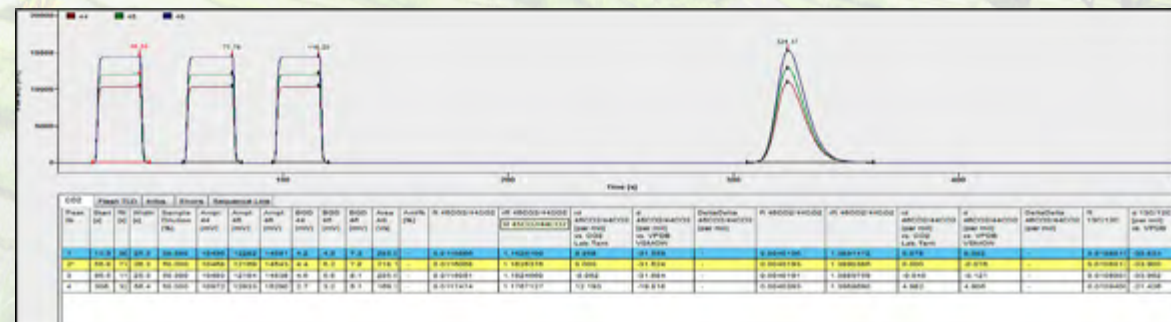
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Nitrogen and Carbon isotope determination

FEATHERS (FREEZE DRIED)

 $\delta^{15}\text{N}$ Chromatogram of freeze dried feathers (0.40 mg) $\delta^{13}\text{C}$ Chromatogram of freeze dried feathers (0.20 mg)

Thanks to Dr. Grazia Casiello, Dr. Dora Nardelli and Dr. Gianfranco Buzzerio, U-Series of Bologna and Operational Based of Valenzano, Bari, Italy, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Hydrogen and Oxygen isotope determination

FEATHERS (FREEZE DRIED)

FLASH 2000 HT Parameters		
Combustion Temperature 1400°C	Analysis Time 500 sec	
Helium Pressure (kPa) 250	Oven Temperature 70°C	
Sampling Delay 7 sec	Helium Reference Flow 100 ml/min	
Helium Carrier Flow 100 ml/min	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo IV: dynamic dilution, 33 % dilution for H, no dilution for CO
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 3.0 Software Suite2

Sample information

Standard: Casein for $\delta^2\text{H}$ ratio, IAEA 601 for $\delta^{18}\text{O}$ ratio
Standard weight: 0.40 mg for both standards
Sample weight: 0.4 mg for $\delta^2\text{H}$ ratio, 0.3 mg for $\delta^{18}\text{O}$ ratio

Sample pre-treatment

The measurements of the $\delta^{18}\text{O}$ and $\delta^2\text{H}$ ratios were carried out on the freeze-dried feathers samples. Raw feathers were firstly freeze-dried and subsequently grinded by means of a commercial mill and stored in sealed containers in a desiccator until analyzed. The day of the analysis, about 0.4 mg and 0,3 of sample were weighed into silver capsules for $\delta^2\text{H}$ and $\delta^{18}\text{O}$ measurements, respectively.

Note

To check the accuracy, working in-house standards and/or certified standard materials were analyzed in each run. In particular, IAEA 601 was used for $\delta^{18}\text{O}$ evaluation. For $\delta^2\text{H}$, supposing the possible exchange of hydrogen with water and/or ambient air moisture, the values were corrected against an Interlaboratory Comparison Material (ICM - casein reference material) according to the “comparative equilibration technique” [1]. Along with standard materials one control sample was routinely included in each analytical run as a check of system performances, very repeatable results over the 2 month running period (standard deviation < 0.2‰) were obtained.

[1] Wassenaar, L. I., & Hobson, K. A. (2003). Comparative equilibration and on-line technique for determination of non-exchangeable hydrogen of keratins. Isotopes in Environmental and Health Studies, 39, 211-217.

Hydrogen and Oxygen isotope ratio data

Weight (ug)	$\delta^2\text{N}$ (‰)	Mean $\delta^2\text{N}$ (‰) Std. Dev.	Weight (ug)	$\delta^{18}\text{C}$ (‰)	Mean $\delta^{18}\text{C}$ (‰) Std. Dev.
0.30	-84.86	-84.92 0.06	0.40	12.05	12.00 0.05
0.28	-84.97		0.38	11.96	
0.31	-84.94		0.41	11.97	



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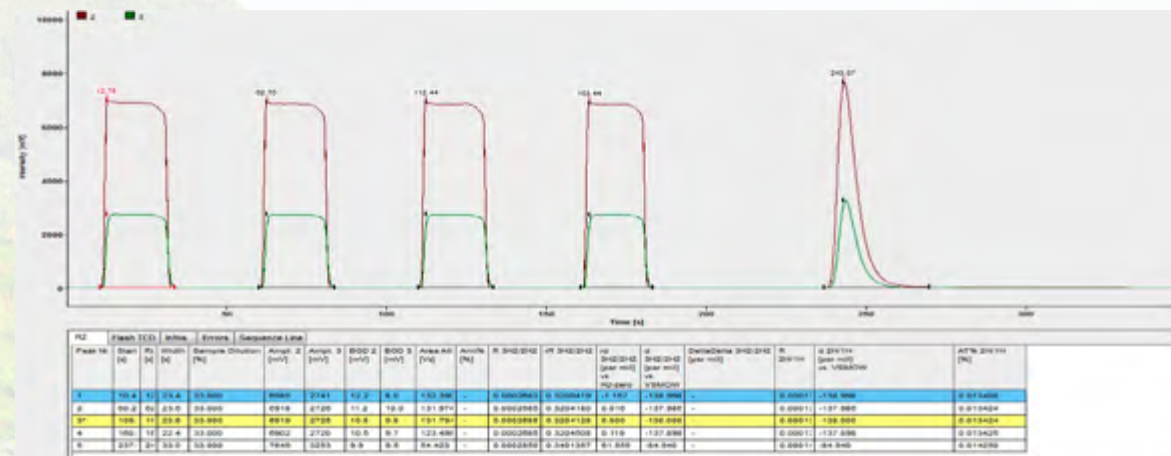
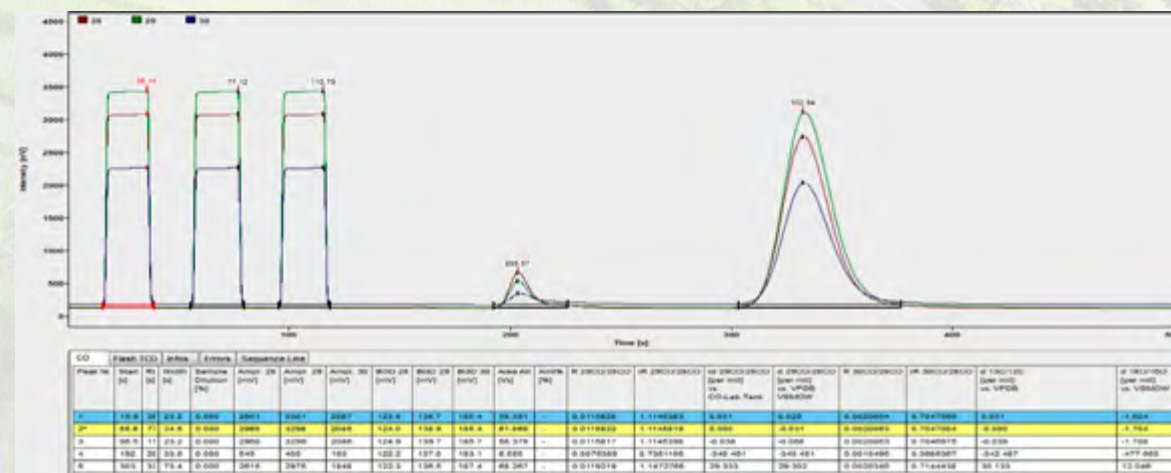
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Nitrogen and Carbon isotope determination

FEATHERS (FREEZE DRIED)

 $\delta^2\text{H}$ Chromatogram of freeze dried feathers (0.40 mg) $\delta^{18}\text{O}$ Chromatogram of freeze dried feathers (0.30 mg)

Thanks to Dr. Grazia Casiello, Dr. Dora Nardelli and Dr. Gianfranco Buzzerio, U-Series of Bologna and Operational Based of Valenzano, Bari, Italy, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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- Squalene

Nitrogen and Carbon isotope determination

FISH TISSUE

FLASH 2000 IRMS Parameters		
Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 45°C
Helium Pressure (kPa) 250	Helium Carrier Flow 90 ml/min	Helium Reference Flow 200 ml/min
Oxygen Pressure (kPa) 250	Oxygen Flow 180 ml/min	Oxygen Injection Time 3 sec
Sampling Delay 23 sec	Analysis Time 450 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV: 2 bar CO₂ / N₂ , 80 % dilution for C
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 3.0 Software Suite2

Sample information

Standard: L-glutamic acid USGS40
Standard weight: 400 µg
Sample weight: 450 ug

NC isotope ratio data

Weight (ug)	δ ¹⁵ N/ ¹⁴ N (‰)	δ ¹³ C/ ¹² C (‰)	Mean δ ¹⁵ N (‰) Std. Dev.	Mean δ ¹³ C (‰) Std. Dev.
432	14.794	-14.859	14.729 0.082	-14.931 0.063
455	14.757	-14.955		
458	14.637	-14.979		



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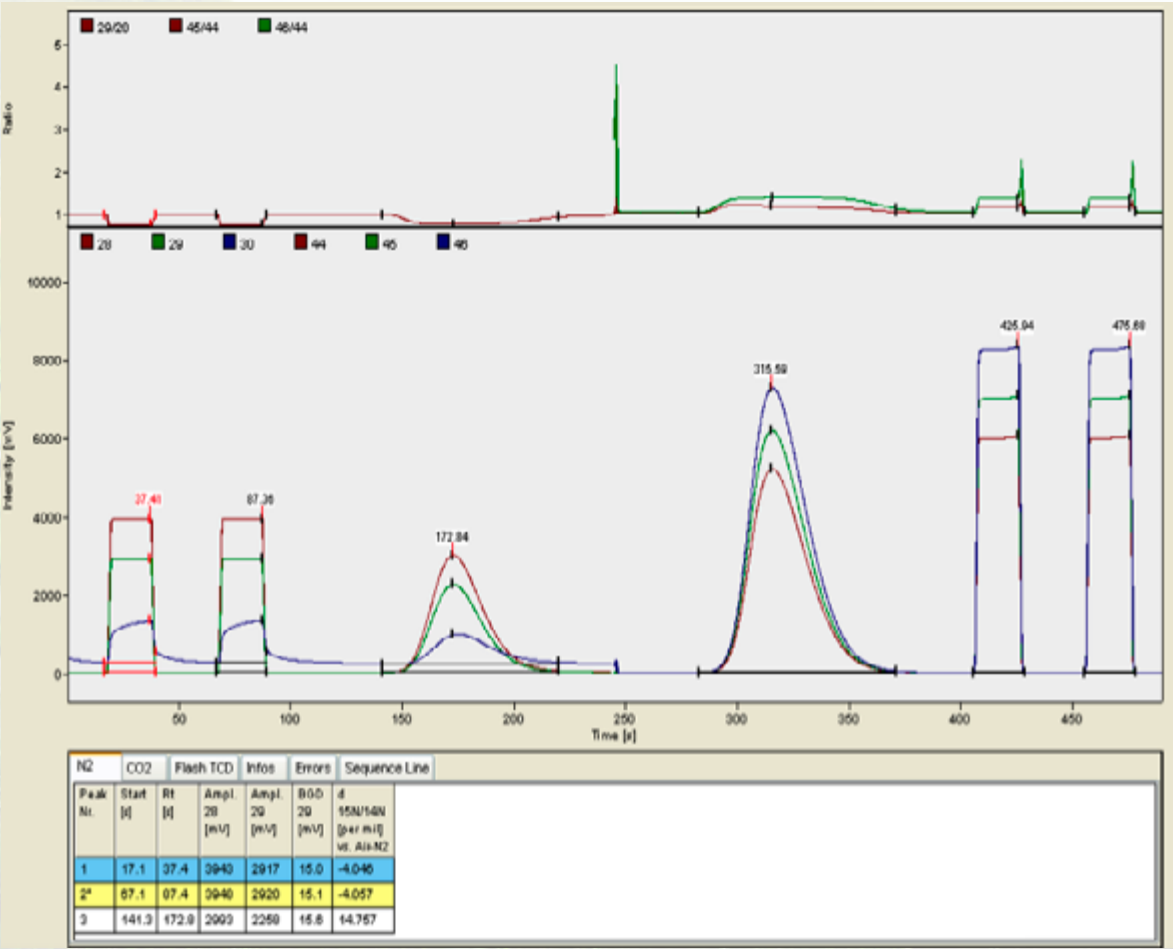
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Nitrogen and Carbon isotope determination

FISH TISSUE

Chromatogram of fish tissue



Thanks to Sofia Goncalves, CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, Porto, Portugal, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Nitrogen and Carbon isotope determination

GREEN ALGAE

FLASH 2000 IRMS Parameters		
Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 45°C
Helium Pressure (kPa) 250	Helium Carrier Flow 90 ml/min	Helium Reference Flow 200 ml/min
Oxygen Pressure (kPa) 250	Oxygen Flow 180 ml/min	Oxygen Injection Time 3 sec
Sampling Delay 23 sec	Analysis Time 450 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV: 2 bar CO₂ / N₂ , 80 % dilution for C
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 3.0 Software Suite2

Sample information

Standard: L-glutamic acid USGS40
Standard weight: 400 µg
Sample weight: 750 ug

NC isotope ratio data

Weight (ug)	δ ¹⁵ N/ ¹⁴ N (‰)	δ ¹³ C/ ¹² C (‰)	Mean δ ¹⁵ N (‰) Std. Dev.	Mean δ ¹³ C (‰) Std. Dev.
716	-1.595	-10.492	-1.569 0.093	-10.483 0.075
770	-1.647	-10.554		
744	-1.466	-10.404		



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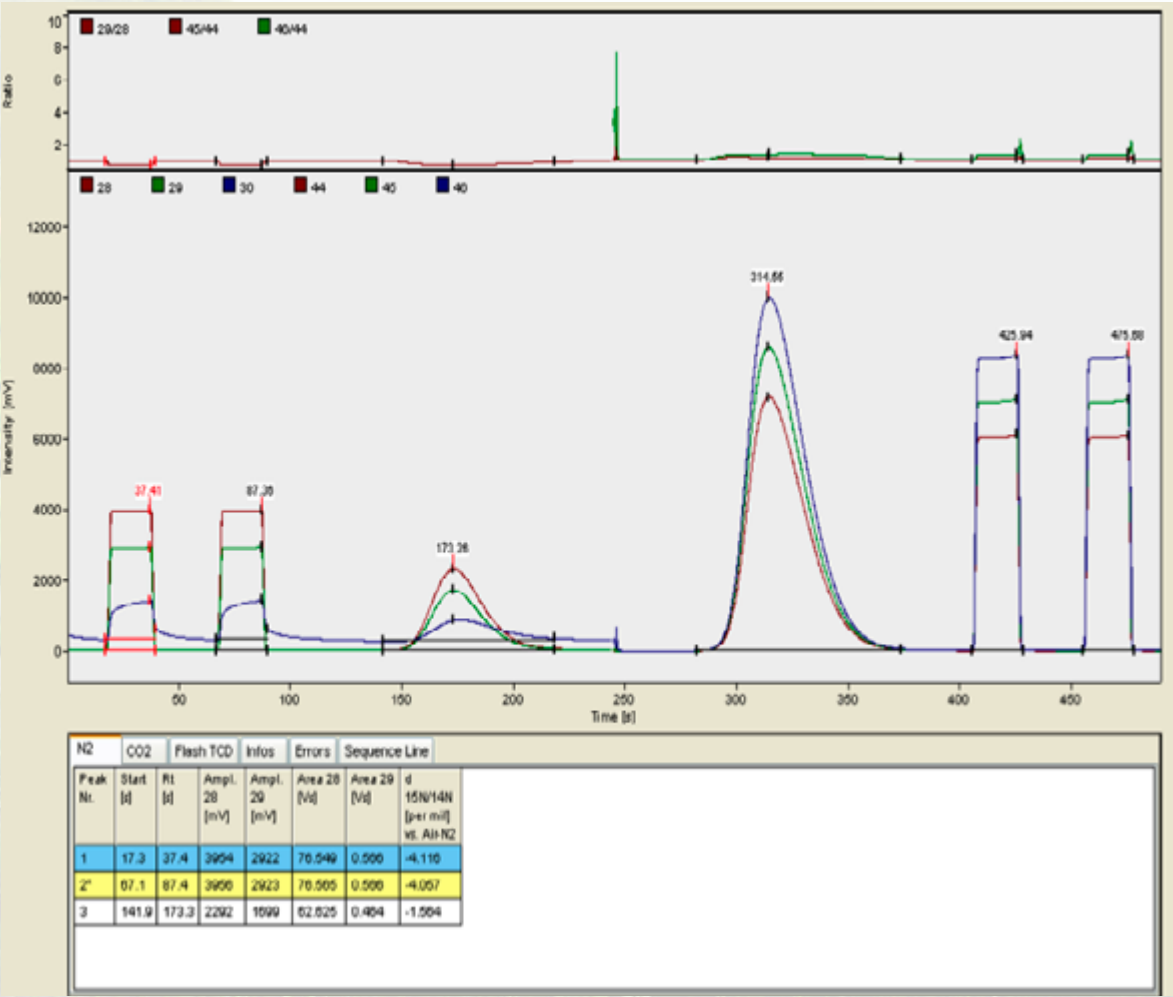
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GREEN ALGAE

Chromatogram of fish tissue



Thanks to Sofia Goncalves, CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, Porto, Portugal, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Nitrogen, Carbon and Sulfur isotope determination

OCTOPUS TISSUE

Information

The Thermo Scientific FlashEA 1112 and the Thermo Scientific ConFlo IV were connected through the smartEA option.

The IRMS system used was a Thermo Scientific DELTA V Plus with a universal triple collector.

For the simultaneous NCS determination, the Pre-packed Reactor (p/n 468 02005) was used.

Tubing in the Thermo Scientific FlashEA 1112 and the connection to the Thermo Scientific ConFlo IV interface is made of 1/16" Sulfinert capillary.

Thermo Scientific FlashEA 1112 parameters

Reactor Temperature 1020°C	Analysis Time 320 sec
Helium Carrier Flow 80 ml/min	Thermo Scientific MAS 200R Autosampler
Oven Temperature 70°C	

NCS isotope ratio data

Sample	Amount (mg)	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	$\delta^{34}\text{S}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) S.D.	Mean $\delta^{13}\text{C}$ (‰) S.D.	Mean $\delta^{34}\text{S}$ (‰) S.D.	C/S ratio
Octopus tissue	2.041	10.48	-16.09	15.91	10.50 0.02	-16.07 0.02	15.97 0.11	n.d.
	2.033	10.49	-16.06	16.10				
	2.070	10.52	-16.06	15.91				

Note

For more information see Thermo Scientific Application Note 30194.

(Simultaneous N, C and S Isotope Ratio Determination on a DELTA V Isotope Ratio MS using a Flash Elemental Analyzer)



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Sulfur isotope determination

PINE NEEDLES

IRMS information

- Thermo Scientific ConFlo II conditions: split 0.5% of EA effluent
- Thermo Scientific DELTA S and Plus

Sulfur isotope ratio determination

Sample	Wt (mg)	S% (wt%)	Total S (ug)	SO ₂ * (nmol)	δ ⁶⁶ SO ₂ (‰)	Std. Dev.** (1σ)
1	5.40	0.14	7.38	1.15	4.68	0.24
2	5.70	0.16	9.22	1.44	3.40	0.16
3	8.47	0.09	7.95	1.24	1.00	0.21
4	8.60	0.12	10.10	1.58	1.38	0.09

* Nanomoles SO₂ in the Delta plus ion source, with a ConFlo II split ratio of 1:200

** All samples were analyzed in triplicate

Note

For more information see Thermo Scientific Application report No. G 25



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Total Carbon isotope determination

QUERCUS WOOD

Thermo Scientific FlashEA 1112 parameters

Combustion Temperature 1050°C	Single reactor	Oven Temperature 50°C
Helium Pressure (kPa) 200	Helium Carrier Flow 140 ml/min	Helium Reference Flow 140 ml/min
Oxygen Pressure (kPa) 200	Oxygen Flow 250 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 12 sec	Analysis Time 400 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 0.8 bar Helium, 1 bar CO₂
- Thermo Scientific DELTA Plus XP2
- Thermo Scientific ISODAT 2.0

Sample information

Standard: 0.06 - 0.08 mg ANU-Sucrose (NIST-RM 8542)
 0.01 - 0.02 mg Graphite (internal Reference Material)
 0.03 - 0.05 mg Polyethylene foil (RM 8540)

Sample weight: 0.1 - 0.5 mg

Carbon isotope data of quercus wood sample

$\delta^{13}\text{C}$ (‰) (VPDB)	Std. Dev.
-26.62	0.13
-26.73	

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.



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Nitrogen and Carbon isotope determination

SEAWEED (ULVA RIGIDA)

Information

FLASH 2000 HT analyzer and ConFlo IV were used. The IRMS system used was a Delta V Plus with a universal triple collector. For the simultaneous NC determination, the prepacked tube (p/n 468 020 05) was used. Tubing in the FLASH 2000 HT analyzer and the connection to the ConFlo IV interface is made of 1/16 SS capillary.

FLASH 2000 HT Parameters		
Combustion Temperature 1000°C	Thermo Scientific MAS 200R Autosampler	
Helium Carrier Flow 160 ml/min		
Analysis Time 700 sec		
Oven Temperature 40°C		

NC isotope data

Sample	Weight (mg)	Mean $\delta^{15}\text{N}$ (‰)	Mean $\delta^{13}\text{N}$ (‰)	Std. Dev. $\delta^{15}\text{N}$ (‰)	Std. Dev. $\delta^{13}\text{N}$ (‰)	C/N ratio (mol/mol)	Std. Dev C/N ratio
Ulva rigida	0.500	8.77	-16.15	1.29	1.04	8.82	1.36
Red Gracilaria	0.220	8.32	-18.69	0.72	1.09	6.02	2.03

Thanks to Daniela Berto, Federico Rampazzo, Claudia Gion. Italian National Institute for Environmental Protection and Research (ISPRA), Laboratory of Oceanography and Contamination of the Aquatic Environment, Chioggia (VE), Italy.



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Nitrogen and Carbon isotope determination

SPERM WHALES

Information

FLASH 2000 HT analyzer and ConFlo IV were used. The IRMS system used was a Delta V Plus with a universal triple collector. For the simultaneous NC determination, the preppacked tube (p/n 468 020 05) was used. Tubing in the FLASH 2000 HT analyzer and the connection to the ConFlo IV interface is made of 1/16 SS capillary.

FLASH 2000 HT Parameters

Combustion Temperature 1000°C	Thermo Scientific MAS 200R Autosampler	
Helium Carrier Flow 160 ml/min		
Analysis Time 700 sec		
Oven Temperature 40°C		

NC isotope data

Sample	Weight (mg)	Mean $\delta^{15}\text{N}$ (‰)	Mean $\delta^{13}\text{N}$ (‰)	Std. Dev. $\delta^{15}\text{N}$ (‰)	Std. Dev. $\delta^{13}\text{N}$ (‰)	C/N ratio (mol/mol)	Std. Dev C/N ratio
Muscle	0.500	8.77	-16.15	1.29	1.04	8.82	1.36
Muscle extracted lipids	0.220	8.32	-18.69	0.72	1.09	6.02	2.03
Liver	0.500	8.77	-16.15	1.29	1.04	8.82	1.36
Liver extracted lipids	0.220	8.32	-18.69	0.72	1.09	6.02	2.03
Skin	0.500	8.77	-16.15	1.29	1.04	8.82	1.36
Skin extracted lipids	0.220	8.32	-18.69	0.72	1.09	6.02	2.03

Thanks to Daniela Berto, Federico Rampazzo, Italian National Institute for Environmental Protection and Research (ISPRA), Laboratory of Oceanography and Contamination of the Aquatic Environment, Chioggia (VE), Italy.



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Nitrogen and Carbon isotope determination

SPIRULINE ALGAE

FLASH 1112 IRMS Parameters

Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 65°C
Helium Pressure (kPa) 250	Helium Carrier Flow 100 ml/min	Helium Reference Flow 200 ml/min
Oxygen Pressure (kPa) 250	Oxygen Flow 250 ml/min	Oxygen Injection Time 4 sec
Sampling Delay 12 sec	Analysis Time 600 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV: SmartEA; Auto-dilution, dynamic for both N₂ and CO₂ with a target intensity of 4000 mV
- Thermo Scientific DELTA Plus XP
- Thermo Scientific 3.0 SP0.88

Sample information

Standard:

Spiruline algae in-house standard calibrated against USGS40, USGS41 and LSVEC

Weight:

2.5 mg

NC isotope ratio data

$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) Std. Dev.	Mean $\delta^{13}\text{C}$ (‰) Std. Dev.
8.7	-29.3	8.6 0.06	-29.27 0.05
8.6	-29.3		
8.6	-29.2		

Thanks to Victor Evrard, PhD, Lab Manager, Basiel, Sustainable Land Use Group, Department of Environmental Sciences, University of Basel, Schönbeinstrasse 6, CH-4056 Basel, Switzerland, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Carbon isotope determination

SQUALENE

Information

The sample is an internal Reference Material prepared by ENI, San Donato Milanese (Milan), Italy.

Thermo Scientific FlashEA 1112 parameters

Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 40°C
Helium Pressure (kPa) 100	Helium Carrier Flow 90 ml/min	Helium Reference Flow 85 ml/min
Oxygen Pressure (kPa) 100	Oxygen Flow 1750 ml/min	Oxygen Injection Time 3 sec
Sampling Delay 18 sec	Analysis Time 450 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo II conditions: helium pressure 1.25 bar, CO₂ pressure 0.9 bar
- Thermo Scientific DELTA Plus: extraction and lenses values in linearity mode
- Thermo Scientific ISODAT 2.0

Sample information

Standard: Acetanilide, NBS 22, IAEA-CH6, USGS 24
 Sample weight: 0.4 mg Acetanilide
 Sample weight: 0.5 mg

Carbon data of Squalene

Amount (mg)	C %	$\delta^{13}_{\text{CVPDB}}$ (‰)
0.631	86.92	-28.45
0.611	85.92	-28.47
0.600	85.95	-28.46
0.549	84.84	-28.48
0.611	86.01	-28.49
0.610	84.83	-28.46
Average	85.75	-28.47
Std. Dev.	0.80	0.02

Thanks to Maria Lema Grille, Universidad de La Coruña, Servicios de Apoyo a la Investigación, La Coruña, Spain.



Analytical - EA-IRMS

Environmental Pollution

- Atmospheric Nitrogen (Gas sample)
- Atmospheric Particulate Matter
- Natural Water
- Pesticide
- Tap Water
- Water Reference

Nitrogen isotope determination

ATMOSPHERIC NITROGEN (GAS SAMPLE)

IRMS information

- Thermo Scientific EA 1110 Analyzer
- Thermo Scientific AS 200 Autosampler
- Thermo Scientific ConFlo II
- Thermo Scientific DELTA Plus
- Analysis Time 2 minutes

Sample information

Air was manually injected with a gas tight syringe between the combustion and reduction reactors through a special attachment to the analyzer.

¹⁵N Results of seven injections between 0.07 and 0.1 ml of air

^δ ¹⁵ NAIR	1σ	n	Air sample
- 0.04 ‰	0.10	7	0.07 - 0.1 ml (2.4 - 3.5 umoles N ₂)

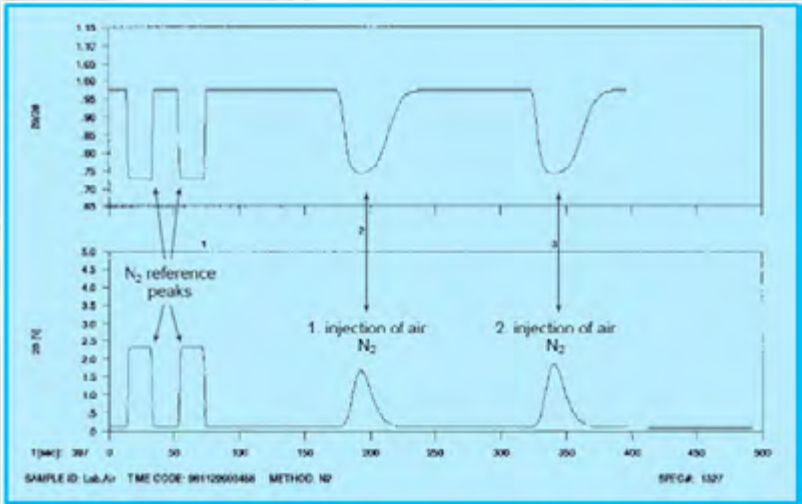


Fig. 2b: Trace of 28/29 (top) and m/z 28 (bottom)

Note

For more information see Thermo Scientific Application report No. G 24.



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Total Carbon isotope determination

ATMOSPHERIC PARTICULATE MATTER

Thermo Scientific FlashEA 1112 parameters

Combustion Temperature 1050°C	Single reactor	Oven Temperature 50°C
Helium Pressure (kPa) 200	Helium Carrier Flow 140 ml/min	Helium Reference Flow 140 ml/min
Oxygen Pressure (kPa) 200	Oxygen Flow 250 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 12 sec	Analysis Time 400 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 0.8 bar Helium, 1 bar CO₂
- Thermo Scientific DELTA Plus XP2
- Thermo Scientific ISODAT 2.0

Sample information

Standard: 0.06 - 0.08 mg ANU-Sucrose (NIST-RM 8542)
 0.01 - 0.02 mg Graphite (internal Reference Material)
 0.03 - 0.05 mg Polyethylene foil (RM 8540)

Sample weight: 2.0 - 2.5 mg (quartz filter combusted at 550°C)

Note

If significant carbonate is present, fumigation is required.

Carbon isotope data of atmospheric particulate matter (PM10) collected on quartz filter (2.55mg)

$\delta^{13}\text{C}$ (‰) (VPDB)	Std. Dev.
-25.34	0.05
-25.28	

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.



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Hydrogen isotope determination

UNDERGROUND NATURAL WATER

Thermo Scientific FlashEA 1112 parameters

Pyrolysis Temperature 1400°C	Helium Carrier Flow 100 ml/min	
Helium Pressure (kPa) 260	Analysis Time 300 sec	
Sampling Delay 14 sec	Helium Reference Flow 50 ml/min	
Oven Temperature 80°C	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo III conditions: Helium pressure 0.9 bar, Hydrogen pressure 1.5 bar
- Thermo Scientific DELTA V Advantage

Sample information

Standard: V-SMOW, GISP, SLAP
 Standard weight: 0.2 µl
 Sample weight: 0.2 µl

Hydrogen isotope data of water sample

$\delta^2\text{H}$ (‰)	Mean	Std. Dev.
76.3	75.4	0.6
75.3		
74.9		
75.8		
74.7		
75.2		

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.



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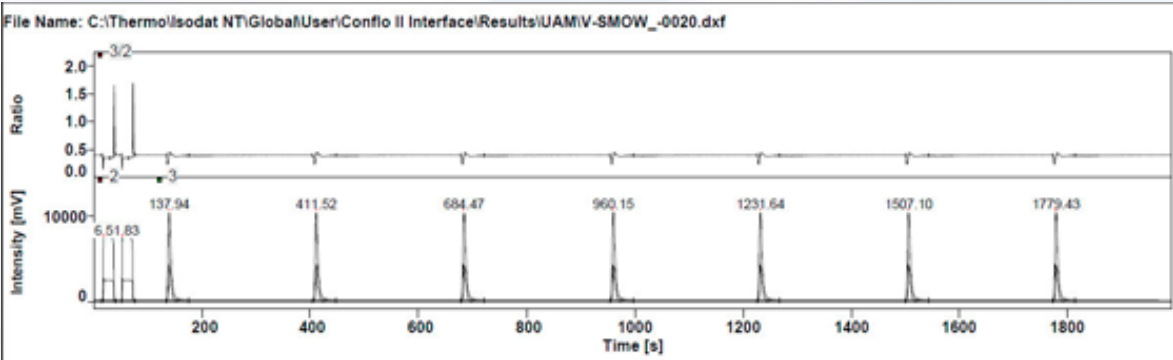
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Hydrogen isotope determination

UNDERGROUND NATURAL WATER

Chromatogram of fish tissue



Thanks to Redondo Ortega, Vanesa Peiró Hernández y Francisco José Caballero Castrejón, Laboratorio de Isótopos Estables, Universidad Autónoma de Madrid, Madrid, Spain.

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Nitrogen, Carbon and Sulfur isotope determination

PESTICIDE

Information

The Thermo Scientific FlashEA 1112 and the Thermo Scientific ConFlo IV were connected through the smartEA option.

The IRMS system used was a Thermo Scientific DELTA V Plus with a universal triple collector.

For the simultaneous NCS determination, the pre-packed Reactor (p/n 468 02005) was used.

Tubing in the Thermo Scientific FlashEA 1112 and the connection to the Thermo Scientific ConFlo IV interface is made of 1/16" Sulfinert capillary.

Thermo Scientific FlashEA 1112 parameters

Reactor Temperature 1020°C	Thermo Scientific MAS 200R Autosampler	
Oven Temperature 70°C		
Helium Carrier Flow 80 ml/min		
Analysis Time 320 sec		

NCS isotope ratio data

Sample	Amount (mg)	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	$\delta^{34}\text{S}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) S.D.	Mean $\delta^{13}\text{C}$ (‰) S.D.	Mean $\delta^{34}\text{S}$ (‰) S.D.	C/S ratio
Pesticide	0.445	-9.28	-31.78	-4.77	-9.21 0.17	-31.74 0.06	-4.68 0.11	3.0
	0.457	-9.01	-31.77	-4.73				
	0.438	-9.34	-31.67	-4.56				

Note

For more information see Thermo Scientific Application Note 30194. (Simultaneous N, C and S Isotope Ratio Determination on a DELTA V Isotope Ratio MS using a Flash Elemental Analyzer)



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- Water Reference

Hydrogen and oxygen isotope determination

TAP WATER

Thermo Scientific FLASH 2000 HT and Thermo Scientific AS 3000 Liquid Autosampler parameters

Settings for H and O determination	Thermo Scientific AS 3000 Autosampler Settings
Reactor Temperature 1415°C	Injection volume 1 µl
Oven Temperature 72°C	Plunger strokes 3
Helium Carrier Flow 125 ml/min	Rinses 0
Helium Reference Flow 60 ml/min	Injection Depth Standard
Thermo Scientific AS 3000 Liquid Autosampler	Pre-Injection dwell Time 1 sec
Syringe size 0.5 µl	Post-Injection dwell Time 16 sec

IRMS information

- Thermo Scientific ConFlo III
- Thermo Scientific DELTA V Plus IRMS
- Thermo Scientific ISODAT 3.0 Software Suite

Standard information

The following IAEA Water Reference Materials were used for the isotope analysis:

- GISP (Greenland Ice Sheet Precipitation): prepared by the University of Copenhagen from a sample of Greenland snow
- VSMOW2 (Vienna Standard Mean Ocean Water 2)
- SLAP2 (Standard Light Antarctic Precipitation 2)

Hydrogen and oxygen isotope data of tap water

Isotope element	$\delta^2\text{H}$ (‰)	$\delta^{18}\text{O}$ (‰)
Data	-42.465	-42.465
	-41.399	-41.399
	-41.316	-41.316
	-40.106	-40.106
Mean values	-41.322	-41.322
Std.Dev.	0.965	0.965



Analytical - EA-IRMS

Environmental Pollution

- Atmospheric Nitrogen (Gas sample)
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- Water Reference

Hydrogen and oxygen isotope determination

WATER REFERENCE MATERIALS

Thermo Scientific FLASH 2000 HT and Thermo Scientific AS 3000 Liquid Autosampler parameters	
Settings for H and O determination	Thermo Scientific AS 3000 Autosampler Settings
Reactor Temperature 1415°C	Injection volume 1 µl
Oven Temperature 72°C	Plunger strokes 3
Helium Carrier Flow 125 ml/min	Rinses 0
Helium Reference Flow 60 ml/min	Injection Depth Standard
Thermo Scientific AS 3000 Liquid Autosampler	Pre-Injection dwell Time 1 sec
Syringe size 0.5 µl	Post-Injection dwell Time 16 sec

Reference Materials information

The following IAEA Water Reference Materials were analyzed:

- GISP (Greenland Ice Sheet Precipitation): prepared by the University of Copenhagen, Denmark, from a sample of Greenland snow.
- VSMOW2 (Vienna Standard Mean Ocean Water 2).
- SLAP2 (Standard Light Antactic Precipitation 2).

Certified values

Sample	GISP		VSMOW2		SLAP2	
Isotope element	δ ² H (‰)	δ ¹⁸ O (‰)	δ ² H (‰)	δ ¹⁸ O (‰)	δ ² H (‰)	δ ¹⁸ O (‰)
Value	-189.5	-189.5	0	0	-427.5	-55.50
Std. Dev.	1.2	1.2	0.3	0.02	0.3	0.02



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Environmental Pollution

- Atmospheric Nitrogen (Gas sample)
- Atmospheric Particulate Matter
- Natural Water
- Pesticide
- Tap Water
- Water Reference

Hydrogen and oxygen isotope determination

WATER REFERENCE MATERIALS

IRMS information

- Thermo Scientific DELTA V Plus IRMS
- Thermo Scientific ISODAT 3.0 Software Suite

Hydrogen and oxygen isotope data of IAEA Water Reference Materials

Sample	GISP		VSMOW2		SLAP2	
Isotope element	$\delta^2\text{H}$ (‰)	$\delta^{18}\text{O}$ (‰)	$\delta^2\text{H}$ (‰)	$\delta^{18}\text{O}$ (‰)	$\delta^2\text{H}$ (‰)	$\delta^{18}\text{O}$ (‰)
Value	-186.954	-24.667	-0.291	-0.038	-422.132	-55.355
	-186.373	-24.745	0.308	-0.056	-422.353	-55.416
	-187.085	-24.754	-0.016	-0.016	-424.450	-55.890
	-186.620	-24.838	-0.111	0.134	-422.672	-55.517
Mean value	-186.758	-24.751	-0.028	0.006	-422.902	-55.545
Std. Dev.	0.323	0.070	0.251	0.087	1.056	0.240

Thanks to Pietro Mainolfi, ARPA Campania, Salerno, Italy.



Analytical - EA-IRMS

Food Origin and Authenticity

- Alcohols
- Base Oil
- Beer soilds
- Chicory
- Ethanol (Wine,Pineapple Juice)
- Glycerol (for Wine)
- Glycine
- Honey
- L-glutamic acid
- Olive Oil
- Potato
- Potato (freeze dried)
- Sucrose
- Sugars
- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Carbon isotope determination

ALCOHOLS

Analytical Parameters		
Thermo Scientific EA1108 Analyzer	Thermo Scientific AS 800 Liquid Autosampler	Thermo Scientific Finnigan Mat ConFlo II*
Combustion Temperature 1050°C	Syringe 10 µl, 80 mm steel needle	Helium dilution: 1.0 - 1.5 bar
Reduction Temperature 650°C	Injection volume 1 µl	CO2 reference: 1.5 - 2.0 bar
Oven Temperature 65°C		(5000 - 6000 mV for m/z = 44)
Pressure Helium Carrier 100 kPa		
Pressure Helium Reference 50 kPa		
Pressure Oxygen 100 kPa		

*The gas flow settings must be assessed for ideal signal intensity

Reference Materials

- CRM/BCR 656 Absolute Alcohol (from IRMM, $\delta^{13}\text{C}$ = -26.91 ‰ vs. V-PDB)
- WS - Ethanol (Carlo Erba, 95%, $\delta^{13}\text{C}$ = -25.77 ‰ vs. V-PDB)

IRMS information

- Thermo Scientific EA 1108 Elemental Analyzer equipped with a 1.5 ml oxygen loop
- Thermo Scientific AS 800 Liquid Autosampler
- Thermo Scientific ConFlo II
- Thermo Scientific DELTA Plus XP
- Thermo Scientific ISODAT 2.0

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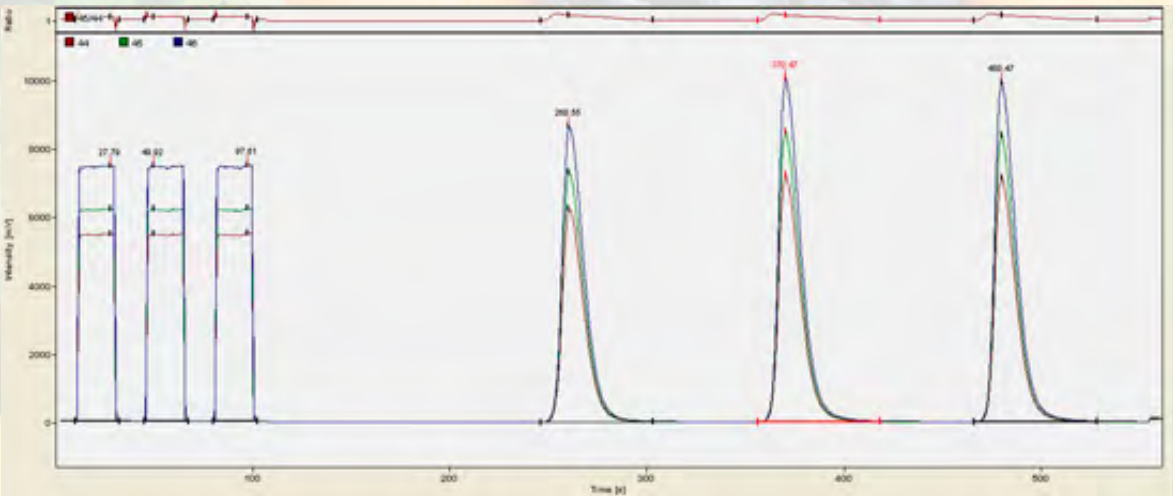
Carbon isotope determination

ALCOHOLS

$\delta^{13}\text{C}$ data of alcohols samples

Sample	Alcohol extracted from Grapes (C3 Plant)	Alcohol extracted from Sugar Cane (C4 Plant)
Element	$\delta^{13}\text{C}$ (‰)	$\delta^{13}\text{C}$ (‰)
Value	-26.40	-12.58
	-26.38	-12.68
	-26.39	-12.52
Std. Dev.	0.01	0.08

Chromatogram of an alcohol sample analyzed in triplicate



Thanks to Claude Guillou, BEVABS Group Leader (JRC-Ispira) and Giovanni Calderone, Technical Support Specialist - Gas IRMS, Unity Lab Services, part of Thermo Fisher Scientific.

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Total Nitrogen isotope determination

BASE OIL

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 1050°C	Single reactor	Oven Temperature 50°C
Helium Pressure (kPa) 200	Helium Carrier Flow 140 ml/min	Helium Reference Flow 140 ml/min
Oxygen Pressure (kPa) 200	Oxygen Flow 250 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 12 sec	Analysis Time 350 sec	

IRMS information

- Thermo Scientific ConFlo III: 0.7 bar Helium, 1 bar CO₂
- Thermo Scientific DELTA Plus XP2
- Thermo Scientific ISODAT 2.02

Sample information

Standard: a) 0.8 - 1.0 mg USGS-40
b) 0.6 - 0.8 mg NH₄Cl
c) 0.7 - 0.9 mg KNO₃

Sample weight: Weigh enough material to have 0.10 mg N

Nitrogen isotope data of base oil sample

δ ¹⁵ N (‰) (AIR)
0.04
0.05

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.



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Carbon isotope determination

EVAPORATED BEER SOLIDS

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 1020°C	Reduction Reactor temperature 650°C	Oven Temperature 65°C
Helium Pressure (kPa) 250	Helium Carrier Flow 100 ml/min	Helium Reference Flow 200 ml/min
Oxygen Pressure (kPa) 250	Oxygen Flow 250 ml/min	Oxygen Injection Time 4 sec
Sampling Delay 12 sec	Analysis Time 600 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV: SmartEA; Auto-dilution, dynamic CO₂ with a target intensity of 4000 mV
- Thermo Scientific DELTA Plus XP
- Thermo Scientific 3.0 SP0.88

Sample information

Standard: urea, sucrose (in-house standard calibrated against USGS40, USGS41 and LSVEC)
Standard weight: 0.8 mg sucrose, 0.6 mg urea
Sample weight: 0.5 mg

Carbon isotope ratio data

δ ¹³ C (‰)	mean δ ¹³ C (‰)
	S.D.
-27.20	-27.28 0.08
-27.29	
-27.35	

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EVAPORATED BEER SOLIDS

Chromatogram of evaporated beer solids



Thanks to Victor Evrard, PhD, Lab Manager, Basel, Sustainable Land Use Group, Department of Environmental Sciences, University of Basel, Schönbeinstrasse 6, CH-4056 Basel, Switzerland, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Nitrogen and Carbon isotope determination

CHICORY (RADICCHIO DI CHIOGGIA IGP)

Information

FLASH 2000 HT analyzer and ConFlo IV were used. The IRMS system used was a Delta V Plus with a universal triple collector. For the simultaneous NC determination, the prepacked tube (p/n 468 020 05) was used. Tubing in the FLASH 2000 HT analyzer and the connection to the ConFlo IV interface is made of 1/16 SS capillary.

FLASH 2000 HT Parameters		
Furnace Temperature 1000°C	Thermo Scientific MAS 200R Autosampler	
Helium Carrier Flow 160 ml/min		
Oven Temperature 40°C		
Analysis Time 700 sec		

NC isotope data

Sample	Weight (mg)	Mean $\delta^{15}\text{N}$ (‰)	Mean $\delta^{13}\text{N}$ (‰)	Std. Dev. $\delta^{15}\text{N}$ (‰)	Std. Dev. $\delta^{13}\text{N}$ (‰)	C/N ratio (mol/mol)	Std. Dev C/N ratio
Chicory red leaf	0.200	3.37	-23.05	0.93	2.62	3.37	0.93
Chicory white leaf	0.190	4.51	-23.66	0.67	1.31	4.51	0.67

Thanks to Daniela Berto, Federico Rampazzo, Claudia Gion, Malgorzata Formalewic, Italian National Institute for Environmental Protection and Research (ISPRA), Laboratory of Oceanography and Contamination of the Aquatic Environment, Chioggia (VE), Italy.

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Carbon, hydrogen and oxygen isotope determination

ETHANOL (WINE AND PINEAPPLE JUICE)

Sample info for $\delta^{13}\text{C}$ determination

1 μl of pure ethanol was injected with a 1.2 μl syringe into a small tin container for liquids. The container was closed using a pair of wire cutting pliers with a smooth and sharp edge. Excess tin was removed. The capsule was placed into the Thermo Scientific MAS 200R Autosampler.

Sample info for $\delta^2\text{H}$ and $\delta^{18}\text{O}$ determination

0.1 μl of pure ethanol was injected with a 0.5 μl syringe into a glassy carbon rector through the Thermo Scientific AS 3000 Liquid Autosampler.

Thermo Scientific ConFlo interface information

It diluted the CO_2 sample peak with 1 bar helium resulting in a split of about 1:12.

Parameters of the Thermo Scientific FLASH 2000 HT and Thermo Scientific AS 3000 Autosampler		
Settings for C determination	Settings for H and O determination	Thermo Scientific AS 3000 Autosampler Settings
Reactor Temperature 1020°C	Reactor Temperature 1400°C	Injection volume 0.1 μl
Oven Temperature 45°C	Oven Temperature 90°C	Plunger strokes 7
Helium Carrier Flow 90 ml/min	Helium Carrier Flow 100 ml/min	Rinses 0
Oxygen Flow 250 ml/min	Thermo Scientific AS 3000 Liquid	Pre-Injection dwell Time 0 sec
Oxygen Injection Time 1 sec	Autosampler	Post-Injection dwell Time 10 sec
Sampling Delay 23 sec	Syringe size 0.5 μl	Solvent wash cycle 0
Thermo Scientific MAS 200R Autosampler		

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- Vanillin
- Vitamins

Carbon, hydrogen and oxygen isotope determination

ETHANOL (WINE AND PINEAPPLE JUICE)

$\delta^{13}\text{C}$ values of ethanol extracted from wine and pineapple juice.

Sample	$\delta^{13}\text{C}$ (‰) (VPDB)	Average $\delta^{13}\text{C}$ (‰)	Std. Dev.
Ethanol standard	-26.99	-26.97	0.03
	-27.01		
	-26.97		
	-26.96		
	-26.94		
Ethanol wine	-19.15	-19.14	0.09
	-19.22		
	-19.05		
Ethanol pineapple	-14.34	-14.32	0.07
	-14.35		
	-14.45		
	-14.27		
	-14.25		
	-14.28		

$\delta^2\text{H}$ and $\delta^{18}\text{O}$ values and precision (Std. Dev.) - Standards: n=10; ethanol: n=5; first data skipped

Sample	Mean $\delta^2\text{H}$	Std. Dev.	Mean $\delta^{18}\text{O}$	Std. Dev.
Lab Standard	-53.69	0.20	-7.84	0.04
V-SMOW	0.00	0.34	0.00	0.08
GISP	-189.50	0.40	-24.80	0.05
Ethanol	-234.80	0.12	-24.18	0.08
Lab Standard	-53.76	0.39	-7.85	0.03

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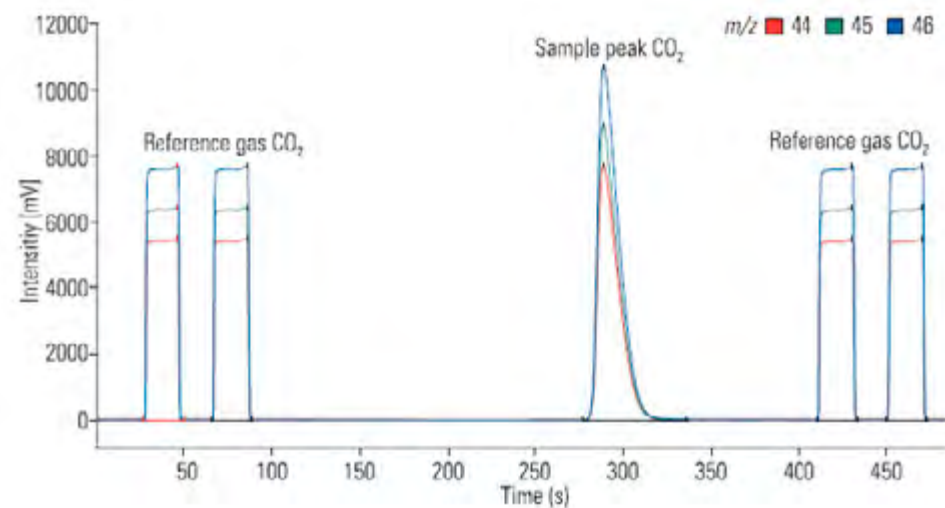
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- Glycerol (for Wine)
- Glycine
- Honey
- L-glutamic acid
- Olive Oil
- Potato
- Potato (freeze dried)
- Sucrose
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- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Carbon, hydrogen and oxygen isotope determination

ETHANOL (WINE AND PINEAPPLE JUICE)

Example chromatogram of an ethanol analysis showing the mass traces 44, 45 and 46 for evaluation of $^{13}\text{C} / ^{12}\text{C}$ ratio. Sample drop was 170 seconds before the sample peak, just after the first two reference gas injections.



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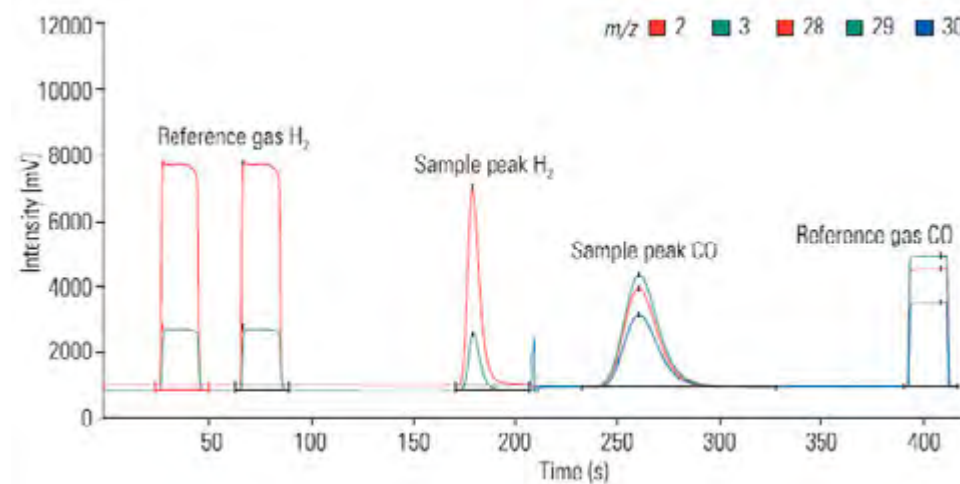
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Carbon, hydrogen and oxygen isotope determination

ETHANOL (WINE AND PINEAPPLE JUICE)

Example chromatogram of ethanol for simultaneous H and O isotope analysis showing the mass traces 2 and 3 and 28/29/30 for evaluation of 1H / 2H and 18O / 16O ratio, respectively.

Sample injection was 90 seconds before the H₂ sample peak, just after the first two reference gas injections. Automatic fast magnet jump at 210 seconds allowed for subsequent of CO traces.



Note

For more information see Thermo Scientific Application Note 30147 (13C and Simultaneous 18O and 2H Isotope Analysis in Ethanol with Thermo Scientific DELTA V Isotope Ratio Mass Spectrometers

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- Honey
- L-glutamic acid
- Olive Oil
- Potato
- Potato (freeze dried)
- Sucrose
- Sugars
- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Total Carbon isotope determination

GLYCEROL (EXTRACTED FROM WINE)

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 1050°C	Single reactor	Oven Temperature 50°C
Helium Pressure (kPa) 200	Helium Carrier Flow 140 ml/min	Helium Reference Flow 140 ml/min
Oxygen Pressure (kPa) 200	Oxygen Flow 250 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 12 sec	Analysis Time 400 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 0.8 bar Helium, 1 bar CO₂
- Thermo Scientific DELTA Plus XP2
- Thermo Scientific ISODAT 2.0

Sample information

Standard: 0.06 - 0.08 mg ANU-Sucrose (NIST-RM 8542)
0.01 - 0.02 mg Graphite (internal Reference Material)
0.03 - 0.05 mg Polyethylene foil (RM 8540)

Standard weight: 0.7 - 1.0 mg

Pre-treatment: extraction of glycerol

Carbon isotope data of glycerol extract from wine sample

δ13C (‰) (VPDB)	Std. Dev.
-27.03	0.1
-26.90	

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.



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Nitrogen isotope determination

GLYCINE

IRMS information

- Thermo Scientific EA 1108 Elemental Analyzer
- Thermo Scientific AS 200 Autosampler
- Thermo Scientific ConFlo II
- Thermo Scientific Delta Plus

$\delta^{15}\text{N}$ of Glycine over a size range corresponding to 7 to 75 $\mu\text{g N}$

Sample size		$\delta^{15}\text{N}_{\text{AIR}}$ (‰)		Peak Area $m/z=28$	Average values			Blank contribution
($\mu\text{g N}$)	($\mu\text{m N}$)	Observed	Corrected	(Volt-sec.)	Wt. (μg)	$\delta^{15}\text{NAIR}$ (‰)	Precision (‰)	%
73.50	5.23	1.36	1.41	92.47	74.36	1.49	0.05	0.3
72.37	5.14	1.45	1.50	91.09				
72.26	5.14	1.44	1.49	91.58				
69.11	4.91	1.44	1.49	86.84				
67.17	4.78	1.51	1.56	85.48				
19.48	1.39	1.23	1.42	24.30	18.45	1.44	0.07	1.2
18.53	1.32	1.30	1.50	22.88				
18.53	1.32	1.14	1.34	23.03				
18.47	1.31	1.33	1.53	23.01				
18.33	1.30	1.19	1.38	23.20				
17.38	1.24	1.25	1.46	22.01	12.60	1.38	0.06	1.7
12.91	0.92	1.16	1.45	15.85				
12.84	0.91	1.06	1.34	15.84				
12.70	0.90	1.05	1.32	16.51				
12.67	0.90	1.08	1.36	15.87				
12.36	0.88	1.16	1.45	15.47				
12.10	0.86	1.06	1.36	15.00				

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Nitrogen isotope determination

GLYCINE

$\delta^{15}\text{N}$ of Glycine over a size range corresponding to 7 to 75 $\mu\text{g N}$ (continued)

Sample size		$\delta^{15}\text{N}_{\text{AIR}}$ (‰)		Peak Area m/z=28	Average values			Blank contribution
($\mu\text{g N}$)	($\mu\text{m N}$)	Observed	Corrected	(Volt-sec.)	Wt. (μg)	$\delta^{15}\text{NAIR}$ (‰)	Precision (‰)	%
7.93	0.56	1.14	1.61	9.81	7.03	1.48	0.08	3.0
7.53	0.54	0.92	1.40	9.37				
7.08	0.50	0.97	1.49	8.68				
6.82	0.49	0.97	1.55	7.94				
6.65	0.47	0.85	1.39	8.37				
6.20	0.44	0.85	1.45	7.51				
Blanks					0.22			
0.24	0.017			0.31				
0.22	0.016			0.30				
0.21	0.015			0.28				
0.21	0.015			0.27				
0.20	0.014			0.25				

Note
For more information see Thermo Scientific Application report No. G 29

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Carbon isotope determination

HONEY AND HONEY PROTEIN

Information

100 - 200 µg of honey are loaded into a tin container.
The proteins in the honey sample were extracted following the AOAC 998.12 guideline (Association of Analytical Communities Handbook), which specifies mixing 15g of honey with 3ml of water and heating to 80°C.
The proteins precipitate after addition of acid and tungstic solution within about 2 minutes.
The supernatant is repeatedly decanted after centrifuging and rinsing with water.
After drying, 100 - 200 µg of the protein sample are loaded into a tin container for analysis.

Average results and Standard Deviation of δ¹³C in ‰ of three honeys and their extracted proteins

	HONEY 1	PROTEIN 1	HONEY 2	PROTEIN 2	HONEY 3	PROTEIN 3
	-23.60	-24.08	-23.83	-24.01	-24.17	-24.49
	-23.68	-24.09	-23.81	-23.95	-24.06	-24.44
	-23.57	-24.09		-23.91	-24.07	-24.17
	-23.48	-24.09		-23.87	-24.11	-24.00
	-23.53	-24.01		-23.84		-24.29
	-23.60	-24.01				
	-23.61	-23.98				
	-23.60					
Average	-23.58	-24.05	-23.82	-23.91	-24.10	-24.28
Std. Dev.	0.06	0.05	0.01	0.07	0.05	0.20

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- Glycerol (for Wine)
- Glycine
- Honey
- L-glutamic acid
- Olive Oil
- Potato
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- Sucrose
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- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

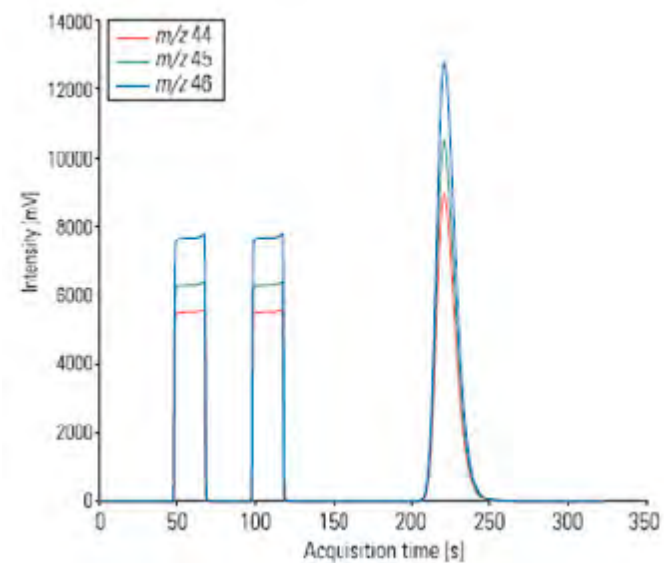
Carbon isotope determination

HONEY AND HONEY PROTEIN

Typical chromatogram of protein or honey analysis.

Two reference gas injections of CO₂ are followed by the gas chromatographically separated CO₂ peak from the sample combustion.

The traces show signal intensity in mV of the simultaneously collected masses of 44, 45 and 46 amu.



Note

For more information see Thermo Scientific Application Note 30177.

(Detection of Honey Adulteration with FlashEA Elemental Analyzer and DELTA V Isotope Ratio Mass Spectrometer)

Analytical - EA-IRMS

Food Origin and Authenticity

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Carbon isotope determination

HONEY AND HONEY PROTEIN

Thermo Scientific FlashEA 1112 IRMS parameters		
Combustion Temperature 900°C	Reduction Temperature 680°C	Oven Temperature 45°C
Helium Pressure (kPa) 200	Helium Carrier Flow 120 ml/min	Helium Reference Flow 150 ml/min
Oxygen Pressure (kPa) 400	Oxygen Flow 250 ml/min	Oxygen Injection Time 5 sec
Sampling Delay 15 sec	Analysis Time 320 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV conditions: 3 bar N₂, 1 bar He, 3 bar CO₂
- Thermo Scientific DELTA V Plus2
- Thermo Scientific ISODAT 3.02

Sample information

Standard: Casein
Standard weight: 0.5 mg
Pre-treatment: 0.5 - 0.8 mg

The AOAC 991.4 method was used for protein precipitation

NC isotope data

Sample	Amount (mg)	δ ¹⁵ N (‰)	δ ¹³ C (‰)	Mean δ ¹⁵ N (‰) S.D.	Mean δ ¹³ N (‰) S.D.
Pesticide	0.72		-25.15		-25.13
	0.66		-25.08		
Pesticide	0.66	4.34	-24.76	4.38	-24.86
	0.71	4.42	-24.95		

Thanks to Federica Camin and Luca Ziller, Fondazione Edmund Mach, CRI-DQAN, San Michele all'Adige, (TN), Italy.

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- Sugars
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- Vanillin
- Vitamins

Carbon isotope determination

HONEY AND HONEY PROTEIN

FLASH 2000 HT Parameters

Combustion Temperature 1000°C	Helium Carrier Flow 100 ml/min	Reference Flow 100 ml/min
Helium Pressure (kPa) 250	Oxygen Flow 200 ml/min	Oxygen Injection Time 2 sec
Oxygen Pressure (kPa) 300	Analysis Time 670 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 40 sec	Oven Temperature 50°C	

IRMS information

- Thermo Scientific ConFlo III: 80% dilution for $\delta^{13}\text{C}$
- Thermo Scientific DELTA V Advantage, without valve heater
- Thermo Scientific ISODAT 2.5

Sample information

Standard: IAEA-CH7 polyethylene, Vanillin
 Standard weight: 500 - 900 μg for IAEA-CH7, 600 - 800 μg for vanillin
 Pre-treatment: 1000 - 2000 μg

Carbon isotope ratio data

Sample	Weight (mg)	$\delta^{13}\text{C}$ (‰)	Mean $\delta^{13}\text{C}$ (‰) S.D.
Honey	1.289	-25.84	-25.86 0.03
	1.416	-25.88	
Honey Protein	1.181	-25.42	-25.41 0.02
	1.734	-25.39	



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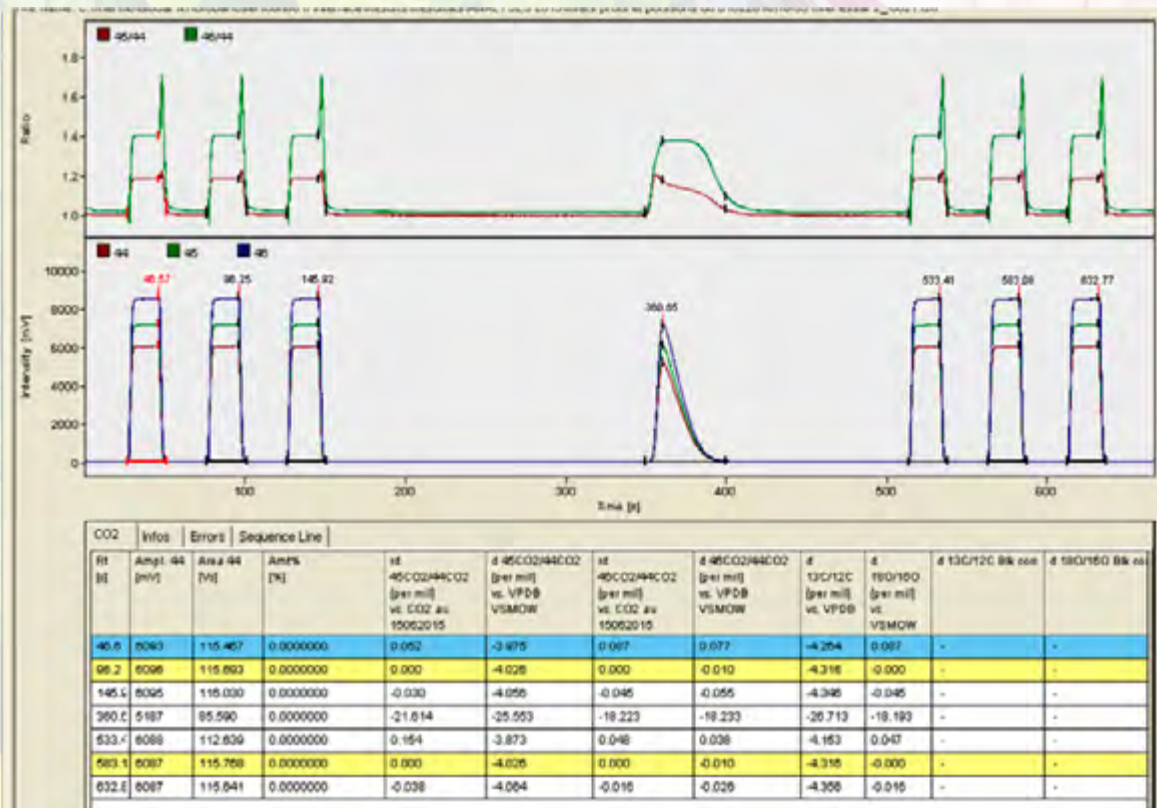
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- Glycine
- Honey
- L-glutamic acid
- Olive Oil
- Potato
- Potato (freeze dried)
- Sucrose
- Sugars
- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Carbon isotope determination

HONEY AND HONEY PROTEIN

Chromatogram of Honey



Thanks to Nicolas Cocolo, Ingénieur de Laboratoire, Service Commun des Laboratoires, 146 traverse Charles Susini, 13388 Marseille, France, tel: 0491618209, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



Analytical - EA-IRMS

Food Origin and Authenticity

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- Chicory
- Ethanol (Wine,Pineapple Juice)
- Glycerol (for Wine)
- Glycine
- Honey
- L-glutamic acid
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- Vitamins

Nitrogen isotope determination

L-GLUTAMIC ACID REFERENCE MATERIAL (USGS40)

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 1050°C	Single reactor	Oven Temperature 50°C
Helium Pressure (kPa) 200	Helium Carrier Flow 140 ml/min	Helium Reference Flow 140 ml/min
Oxygen Pressure (kPa) 200	Oxygen Flow 250 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 12 sec	Analysis Time 400 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 0.8 bar Helium, 1 bar CO₂
- Thermo Scientific DELTA Plus XP2
- Thermo Scientific ISODAT 2.0

Carbon isotope data of L-Glutamic Acid Reference Material (USGS40)

Theoretical value		Experimental value	
δ ¹⁵ N (‰)	Std. Dev.	δ ¹⁵ N (‰)	Std. Dev.
-4.5	± 0.1	-4.64 -4.69	0.04

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CRN, Pisa, Italy.

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- L-glutamic acid
- Olive Oil
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- Potato (freeze dried)
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- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Nitrogen and Carbon isotope determination

L-GLUTAMIC ACID REFERENCE MATERIAL (USGS40)

Thermo Scientific FlashEA 1112 parameters

Combustion Reactor temperature 1020°C	Reduction Reactor temperature 650°C	Oven Temperature 45°C
Helium Pressure (kPa) 250	Helium Carrier Flow 90 ml/min	Reference Flow 200 ml/min
Oxygen Pressure (kPa) 250	Oxygen Flow 180 ml/min	Oxygen Injection Time 3 sec
Sampling Delay 23 sec	Analysis Time 450 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV: 2 bar CO₂ / N₂ , 80 % dilution for C
- Thermo Scientific DELTA V Advantage
- Thermo Scientific ISODAT 3.0

Sample information

Standard:

L-glutamic acid USGS40

Sample weight:

400 µg

NC isotope ratio data

Weight (ug)	$\delta^{15}\text{N}/^{14}\text{N}$ (‰)	$\delta^{13}\text{C}/^{12}\text{C}$ (‰)	mean $\delta^{15}\text{N}$ (‰) S.D.	mean $\delta^{13}\text{C}$ (‰) S.D.
412	-4.527	-25.986	-4.506 0.024	-26.006 0.018
417	-4.512	-26.012		
436	-4.48	-26.021		



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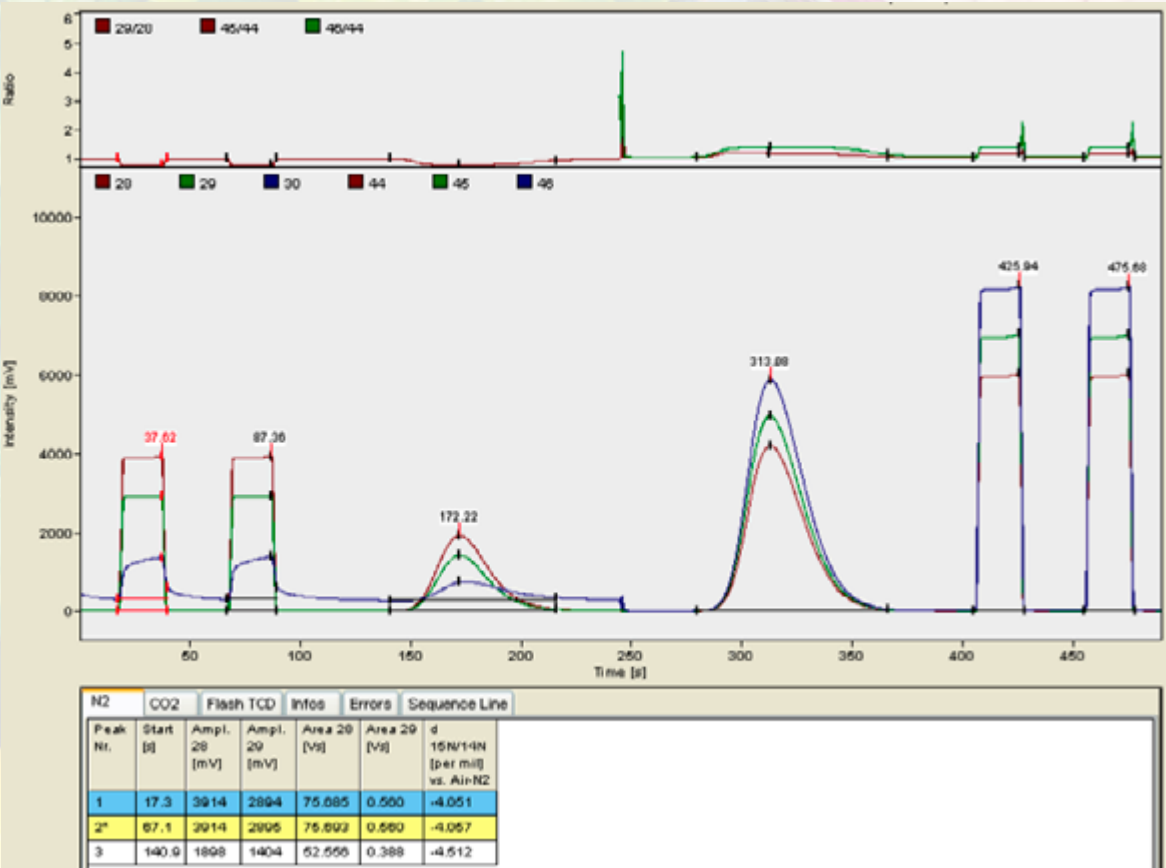
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Nitrogen isotope determination

L-GLUTAMIC ACID REFERENCE MATERIAL (USGS40)

Chromatogram of L-glutamic acid



Thanks to Sofia Goncalves, CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, Porto, Portugal, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Carbon isotope determination

OLIVE OIL

FLASH 2000 HT Parameters		
Furnace Temperature 1000°C	Helium Carrier Flow 100 ml/min	Reference Flow 100 ml/min
Helium Pressure (kPa) 250	Oxygen Flow 200 ml/min	Oxygen Injection Time 2 sec
Oxygen Pressure (kPa) 300	Analysis Time 670 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 40 sec	Oven Temperature 50°C	

IRMS information

- Thermo Scientific ConFlo III: 80% dilution for $\delta^{13}\text{C}$
- Thermo Scientific DELTA V Advantage, without valve heater
- Thermo Scientific ISODAT 2.5

Sample information

Standard: IAEA-CH7 polyethylene, vanillin
Standard weight: 500 - 900 mg for IAEA-CH7, 600 - 800 μg for vanillin
Sample weight: 0.5 - 0.9 mg

Carbon isotope ratio data

Sample Type	$\delta^{13}\text{C}$ (‰)	mean $\delta^{13}\text{C}$ (‰) S.D.
Olive oil	-30.16 -30.19	-30.18 0.02

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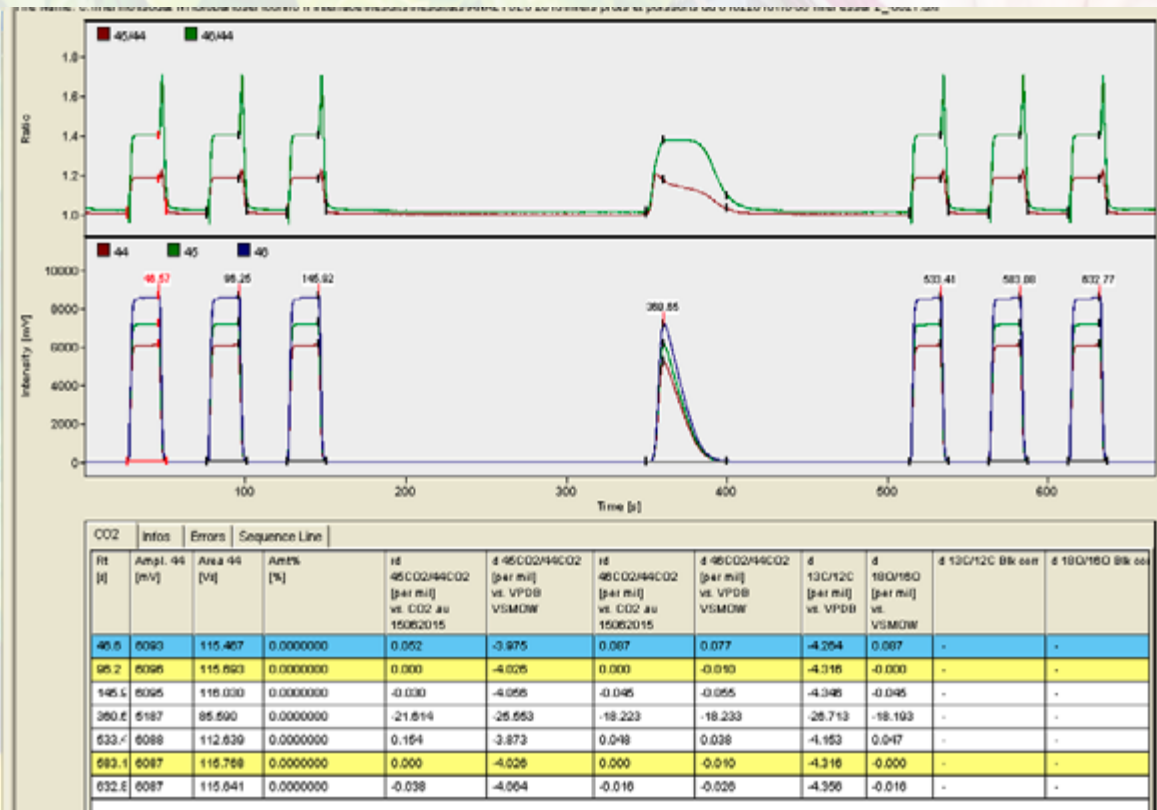
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Carbon isotope determination

OLIVE OIL

Chromatogram of olive oil



Thanks to Nicolas Cocolo, Ingénieur de Laboratoire, Service Commun des Laboratoires, 146 traverse Charles Susini, 13388 Marseille, France, tel: 0491618209, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Hydrogen isotope determination

OLIVE OIL

FLASH 2000 HT Parameters		
Pyrolysis Temperature 1400°C	Analysis Time 670 sec	
Helium Pressure (kPa) 250	Oven Temperature 70°C	
Sampling Delay 40 sec	Reference Flow 150 ml/min	
Helium Carrier Flow 100 ml/min	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo III: without dilution
- Thermo Scientific DELTA V Advantage, without valve heater
- Thermo Scientific ISODAT 2.5

Sample information

Standard: NBS-22 oil
Standard weight: 40 - 70 ug
Sample weight: 0.03 - 0.09 ul

Hydrogen isotope ratio data

Sample Type	$\delta^2\text{H}$ (‰)	mean $\delta^2\text{H}$ (‰) S.D.
Olive oil	-149.43	-148.88 0.76
	-147.81	
	-149.42	
	-148.87	

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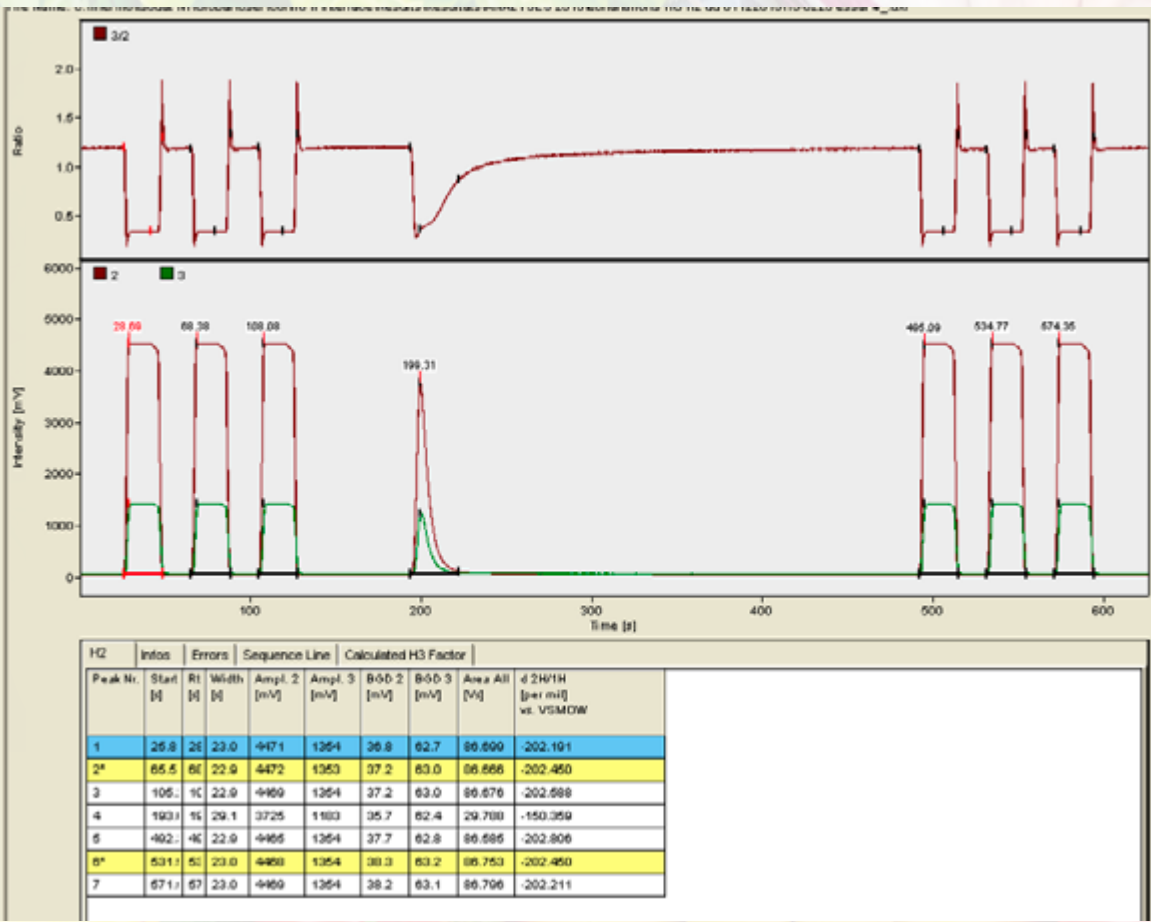
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Hydrogen isotope determination

OLIVE OIL

Chromatogram of olive oil



Thanks to Nicolas Cocolo, Ingénieur de Laboratoire, Service Commun des Laboratoires, 146 traverse Charles Susini, 13388 Marseille, France, tel: 0491618209, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Oxygen isotope determination

OLIVE OIL

FLASH 2000 HT Parameters		
Pyrolysis Temperature 1400°C	Analysis Time 890 sec	
Helium Pressure (kPa) 250	Oven Temperature 70°C	
Sampling Delay 40 sec	Reference Flow 150 ml/min	
Helium Carrier Flow 100 ml/min	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo III: without dilution
- Thermo Scientific DELTA V Advantage, without valve heater
- Thermo Scientific ISODAT 2.5

Sample information

Standard: Benzoic acid IAEA-601 and IAEA-602
Standard weight: 250 - 350 ug
Sample weight: 0.7 ul

Oxygen isotope ratio data

Sample Type	$\delta^{18}\text{O}$ (‰)	mean $\delta^{18}\text{O}$ (‰) S.D.
Olive oil	23.42	23.60 0.16
	23.66	
	23.72	

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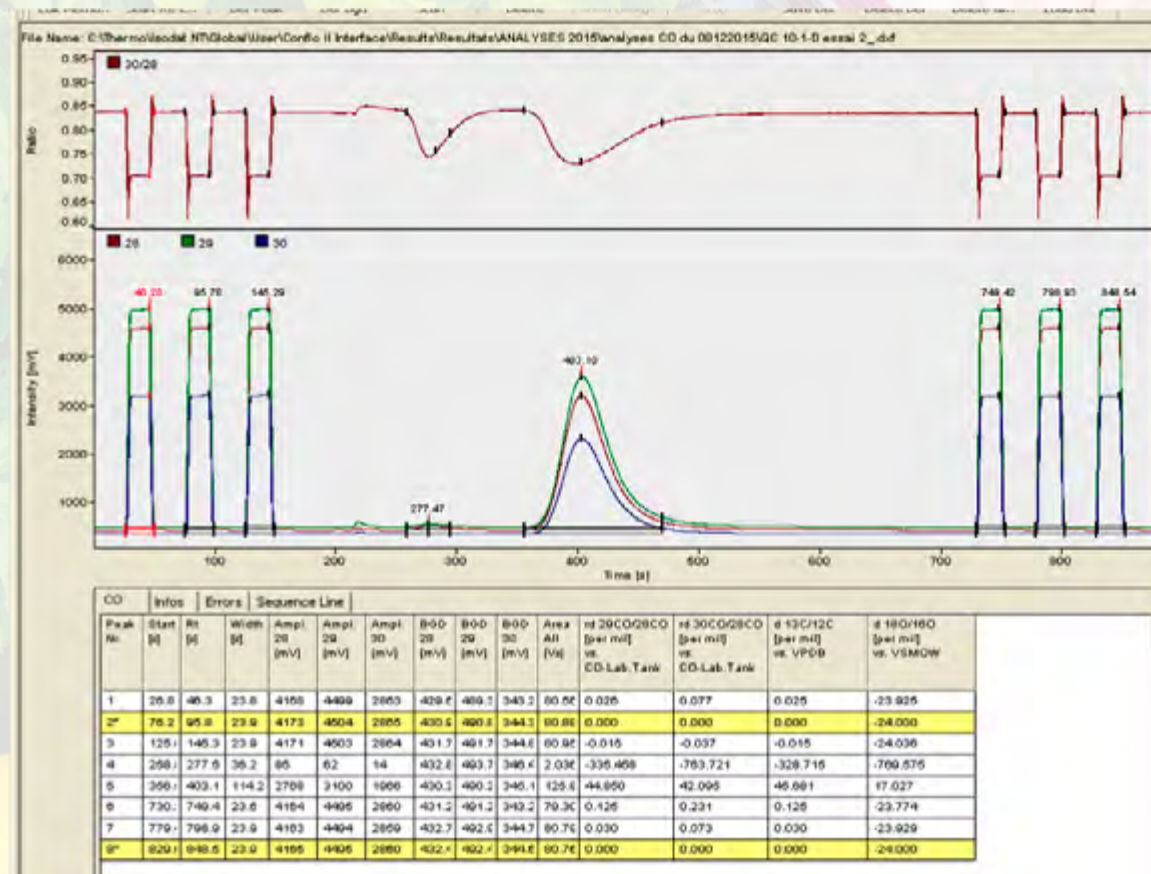
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Chromatogram of olive oil



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Hydrogen and Oxygen isotope determination

POTATO

FLASH 2000 HT Parameters

Pyrolysis Temperature 1400°C	Analysis Time 700 sec	
Helium Pressure (kPa) 250	Oven Temperature 70°C	
Sampling Delay 7 sec	Reference Flow 100 ml/min	
Helium Carrier Flow 100 ml/min	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo IV: dynamic dilution, 33 % dilution for H, no dilution for CO
- Thermo Scientific DELTA V Advantage
- Thermo Scientific ISODAT 3.0

Sample information

Standard: NBS-22 oil for $\delta^2\text{H}$ ratio, IAEA 601 for $\delta^{18}\text{O}$ ratio
 Standard weight: 0.25 mg for NBS-22 oil, 0.40 mg for IAEA 601
 Sample weight: 0.4 mg for both determinations

Sample pre-treatment

The determination of $\delta^{18}\text{O}$ and $\delta^2\text{H}$ ratios was carried out on the freeze-dried potato samples. Briefly, potato tubers were peeled with a suitable tool, cut into thin slices and freeze-dried for 3 days. Freeze-dried potatoes, so obtained, were powdered using a laboratory blender and stored in sealed containers in a desiccator until analysis. The day of the analysis, about 0.41 mg of sample were weighed into silver capsules for $\delta^{18}\text{O}$ and $\delta^2\text{H}$ analysis, the measurements were carried out in a single run.

Note

One control sample was routinely included in each analytical run as a check of system performances; very repeatable results over the 2 month running period (standard deviation < 0.2‰) were obtained. The samples were analyzed using for data normalisation a single standard, i.e Nbs-22 oil and IAEA 601, for and $\delta^2\text{H}$ and $\delta^{18}\text{O}$, respectively.

Hydrogen and Oxygen isotope ratio data

Weight (mg)	$\delta^{18}\text{O}$ (‰)	mean $\delta^{18}\text{O}$ (‰) S.D.	$\delta^2\text{H}$ (‰)	mean $\delta^2\text{O}$ (‰) S.D.
0.38	30.58	30.38 0.18	-77.48	-77.52 0.22
0.41	30.29		-78.79	
0.35	30.26		-77.37	

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- Sugars
- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Nitrogen and Carbon isotope determination

POTATO (FREEZE DRIED)

FLASH 2000 HT Parameters

Reactor Temperature 1020°C	Helium Carrier Flow 150 ml/min	Reference Flow 100 ml/min
Helium Pressure (kPa) 250	Oxygen Flow 250 ml/min	Oxygen Injection Time 2 sec
Oxygen Pressure (kPa) 150	Analysis Time 450 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 7 sec	Oven Temperature 70°C	

IRMS information

- Thermo Scientific ConFlo IV: dynamic dilution, no dilution for N, 50 % dilution for C
- Thermo Scientific DELTA V Advantage
- Thermo Scientific ISODAT 3.0

Sample information

Standard: Commercial Casein
 Standard weight: 0.2 mg both for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios
 Sample weight: 2mg for N, 0.2 mg for C

Sample pre-treatment

The determination of the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ratios was carried out on the freeze-dried potato samples. Briefly, potato tubers were peeled, cut into thin slices and freeze-dried for 3 days. Freeze-dried potatoes, so obtained, were powdered using a commercial mill and stored in sealed containers in a desiccator until analysis. The day of the analysis, about 0.2 mg or 2.0 mg of sample were directly weighed into tin containers for $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ determination, respectively.

NC isotope ratio data

Weight (mg) $\delta^{13}\text{C}$ / $\delta^{15}\text{N}$	$\delta^{13}\text{C}$ (‰)	mean $\delta^{13}\text{C}$ (‰) S.D.	$\delta^{15}\text{N}$ (‰)	mean $\delta^{15}\text{N}$ (‰) S.D.
0.23/2.2	-25.88	-25.89 0.05	-1.01	-1.24 0.23
0.21/2.0	-25.95		-1.25	
0.19/1.98	-25.85		-1.46	

Analytical - EA-IRMS

Food Origin and Authenticity

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- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Carbon isotope determination

SUCROSE REFERENCE MATERIAL (NIST-RM 8542)

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 1050°C	Single reactor	Oven Temperature 50°C
Helium Pressure (kPa) 200	Helium Carrier Flow 140 ml/min	Reference Flow 140 ml/min
Oxygen Pressure (kPa) 200	Oxygen Flow 250 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 12 sec	Analysis Time 400 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 0.8 bar Helium, 1 bar CO₂
- Thermo Scientific DELTA Plus XP
- Thermo Scientific ISODAT 2.0

Sample information

Standard: Commercial Casein
Standard weight: 0.2 mg both for δ¹³C and δ¹⁵N ratios
Sample weight: 2mg for N, 0.2 mg for C

Carbon isotope data of ANU-Sucrose (NIST-RM 8542)

Theoretical value		Experimental value	
δ ¹³ C (‰)	Std. Dev.	δ ¹³ C (‰)	Std. Dev.
10.45	± 0.07	-10.32 -10.42 -10.36	0.07

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.

Analytical - EA-IRMS

Food Origin and Authenticity

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- Vanillin
- Vitamins

Carbon isotope determination

RAW SUCROSE IN CRYSTALS

Thermo Scientific FlashEA 1112 parameters		
Combustion Reactor temperature 1000°C	Oxygen Flow 250 ml/min	Oxygen Injection Time 1 sec
Helium Pressure (kPa) 100	Oxygen Pressure 350 kPa	Thermo Scientific MAS 200R Autosampler
Sampling Delay 10 sec	Oven Temperature 50°C	
Helium Carrier Flow 100 ml/min	Reference Flow 100 ml/min	

IRMS information

- Thermo Scientific ConFlo IV: CO₂ 1 bar; sample dilution 50% dilution
- Thermo Scientific DELTA V Advantage
- Thermo Scientific ISODAT 3.0

Sample information

Standard: Glucose BCR 657
Standard weight: 0.20 - 0.25 mg
Sample weight: 0.2 mg

Carbon isotope ratio data

$\delta^{13}\text{C}$ (‰)	mean $\delta^{13}\text{C}$ (‰)	S.D.
-12,071	-12,086	0,12
-12,039		
-11,978		
-12,256		

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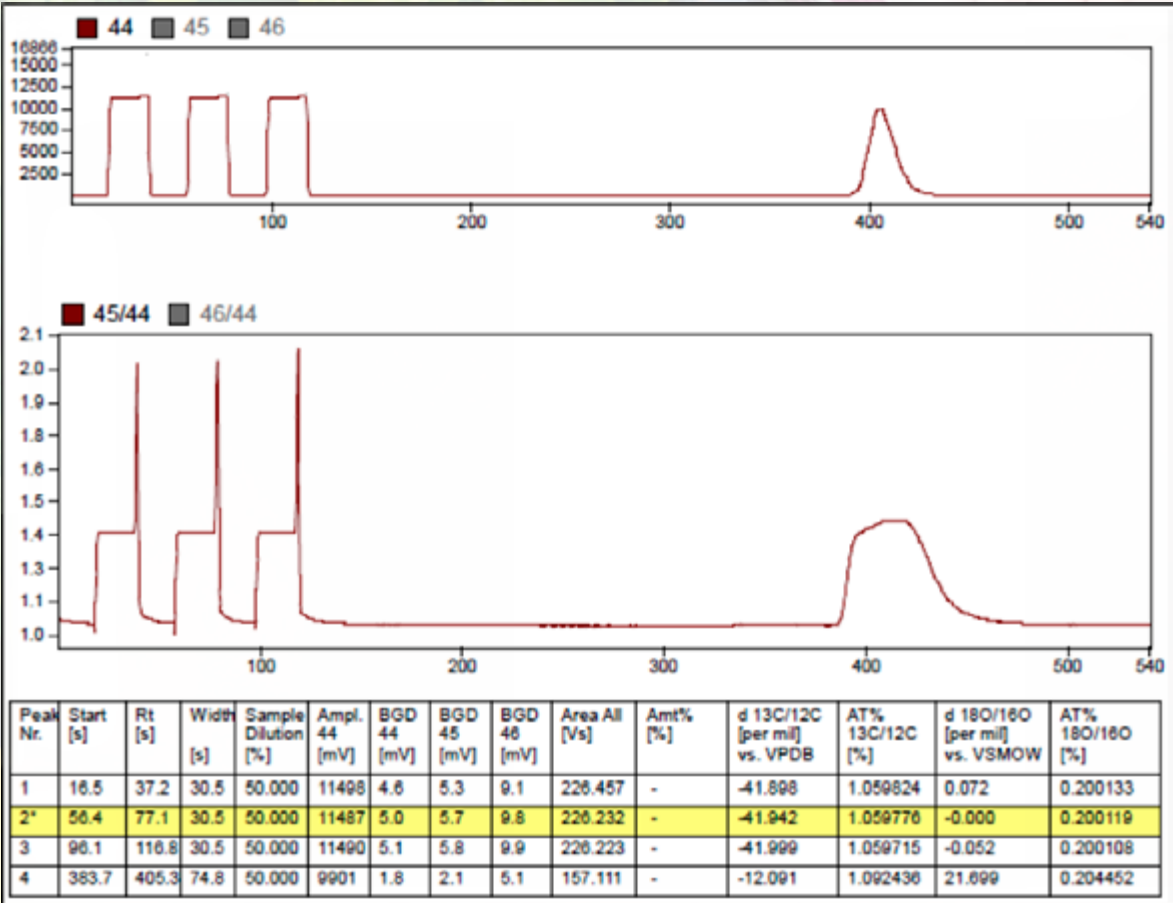
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- Glycerol (for Wine)
- Glycine
- Honey
- L-glutamic acid
- Olive Oil
- Potato
- Potato (freeze dried)
- Sucrose
- Sugars
- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Carbon isotope determination

SUCROSE REFERENCE MATERIAL (NIST-RM 8542)

Chromatogram of raw sucrose



Thanks to Francesca Filippi, Italian Customs Agency - Chemical Laboratory of Turin, Italy, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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- L-glutamic acid
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- Sucrose
- Sugars
- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Carbon isotope determination

SUGARS

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 900°C	Reduction Temperature 680°C	Oven Temperature 45°C
Helium Pressure (kPa) 200	Helium Carrier Flow 120 ml/min	Reference Flow 150 ml/min
Oxygen Pressure (kPa) 400	Oxygen Flow 250 ml/min	Oxygen Injection Time 5 sec
Sampling Delay 15 sec	Analysis Time 320 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV conditions: N₂ 3 bar, He 1 bar, CO₂ 3bar
- Thermo Scientific DELTA V Plus
- Thermo Scientific ISODAT 3.0

Sample information

Standard: Casein
Standard weight: 0.5 mg
Sample weight: 0.5 mg

Carbon isotope data of sugar sample

Amount (mg)	δ ¹³ C (‰)	Mean δ ₁₃ C (‰)
0.500	-26.71	-26.72
0.650	-26.73	



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- Glycine
- Honey
- L-glutamic acid
- Olive Oil
- Potato
- Potato (freeze dried)
- Sucrose
- Sugars
- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Nitrogen, Carbon and Sulfur isotope determination

SULFANILAMIDE AND CYSTEINE (ORGANIC STANDARDS)

Information

The Thermo Scientific FlashEA 1112 and the Thermo Scientific ConFlo IV were connected through the smartEA option. The IRMS system used was a Thermo Scientific DELTA V Plus with a universal triple collector.

For the simultaneous NCS determination, the pre-packed reactor (p/n 468 02005) was used.

Tubing in the Thermo Scientific FlashEA 1112 and the connection to the Thermo Scientific ConFlo IV interface is made of 1/16" Sulfinert capillary.

Thermo Scientific FlashEA 1112 parameters

Reactor Temperature 1020°C	Thermo Scientific MAS 200R Autosampler	
Helium Carrier Flow 80 ml/min		
Oven Temperature 70°C		
Analysis Time 320 sec		

Carbon isotope data of sugar sample

Sample	Amount (mg)	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	$\delta^{34}\text{S}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) S.D.	Mean $\delta^{13}\text{C}$ (‰) S.D.	Mean $\delta^{34}\text{S}$ (‰) S.D.	C/S ratio
Sulfanilamide	0.245	-1.76	-1.76	-1.76	-1.84 0.07	-28.77 0.03	3.04 0.12	2.2
	0.192	-1.87	-1.87	-1.87				
	0.244	-1.89	-1.89	-1.89				
Cysteine	0.299	10.03	-14.26	7.13	10.12 0.17	-14.25 0.02	7.11 0.07	1.1
	0.288	10.32	-14.23	7.17				
	0.280	10.01	-14.27	7.03				

Note

For more information see Thermo Scientific Application Note 30194.

(Simultaneous N, C and S Isotope Ratio Determination on a DELTA V Isotope Ratio MS using a Flash Elemental Analyzer)



Analytical - EA-IRMS

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- Chicory
- Ethanol (Wine,Pineapple Juice)
- Glycerol (for Wine)
- Glycine
- Honey
- L-glutamic acid
- Olive Oil
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- Sucrose
- Sugars
- Sulfanilamide and Cysteine
- Vanillin
- Vitamins

Carbon isotope determination

VANILLIN

FLASH 2000 HT Parameters		
Combustion Reactor temperature 1000°C	Helium Carrier Flow 100 ml/min	Reference Flow 100 ml/min
Helium Pressure (kPa) 250	Oxygen Flow 200 ml/min	Oxygen Injection Time 2 sec
Oxygen Pressure (kPa) 300	Analysis Time 670 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 40 sec	Oven Temperature 50°C	

IRMS information

- Thermo Scientific ConFlo III: 80% dilution for $\delta^{13}\text{C}$
- Thermo Scientific DELTA V Advantage, without valve heater
- Thermo Scientific ISODAT 2.5

Sample information

Standard: Vanillin
Standard weight: 600 - 800 ug
Sample weight: 600 - 800 ug

Carbon isotope ratio data

Sample Type	$\delta^{13}\text{C}$ (‰)	mean $\delta^{13}\text{C}$ (‰) S.D.
Vanillin	-27.75	-27.75 0.01
	-27.74	
	-27.75	
	-27.76	

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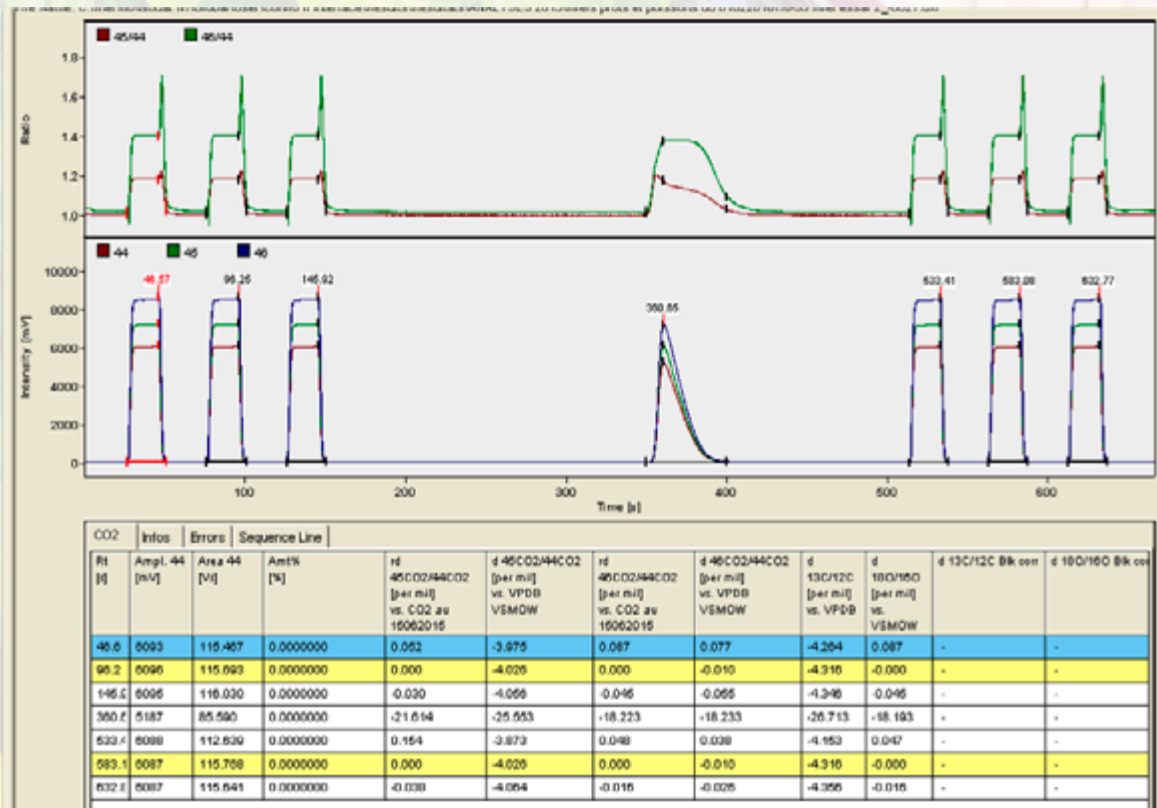
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Carbon isotope determination

VANILLIN

Chromatogram of Vanillin



Thanks to Nicolas Cocolo, Ingénieur de Laboratoire, Service Commun des Laboratoires, 146 traverse Charles Susini, 13388 Marseille, France, tel: 0491618209, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Nitrogen, Carbon and Sulfur isotope determination

VITAMINS

Information

The Thermo Scientific FlashEA 1112 and the Thermo Scientific ConFlo IV were connected through the smartEA option. The IRMS system used was a Thermo Scientific DELTA V Plus with a universal triple collector.

For the simultaneous NCS determination, the pre-packed tube (p/n 468 02005) was used.

Tubing in the Thermo Scientific FlashEA 1112 and the connection to the Thermo Scientific ConFlo IV interface is made of 1/16" Sulfinert capillary.

Thermo Scientific FlashEA 1112 parameters

Reactor Temperature 1020°C	Thermo Scientific MAS 200R Autosampler	
Helium Carrier Flow 80 ml/min		
Oven Temperature 70°C		
Analysis Time 320 sec		

Carbon isotope data of sugar sample

Sample	Amount (mg)	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	$\delta^{34}\text{S}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) S.D.	Mean $\delta^{13}\text{C}$ (‰) S.D.	Mean $\delta^{34}\text{S}$ (‰) S.D.	C/S ratio
Vitamin B1	0.192	-1.02	-32.88	-4.94	-0.96 0.06	-32.85 0.04	-4.96 0.09	4.4
	0.240	-0.89	-32.86	-5.06				
	0.196	-0.96	-32.81	-4.89				
Vitamin H	0.412	-12.34	-29.23	10.42	-12.30 0.04	-29.96 0.03	10.42 0.10	3.8
	0.468	-12.31	-29.30	10.32				
	0.474	-12.27	-29.24	10.52				

Note

For more information see Thermo Scientific Application Note 30194.

(Simultaneous N, C and S Isotope Ratio Determination on a DELTA V Isotope Ratio MS using a Flash Elemental Analyzer)



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Forensics

- Collagen
- Keratin (Nails)

Nitrogen and Carbon isotope determination

COLLAGEN (FROM HUMAN AND ANIMAL BONE)

FLASH 1112 IRMS Parameters

Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 40°C
Helium Pressure (kPa) 250	Helium Carrier Flow 100 ml/min	Helium Reference Flow 250 ml/min
Oxygen Pressure (kPa) 300	Oxygen Flow 250 ml/min	Oxygen Injection Time 10 sec
Sampling Delay 14 sec	Analysis Time 600 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 1.5 bar CO₂ / N₂, He 0.6 bar
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 3.0 Software Suite2

Sample information

Standard:	Nicotinamide	R041, IAEA-N-2, IAEA-CH-6, Fish (in house QC std)
Standard weight:	0.50 - 0.60 mg Nicotinamide, 0.45 - 0.55 mg R041 0.30 - 0.40 mg IAEA-N-2 0.55 - 0.65 mg IAEA-CH-6	
Sample weight:	0.90 - 1.10 mg Fish (QC) 0.8 - 1.10 mg	

Sample pre-treatment

Based on method by Brown et al. 1998, using a Vivaspin® filter cleaning method introduced by Bronk Ramsey et al (2004). Mild acid and alkali solutions were used to remove inorganic and natural organic post depositional contaminants. For collagen extraction and gelatinization were used acidified water and heated to dissociate the amino acids from the bone matrix.

NC isotope data

Weight (ug)	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) Std. Dev.	Mean $\delta^{13}\text{C}$ (‰) Std. Dev.
1.280	9.161	-21.451	9.196 0.030	-21.462 0.010
1.097	9.214	-21.464		
1.156	9.212	-21.471		



Analytical - EA-IRMS

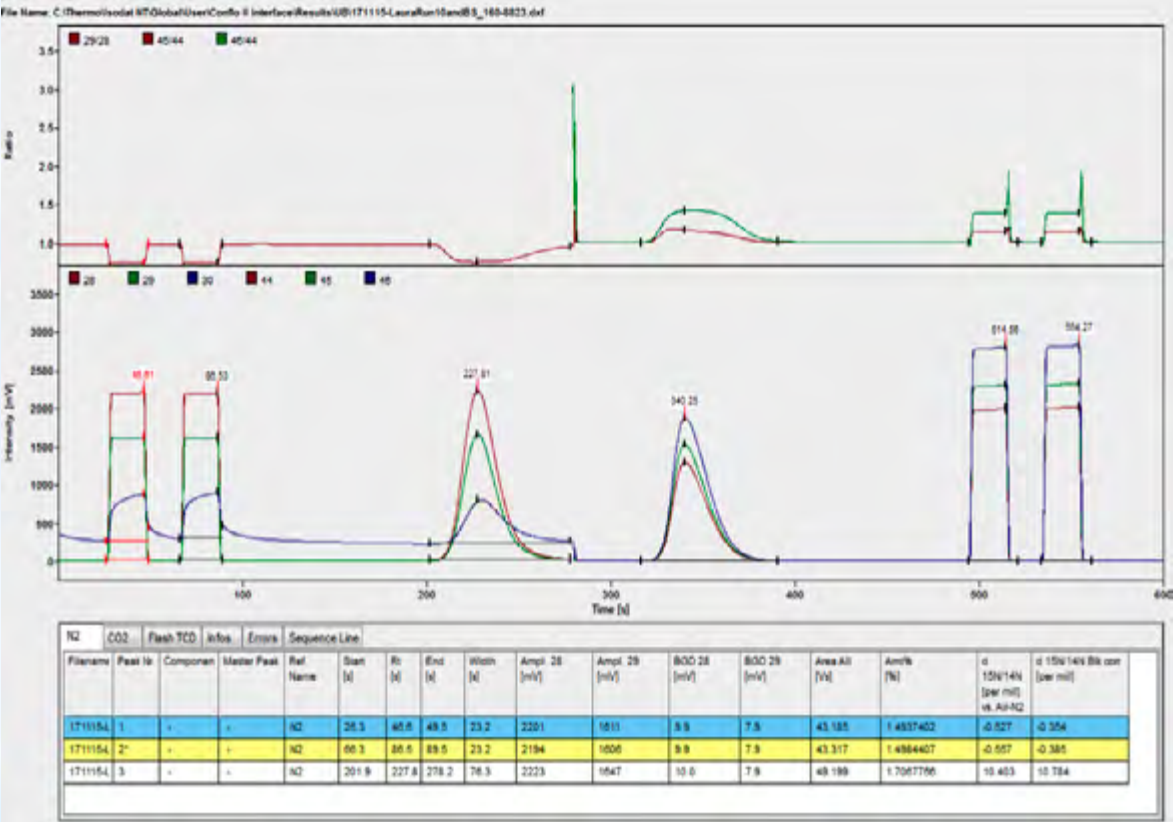
Forensics

- Collagen
- Keratin (Nails)

Nitrogen and Carbon isotope determination

COLLAGEN (FROM HUMAN AND ANIMAL BONE)

Chromatogram of collagen



Thanks to Dr. Michelle Thompson, Queens University Belfast, Paleoecology Centre, 42 Fitzwilliam Street, Belfast, UK, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.

Analytical - EA-IRMS

Forensics

- Collagen
- Keratin (Nails)

Nitrogen and Carbon isotope determination

KERATIN (NAILS)

FLASH 2000 HT Parameters		
Reactor temperature 1020°C	Helium Carrier Flow 100 ml/min	Reference Flow 100 ml/min
Helium Pressure (kPa) 290	Oxygen Flow 250 ml/min	Oxygen Injection Time 3 sec
Oxygen Pressure (kPa) 260	Analysis Time 500 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 208 sec	Oven Temperature 50°C	

IRMS information

- Thermo Scientific ConFlo IV conditions: for nails keratin 0% dilution for N₂ and 80 % dilution for CO₂ while for Urea, Sucrose, Marble and Ammonium Sulphate no dilution was used.
- Thermo Scientific DELTA V Advantage
- Thermo Scientific ISODAT 3.0

Sample information

Standard: Urea, Sucrose, Ammonium Sulphate, Carrara Marble
Standard weight: 0.15 mg Urea,
0.80 - 0.12 mg Sucrose,
0.28 mg Ammonium Sulphate,
0.25 mg Carrara Marble
Sample weight: 0.28 - 0.36 mg nails keratin

Sample pre-treatment

Nails keratin sample was cleaned mechanically, rinsing in solution of methanol and chloroform (2:1, v/v) for 60 min the first Time, second Time for 30 min, rinsing in deionized water for 60 min in ultrasonic bath, finally dried overnight.

NC isotope ratio data

Sample	Amount (mg)	δ ¹⁵ N (‰)	δ ¹³ C (‰)	Mean δ ¹⁵ N (‰) S.D.	Mean δ ¹³ C (‰) S.D.
Fingernail keratin	0.31	10.03	-20.93	10.01 0.06	-20.82 0.12
	0.28	9.94	-20.69		
	0.27	10.06	-20.83		



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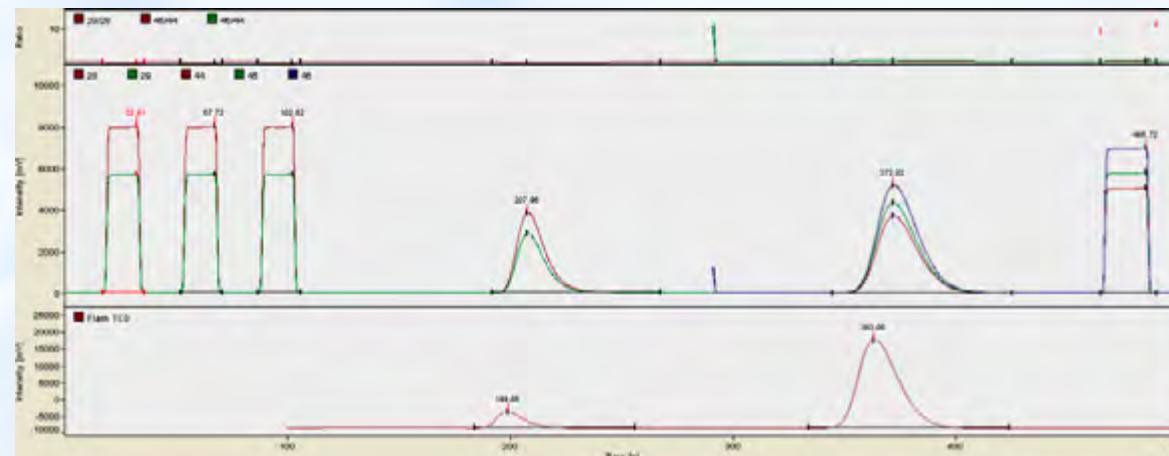
Forensics

- Collagen
- Keratin (Nails)

Nitrogen and Carbon isotope determination

KERATIN (NAILS)

Chromatogram of nails keratin (0.31 mg)



Thanks to Mgr. Zuzana Grolmusová, PhD, Department of special laboratories, State Geological Institute of Dionyz Stur, Mlynska dolina 1, 817 04 Bratislava, e-mail: zuzana.grolmusova@geology.sk, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific

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Nitrogen and Carbon isotope determination

COALS

FLASH 2000 HT Parameters

Combustion Temperature 900°C	Analysis Time 300 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 14 sec	Oven Temperature 40°C	
Helium Carrier Flow 300 ml/min	Reference Flow 100 ml/min	
Oxygen Flow 250 ml/min	Oxygen Injection Time 5 sec	

IRMS information

- Thermo Scientific ConFlo II
- Thermo Scientific DELTA Plus
- Thermo Scientific ISODAT 3.0

Sample information

Standard:

Standard weight:

Glutamic acid, Sucrose IAEA-CH6
1 mg for Carbon determination
5 mg for N determination

NC isotope ratio data

	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)		
Coal sample	(‰)	Replicate 1	Replicate 2	Average
A	1.069	-24.004	-24.080	-24.042
B	3.438	-23.565	-24.598	-24.082
C	-0.527	-23.042	-23.428	-23.235
D	0.160	-22.102	-22.768	-22.435
E	0.833	-23.274	-23.493	-23.384
F	-1.464	-22.490	-22.740	-22.615

Thanks to Daniela Berto and Federico Rampazzo, Italian National Institute for Environmental Protection and Research (ISPRA), Laboratory of Oceanography and Contamination of the Aquatic Environment, Chioggia (VE), Italy.



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Carbon isotope determination

KEROGEN

FLASH 2000 IRMS Parameters		
Combustion Temperature 950°C	Oxygen Flow 300 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 10 sec	Analysis Time 600 sec	Thermo Scientific MAS 200R Autosampler
Reduction Temperature 650°C	Oven Temperature 40°C	
Helium Carrier Flow 300 ml/min	Reference Flow 200 ml/min	

IRMS information

- Thermo Scientific ConFlo IV conditions: CO2 1.6 bar, 60 %dilution and weight correction
- Thermo Scientific DELTA Plus XP
- Thermo Scientific ISODAT 3.0

Sample information

Standard: Oil

Standard weight: 0.05 - 0.50 mg

0.10 - 20 mg

Note

Kerogen is a mixture of insoluble organic compounds with high molecular weight and the stuff can generate oil and gas.

Carbon isotope ratio data

Sample	Weight (mg)	$\delta^{13}\text{C}$ (‰)	Mean $\delta^{13}\text{C}$ (‰) S.D.
Kerogen	5	-23.53	-25.58 0.04
	9	-23.62	
	7	-23.59	

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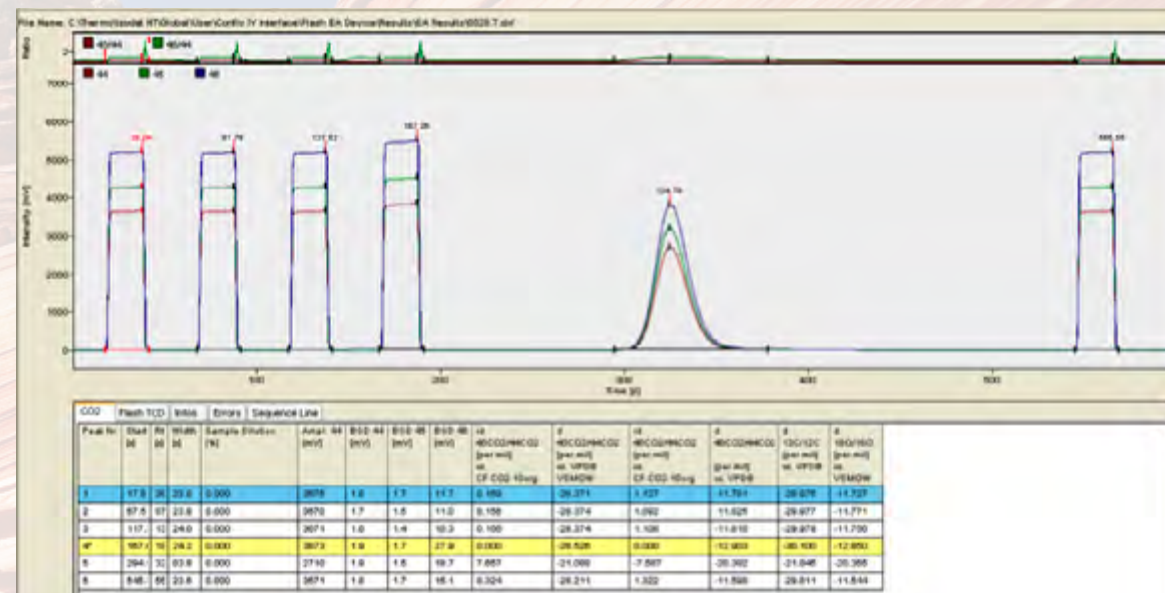
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Carbon isotope determination

KEROGEN

Chromatogram of Kerogen (9.6 mg)



Thanks to Lu, Feng, Aramco Oil Company, Saudi Aramco, Dhahra, SA, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Carbon isotope determination

LUBRICANT OIL

Sample information

The sample is an internal Reference Material prepared by ENI, San Donato Milanese (Milan), Italy.

FLASH 2000 IRMS Parameters

Combustion Temperature 900°C	Oxygen Flow 250 ml/min	Oxygen Injection Time 14 sec
Helium Pressure (kPa) 140	Analysis Time 270 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 14 sec	Oven Temperature 75°C	
Reduction Temperature 640°C	Reference Flow 100 ml/min	

IRMS information

- Thermo Scientific ConFlo II
- Thermo Scientific DELTA XP
- Dual Inlet System
- Thermo Scientific ISODAT 3.0

Carbon isotope data of Oil sample

Theoretical value	Experimental value	
$\delta^{13}\text{C}$ (‰)	$\delta^{13}\text{C}$ (‰)	Std. Dev.
	-30.23	0.03
-30.26	-30.29	
	-30.27	

Thanks to Carla Martinenghi and Corrado Barbieri, ENI, San Donato Milanese (Milan), Italy.



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Carbon isotope determination

MARBLE - CARRARA MARBLE REFERENCE MATERIAL (IAEA R022)

FLASH 2000 HT Parameters		
Combustion Temperature 1020°C	Helium Carrier Flow 100 ml/min	Reference Flow 100 ml/min
Helium Pressure (kPa) 290	Oxygen Flow 250 ml/min	Oxygen Injection Time 3 sec
Oxygen Pressure (kPa) 260	Analysis Time 500 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 208 sec	Oven Temperature 50°C	

IRMS information

- Thermo Scientific ConFlo IV conditions: for Urea, Sucrose, Marble and Ammonium Sulphate no dilution was used.
- Thermo Scientific DELTA V Advantage
- Thermo Scientific ISODAT 3.0

Sample information

Standard: Urea, Sucrose, Ammonium Sulphate, Carrara Marble
Standard weight: 0.15 mg Urea,
0.80 - 0.12 mg Sucrose,
0.28 mg Ammonium Sulphate,
0.25 mg Carrara Marble
Sample weight: 0.26 - 0.27 mg

Carbon isotope ratio data

Sample	Weight (mg)	$\delta^{13}\text{C}$ (‰)	Mean $\delta^{13}\text{C}$ (‰) S.D.
Marble (standard IAEA R022)	0.27	-28.57	-28.64 0.06
	0.26	-28.70	
	0.27	-28.66	

Thanks to Carla Martinenghi and Corrado Barbieri, ENI, San Donato Milanese (Milan), Italy.



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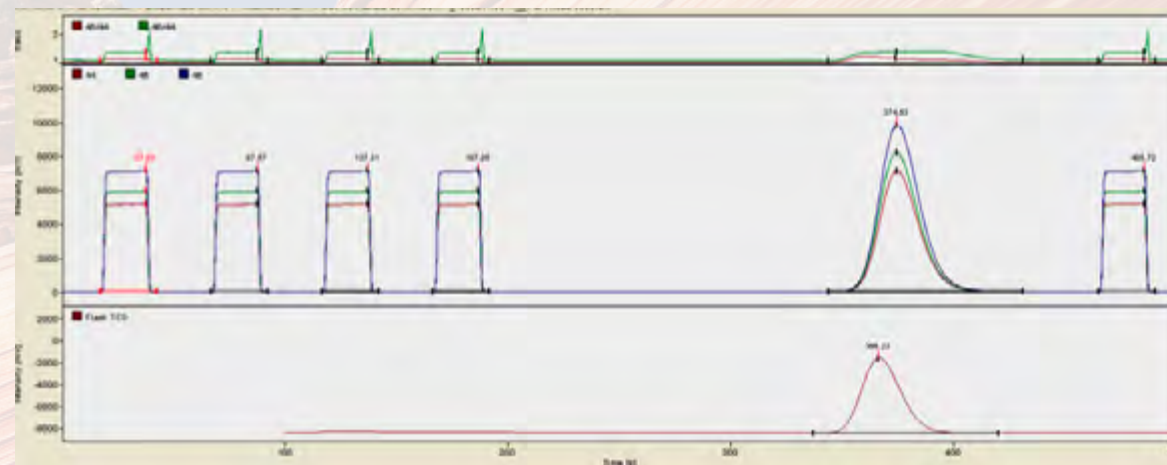
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Carbon isotope determination

MARBLE - CARRARA MARBLE REFERENCE MATERIAL (IAEA R022)

Chromatogram of Carrara Marble (0.26 mg)



Thanks to Mgr. Zuzana Grolmusová, PhD, Department of special laboratories, State Geological Institute of Dionyz Stur, Mlynska dolina 1, 817 04 Bratislava, e-mail: zuzana.grolmusova@geology.sk, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.

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- Water Reference

Hydrogen isotope determination

MINERALS

FLASH 2000 HT Parameters		
Combustion Temperature 1400°C	Analysis Time 250 sec	
Helium Pressure (kPa) 200	Oven Temperature 75°C	
Sampling Delay 5 sec	Reference Flow 90 ml/min	
Helium Carrier Flow 90 ml/min	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo III: 1 bar H₂, 0.75 bar He
- Thermo Scientific DELTA Plus XP
- Thermo Scientific ISODAT 2.0

Sample information

Standard: NBS-30 NIST RM, DS-15 (internal standard), BONSALL (internal standard)
Standard weight: 1.4 - 1.5 mg in silver capsule
Sample weight: 0.4 - 2.0 mg

Hydrogen isotope ratio data

Sample	Weight (mg)	δ ² H (‰)	Mean δ ² H (‰) S.D.
Hydromagnesite	0.55	-30.20	-29.2 1.4
	0.51	-28.16	
Serpentine	0.42	-65.70	-65.70 0.01
	0.40	-65.67	



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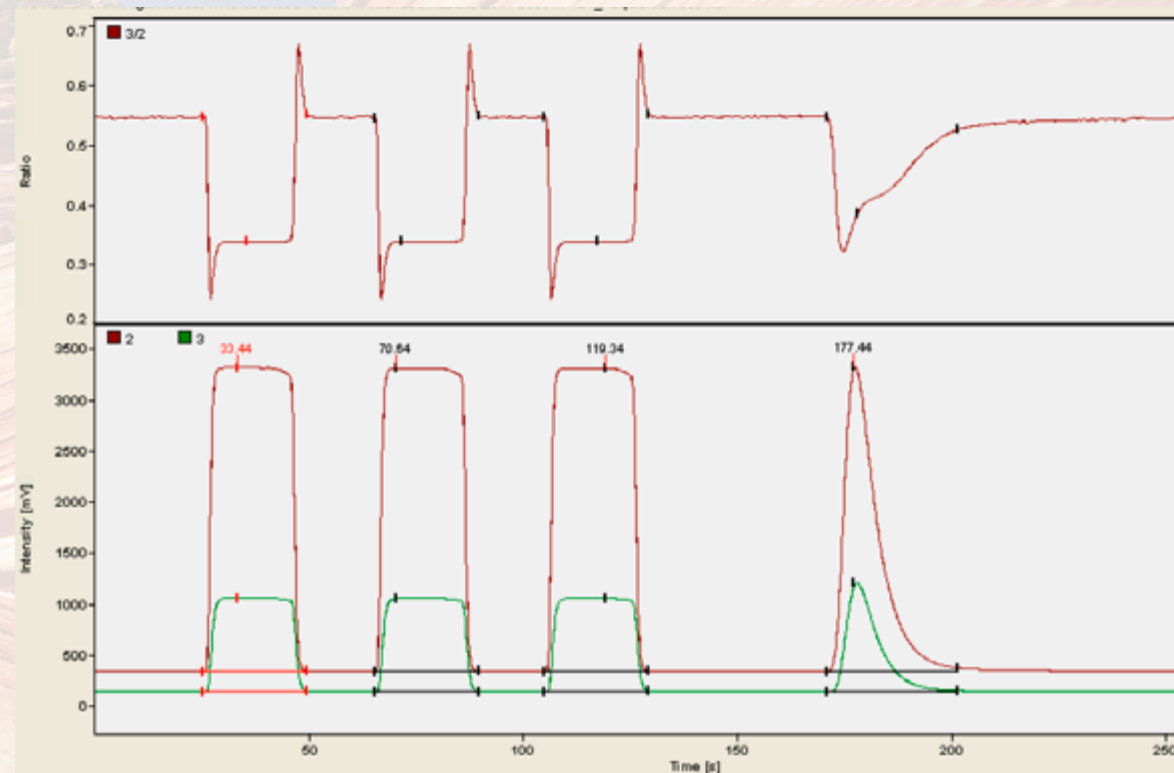
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MINERALS

 $\delta^2\text{H}$ Chromatogram

Hydrogen isotope determination



H2	Error	Extended	Sequence Line							
Peak Nr.	Start [s]	Rt [s]	Width [s]	Ampl. 2 [mV]	Ampl. 3 [mV]	BOD 2 [mV]	BOD 3 [mV]	Area All [V]	d 2H/1H [per mil] vs. VSMOW	
1	25.6	35	24.2	2979	917	333.2	135.9	58.192	-203.227	
2	65.4	70	24.2	2973	916	333.1	135.8	58.086	-202.831	
3*	105	111	24.2	2975	916	333.0	135.8	58.100	-202.600	
4	171.1	177	30.7	2989	1065	331.4	135.7	26.985	-65.700	



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Oxygen isotope determination

MINERALS

FLASH 2000 HT Parameters		
Combustion Temperature 1420°C	Analysis Time 600 sec	
Helium Pressure (kPa) 200	Oven Temperature 90°C	
Sampling Delay 8 sec	Reference Flow 110 ml/min	
Helium Carrier Flow 110 ml/min	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo III: 2 bar CO₂, 0.8 bar He
- Thermo Scientific DELTA Plus XP
- Thermo Scientific ISODAT 2.0

Sample information

Standard: NBS-18, MS (calcite, internal standard)
Standard weight: 0.1 - 0.2 mg with NIC (0.5 mg) and anhydrous AGCl (0.3 mg) in silver capsule
Sample weight: 0.1 - 0.2 mg with NIC (0.5 mg) and anhydrous AGCl (0.3 mg) in silver capsule

Oxygen isotope ratio data

Sample	Weight (mg)	δ ¹⁸ O (‰ V-SMOW)	Mean δ ¹⁸ O (‰ V-SMOW) S.D.
Hydromagnesite	0.20	9.400	9.33 0.09
	0.16	9.269	
Serpentine	0.17	5.279	5.12 0.22
	0.15	4.956	



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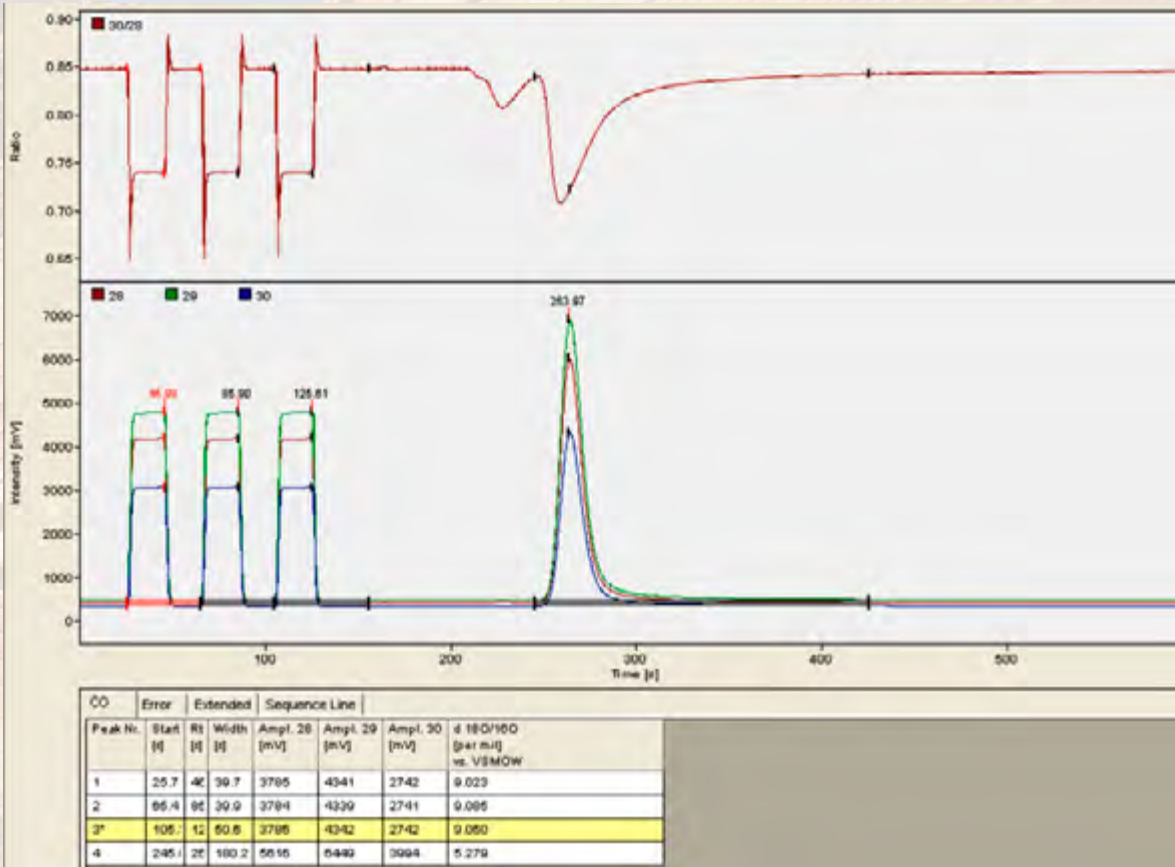
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MINERALS

$\delta^{18}\text{O}$ Chromatogram



Thanks to Dr. Ilaria Baneschi, Dr. Chiara Boschi and Dr. Luigi Dallai, Geoscience and Earth Resources - CNR, Pisa, Italy.



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Carbon isotope determination

MINERAL OIL REFERENCE MATERIAL (NBS 22)

Sample information

The sample is an internal Reference Material prepared by ENI, San Donato Milanese (Milan), Italy.

FLASH 2000 HT Parameters

Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 40°C
Helium Pressure (kPa) 100	Helium Carrier Flow 90 ml/min	Helium Reference Flow 85 ml/min
Oxygen Pressure (kPa) 100	Oxygen Flow 175 ml/min	Oxygen Injection Time 3 sec
Sampling Delay 18 sec	Analysis Time 450 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo II conditions: helium pressure 1.25 bar, CO₂ pressure 0.9 bar
- Thermo Scientific DELTA Plus: extraction and lenses values in linearity mode
- Thermo Scientific ISODAT 2.0

Sample information

Standard: Acetanilide, NBS 22, IAEA-CH6, USGS 24
 Standard weight: 0.4 mg Acetanilide
 Sample weight: 0.5 mg

Carbon data of Mineral Oil reference Material (NBS 22)

Amount (mg)	C %	$\delta^{13}\text{C}_{\text{VPDB}}(\text{‰})$
0.480	85.50	-30.07
0.482	85.67	-29.99
0.341	85.69	-30.05
0.344	86.05	-29.96
0.404	85.67	-29.95
0.428	85.79	-30.11
Average	85.73	-30.02
Std. Dev.	0.18	0.07



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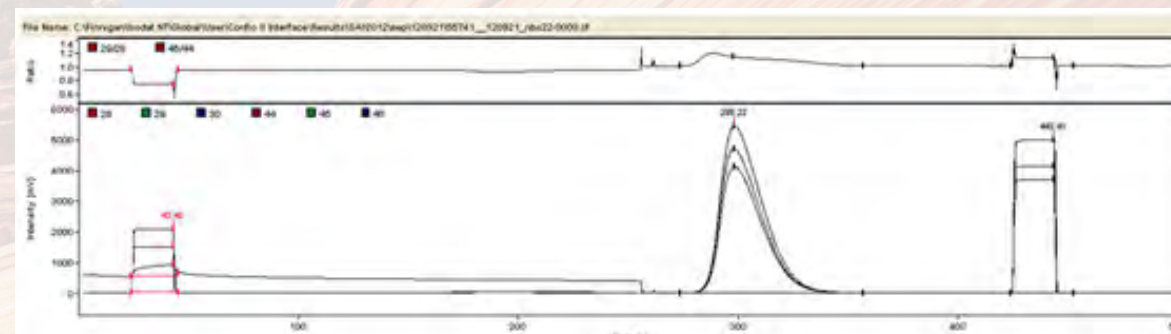
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Carbon isotope determination

MINERAL OIL REFERENCE MATERIAL (NBS 22)

Carbon chromatogram



Thanks to Maria Lema Grille, Universidad de La Coruña, Servicios de Apoyo a la Investigación, La Coruña, Spain.

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Hydrogen isotope determination

UNDERGROUND NATURAL WATER

Thermo Scientific FlashEA 1112 parameters		
Pyrolysis Temperature 1400°C	Helium Carrier Flow 100 ml/min	
Helium Pressure (kPa) 260	Analysis Time 300 sec	
Sampling Delay 14 sec	Helium Reference Flow 50 ml/min	
Oven Temperature 80°C	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo III conditions: Helium pressure 0.9 bar, Hydrogen pressure 1.5 bar
- Thermo Scientific DELTA V Advantage

Sample information

Standard: V-SMOW, GISP, SLAP
Standard weight: 0.2 µl
Sample weight: 0.2 µl

Hydrogen isotope data of water sample

δ²H (‰)	Mean	Std. Dev.
76.3	75.4	0.6
75.3		
74.9		
75.8		
74.7		
75.2		

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.



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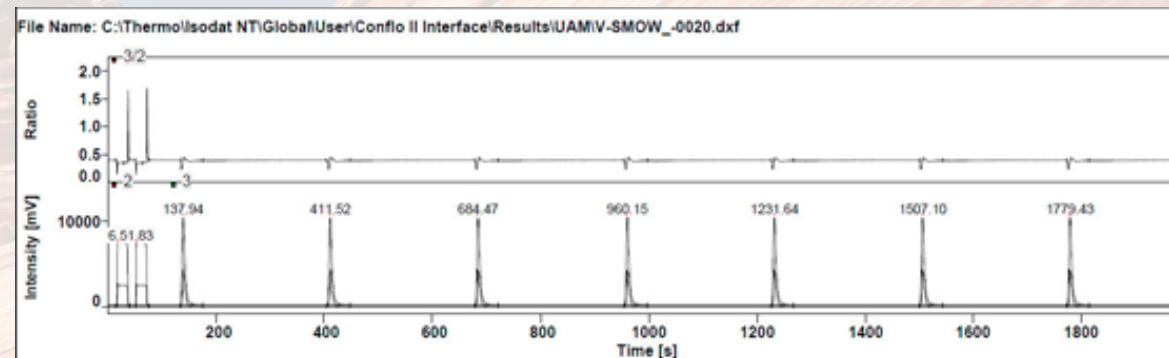
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Hydrogen isotope determination

UNDERGROUND NATURAL WATER

Chromatogram of fish tissue



Thanks to Redondo Ortega, Vanesa Peiró Hernández y Francisco José Caballero Castrejón, Laboratorio de Isótopos Estables, Universidad Autónoma de Madrid, Madrid, Spain.

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Hydrogen isotope determination

OIL NBS-22 REFERENCE MATERIAL

FLASH 2000 HT Parameters		
Combustion Temperature 1400°C	Analysis Time 670 sec	
Helium Pressure (kPa) 250	Oven Temperature 70°C	
Sampling Delay 40 sec	Reference Flow 150 ml/min	
Helium Carrier Flow 100 ml/min	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo III: without dilution
- Thermo Scientific DELTA V Advantage, without valve heater
- Thermo Scientific ISODAT 2.5

Sample information

Standard: NBS-22 oil
Sample weight: 40 - 70 ug

Hydrogen isotope ratio data

Sample	$\delta^2\text{H}$ (‰)	Mean $\delta^2\text{H}$ (‰) S.D.
NBS-22 Oil	-106.61	-107.15 1.98
	-105.17	
	-106.49	
	-107.03	
	-110.47	

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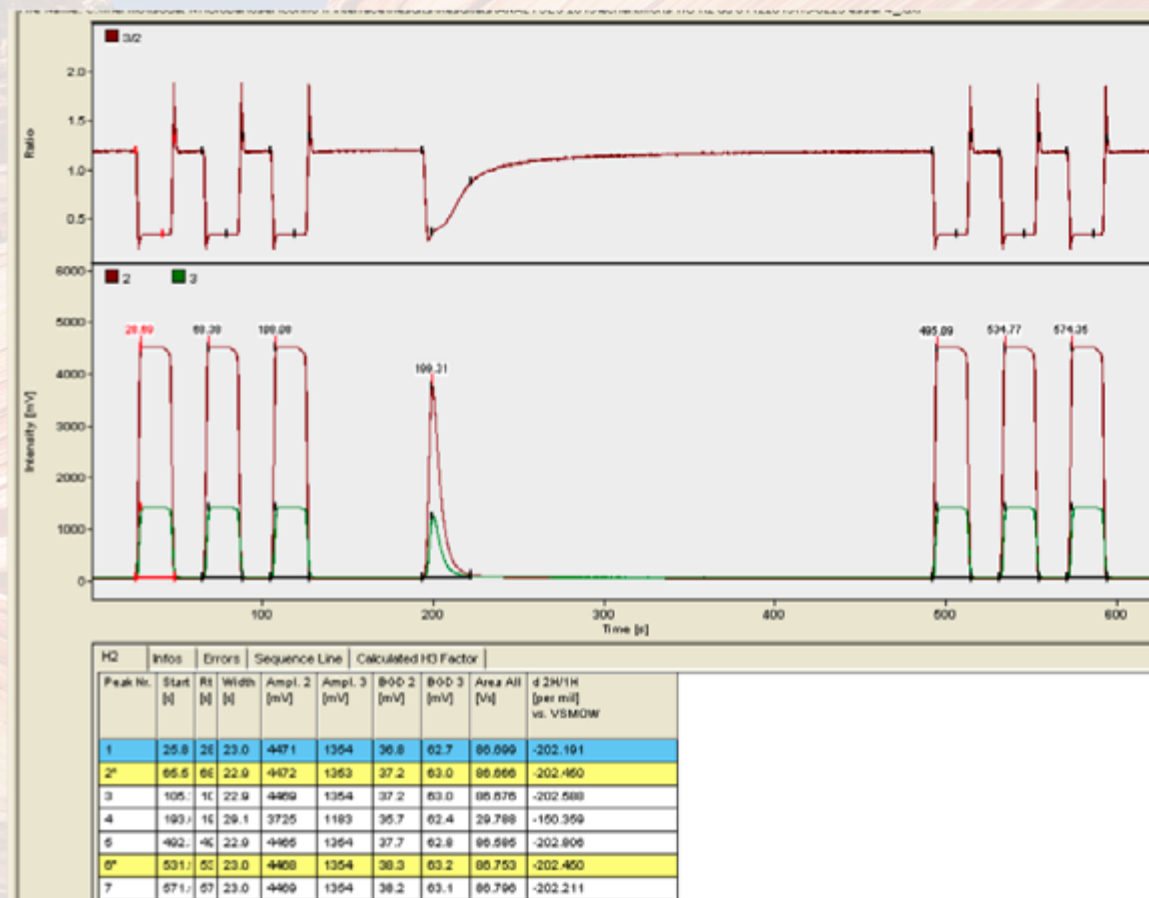
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Hydrogen isotope determination

OIL NBS-22 REFERENCE MATERIAL

Chromatogram of olive oil



Thanks to Nicolas Cocolo, Ingénieur de Laboratoire, Service Commun des Laboratoires, 146 traverse Charles Susini, 13388 Marseille, France, tel: 0491618209, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Carbon isotope determination

PURE LIQUID OIL

FLASH 2000 HT Parameters		
Combustion Temperature 950°C	Oxygen Flow 300 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 10 sec	Analysis Time 600 sec	Thermo Scientific MAS 200R Autosampler
Reduction Temperature 650°C	Oven Temperature 40°C	
Helium Carrier Flow 300 ml/min	Reference Flow 200 ml/min	

IRMS information

- Thermo Scientific ConFlo IV conditions: CO2 1.6 bar, 60 %dilution and weight correction
- Thermo Scientific DELTA Plus XP
- Thermo Scientific ISODAT 3.0

Sample information

Standard: Oil
Standard weight: 0.05 - 0.50 mg
Sample weight: 0.10 - 0.5 mg

Carbon isotope ratio data

Sample	Weight (mg)	$\delta^{13}\text{C}$ (‰)	Mean $\delta^{13}\text{C}$ (‰) S.D.
Pure liquid oil	0.3	-27.38	-27.351 0.02
	0.5	-27.34	
	0.2	-27.34	

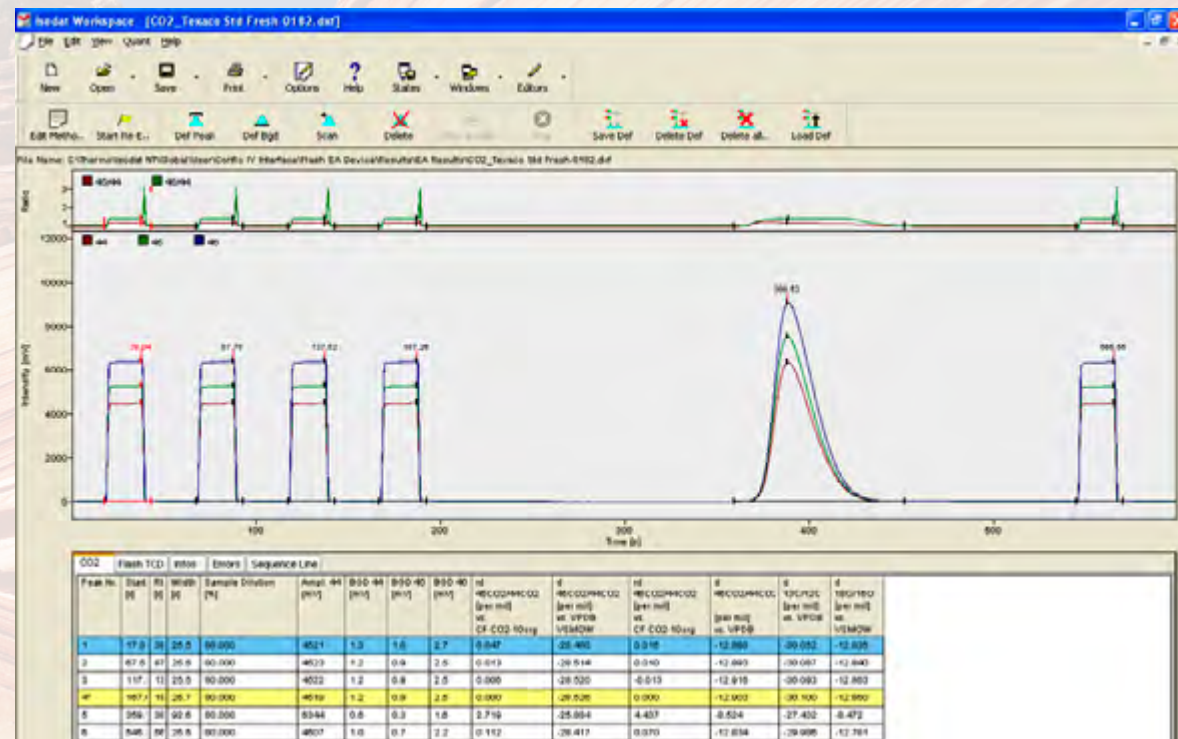
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PURE LIQUID OIL

Chromatogram of Pure liquid oil (0.25 mg)



Thanks to Lu, Feng, Aramco Oil Company, Saudi Aramco, Dhahra, SA, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.

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Nitrogen, Carbon and Sulfur isotope determination

RIVER SEDIMENT

Information

The Thermo Scientific FlashEA 1112 and the Thermo Scientific ConFlo IV were connected through the smartEA option.

The IRMS system used was a Thermo Scientific DELTA V Plus with a universal triple collector.

For the simultaneous NCS determination, the Pre-packed Reactor (p/n 468 02005) was used.

Tubing in the Thermo Scientific FlashEA 1112 and the connection to the Thermo Scientific ConFlo IV interface is made of 1/16" Sulfinert capillary.

Thermo Scientific FlashEA 1112 parameters

Reactor Temperature 1020°C	Thermo Scientific MAS 200R Autosampler	
Helium Carrier Flow 80 ml/min		
Analysis Time 320 sec		
Oven Temperature 70°C		

NCS isotope ratio data

Sample	Amount (mg)	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	$\delta^{34}\text{S}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) S.D.	Mean $\delta^{13}\text{C}$ (‰) S.D.	Mean $\delta^{34}\text{S}$ (‰) S.D.	C/S ratio
River Sediment	5.173	6.00	-22.75	-22.65	6.37 0.33	-22.57 0.17	-22.30 0.38	7.3
	5.327	6.65	-22.42	-21.89				
	5.304	6.46	-22.52	-22.36				

Note

For more information see Thermo Scientific Application Note 30194.

(Simultaneous N, C and S Isotope Ratio Determination on a DELTA V Isotope Ratio MS using a Flash Elemental Analyzer).



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Nitrogen and carbon isotope determination

SEDIMENT

Thermo Scientific FLASH 2000 HT parameters

Combustion Temperature 950°C	Oven Temperature 50°C	GC column PP-QS, 4 m
Helium Pressure (kPa) 180	Helium Carrier Flow 90 ml/min	Helium Reference Flow 200 ml/min
Oxygen Pressure (kPa) 300	Oxygen Flow 250 ml/min	Oxygen Injection Time 3 sec
Sampling Delay 18 sec	Analysis Time 500 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV conditions
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 3.0 Software Suite with SP 082
- Dynamic dilution
- SmartEA

Sample information

Standard: Soil Reference Material
 Standard weight: 2 - 4 mg
 Sample weight: 1.0 - 5 mg

Sample pretreatment

$\delta^{13}\text{C}$ organic carbon was determined after treating the samples with HCl 2N to remove inorganic carbon, rinsed with MilliQ water and dried.

 ^{15}N and ^{13}C data

Sample	$\delta_{13}\text{C}$ (‰) (n=2)	Std. Dev. (‰)	$\delta^{15}\text{N}$ (‰) (n=2)	Std. Dev. (‰)
Sediment 1	-25.35	0.05	9.09	0.04
Sediment 2	-25.22	0.02	8.82	0.07

Thanks to Imma Tolosa, International Atomic Energy Agency - Environment Laboratories, Principality of Monaco.



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Nitrogen, Carbon and Sulfur isotope determination

SOIL

Information

The Thermo Scientific FlashEA 1112 and the Thermo Scientific ConFlo IV were connected through the smartEA option. The IRMS system used was a Thermo Scientific DELTA V Plus with a universal triple collector. For the simultaneous NCS determination, the Pre-packed Reactor (p/n 468 02005) was used. Tubing in the Thermo Scientific FlashEA 1112 and the connection to the Thermo Scientific ConFlo IV interface is made of 1/16" Sulfinert capillary.

Thermo Scientific FlashEA 1112 parameters		
ReactorTemperature 1020°C	Thermo Scientific MAS 200R Autosampler	
Oven Temperature 70°C		
Helium Carrier Flow 80 ml/min		
Analysis Time 320 sec		

NCS isotope ratio data

Amount (mg)	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	$\delta^{34}\text{S}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) S.D.	Mean $\delta^{13}\text{C}$ (‰) S.D.	Mean $\delta^{34}\text{S}$ (‰) S.D.	C/S ratio
95.540	7.01	-23.61	3.73	7.00 0.05	-23.62 0.05	4.00 0.25	67.0
100.979	7.05	-23.67	4.23				
103.211	6.95	-23.57	4.04				

Note

For more information see Thermo Scientific Application Note 30194. (Simultaneous N, C and S Isotope Ratio Determination on a DELTA V Isotope Ratio MS using a Flash Elemental Analyzer).



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Nitrogen and Carbon isotope determination

SOIL

Thermo Scientific FlashEA 1112 IRMS parameters		
CombustionTemperature 900°C	Reduction Temperature 680°C	Oven Temperature 45°C
Helium Pressure (kPa) 200	Helium Carrier Flow 120 ml/min	Helium Reference Flow 150 ml/min
Oxygen Pressure (kPa) 400	Oxygen Flow 250 ml/min	Oxygen Injection Time 5 sec
Sampling Delay 15 sec	Analysis Time 320 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV conditions: N₂ 3 bar, He 1 bar, CO₂ 3bar
- Thermo Scientific DELTA V V Plus
- Thermo Scientific ISODAT 3.0

Sample information

Standard:	Casein
Standard weight:	0.5 mg
Sample weight:	1.0 - 5 mg

NC isotope data

Amount (mg)	δ ¹⁵ N (‰)	δ ¹³ C (‰)	Mean δ ¹⁵ N (‰)	Mean δ ¹³ C (‰)
5.11	8.89	-24.77	8.82	-24.65
5.02	8.74	-24.53		
103.211	6.95	-23.57		

Thanks to Federica Camin and Luca Ziller, Fondazione Edmund Mach, CRI-DQAN, San Michele all'Adige, (TN), Italy.



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Inorganic Carbon isotope determination

SOIL

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 1050°C	Single reactor	Oven Temperature 50°C
Helium Pressure (kPa) 200	Helium Carrier Flow 140 ml/min	Helium Reference Flow 140 ml/min
Oxygen Pressure (kPa) 200	Oxygen Flow 250 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 12 sec	Analysis Time 400 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 0.8 bar Helium, 1 bar CO₂
- Thermo Scientific DELTA Plus XP
- Thermo Scientific ISODAT 2.0

Sample information

Standard: 0.06 - 0.08 mg ANU-Sucrose (NIST-RM 8542)
0.01 - 0.02 mg Graphite (internal Reference Material)
0.03 - 0.05 mg Polyethylene foil (RM 8540)

iStandard weight: 0.4 - 0.7 mg (for soil with TOC >2%), 2 - 3 mg (for soil with TOC <1%)

Sample weight: Leaching with HCl to remove the carbonate

Carbon isotope data of a de-carbonated soil sample

δ ¹³ C (‰) (VPDB)	Std. Dev.
24.49	0.04
-24.44	

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.

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Total Nitrogen isotope determination

SOIL

Thermo Scientific FLASH 2000 HT parameters

Furnace Temperature 1050°C	Single reactor	Oven Temperature 50°C
Helium Pressure (kPa) 200	Helium Carrier Flow 140 ml/min	Helium Reference Flow 140 ml/min
Oxygen Pressure (kPa) 200	Oxygen Flow 250 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 12 sec	Analysis Time 350 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 0.7 bar Helium, 1 bar CO₂
- Thermo Scientific DELTA Plus XP2
- Thermo Scientific ISODAT 2.02

Sample information

Standard: 0.8 - 1.0 mg L-Glutamic acid (USGS-40)
 0.6 - 0.8 mg NH₄Cl
 0.7 - 0.9 mg KNO₃
 Sample weight: 10 - 12 mg (for soil with N >0.5%)

Nitrogen isotope data of ornithogenic soil sample

$\delta^{15}\text{N}$ (‰) (AIR)	Std. Dev.
18.1	0.1
18.3	

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.



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Nitrogen and Carbon isotope determination

SOIL

Thermo Scientific FlashEA 1112 HT parameters		
Combustion Temperature 1020°C	Oven Temperature 45°C	Helium Reference Flow 250 ml/min
Helium Pressure (kPa) 120	Helium Carrier Flow 95 ml/min	Oxygen Injection Time 14 sec
Oxygen Pressure (kPa) 300	Oxygen Flow 240 ml/min	Thermo Scientific MAS 200R Autosampler
Sampling Delay 14 sec	Analysis Time 380 sec	

IRMS information

- Thermo Scientific ConFlo III conditions: Helium pressure 0.9 bar, CO₂ pressure 1 bar, N₂ pressure 2 bar
- Thermo Scientific DELTA V Advantage

Sample information

Standard: Atropine, IAEA N1, IAEA N2, IAEA 305 A & B
IAEA 311, NBS 22, IAEA CH6, IAEA 309

Standard weight: 1.0 mg

Sample weight: 25 - 30 mg

NC data of soil sample

Element	N %	δ ¹⁵ N (‰)	C %	δ ¹³ C (‰)
Data	1.26	13.31	11.50	-26.43
	1.27	13.32	11.49	-26.54
	1.28	13.35	11.50	-26.47
	1.28	13.39	11.63	-26.55
	1.28	13.36	11.63	-26.52
	1.28	13.36	11.63	-26.50
Average	1.28	13.35	11.56	-26.50
Std. Dev.	0.01	0.03	0.07	0.05

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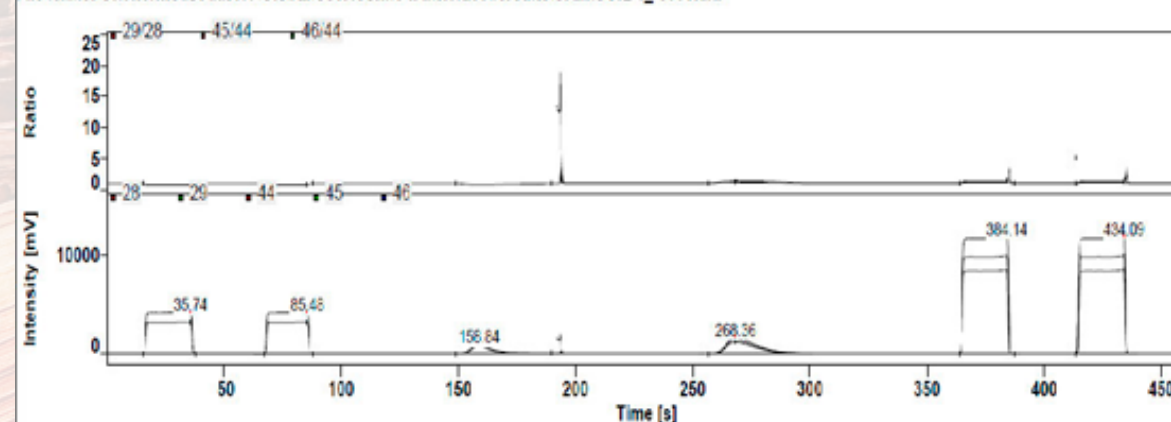
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Nitrogen and Carbon isotope determination

SOIL

NC chromatogram

File Name: C:\Thermo\Isodat NT\Global\User\Confio II Interface\Results\UAM\SOIL 1_-0038.dxf



Thanks to Redondo Ortega, Vanesa Peiró Hernández y Francisco José Caballero Castrejón, Laboratorio de Isótopos Estables, Universidad Autónoma de Madrid, Madrid, Spain.



Analytical - EA-IRMS

Geology and Geoscience

- Coals
- Kerogen
- Lubricant Oil
- Marble
- Minerals
- Mineral Oil
- Natural Water
- Oil (NBS-22)
- Pure liquid Oil
- River Sediment
- Sediment
- Soil
- Tap Water
- Water Reference

Nitrogen and carbon isotope determination

SOIL

Thermo Scientific FLASH 2000 HT parameters		
Combustion Temperature 950°C	Oven Temperature 50°C	GC column PP-QS, 4 m
Helium Pressure (kPa) 180	Helium Carrier Flow 90 ml/min	Helium Reference Flow 200 ml/min
Oxygen Pressure (kPa) 300	Oxygen Flow 250 ml/min	Oxygen Injection Time 3 sec
Sampling Delay 18 sec	Analysis Time 500 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV dynamic conditions
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 3.0 Software Suite with SP 082
- SmartEA

Sample information

Standard:	Soil Reference Material
Standard weight:	2 - 4 mg
Sample weight:	1.0 - 5 mg

Sample pretreatment

$\delta^{13}\text{C}$ organic carbon was determined after treating the samples with HCl 2N to remove inorganic carbon, rinsed with Milli-Q water and dried.

NC data of the Soil Reference Material

Theoretical values				Experimental data			
$\delta^{13}\text{C}$ (‰)	Uncert (‰)	$\delta^{15}\text{N}$ (‰)	Uncert (‰)	$\delta^{13}\text{C}$ (‰) n=14	Std. Dev. (‰)	$\delta^{15}\text{N}$ (‰) n=4	Std. Dev. (‰)
-25.35	-25.35	-25.35	-25.35	-25.35	-25.35	-25.35	-25.35
-25.22	-25.22	-25.22	-25.22	-25.22	-25.22	-25.22	-25.22

Thanks to Imma Tolosa, International Atomic Energy Agency - Environment Laboratories, Principality of Monaco.



Analytical - EA-IRMS

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Nitrogen and Carbon isotope determination

SOIL

Thermo Scientific FLASH 2000 IRMS parameters		
Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 40°C
Helium Pressure (kPa) 100	Helium Carrier Flow 300 ml/min	Helium Reference Flow 250 ml/min
Oxygen Pressure (kPa) 300	Oxygen Flow 250 ml/min	Oxygen Injection Time 4 sec
Sampling Delay 21 sec	Analysis Time 50 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III conditions: CO₂ / N₂ 1 bar
- Thermo Scientific DELTA V Advantage IRMS
- Thermo Scientific ISODAT 2.5 Software Suite

Sample information

Standard: Acetanilide
Standard weight: 0.27 - 0.30 mg
Sample weight: 1.0 mg

NC isotope data

Amount (mg)	δ ¹⁵ N (‰)	δ ¹³ C (‰)	Mean δ ¹⁵ N (‰) Std. Dev.	Mean δ ¹³ C (‰) Std. dev.
0.927	3.236	-11.571	3.993 0.708	-9.136 2.698
1.049	4.102	-9.600		
1.211	4.640	-6.236		

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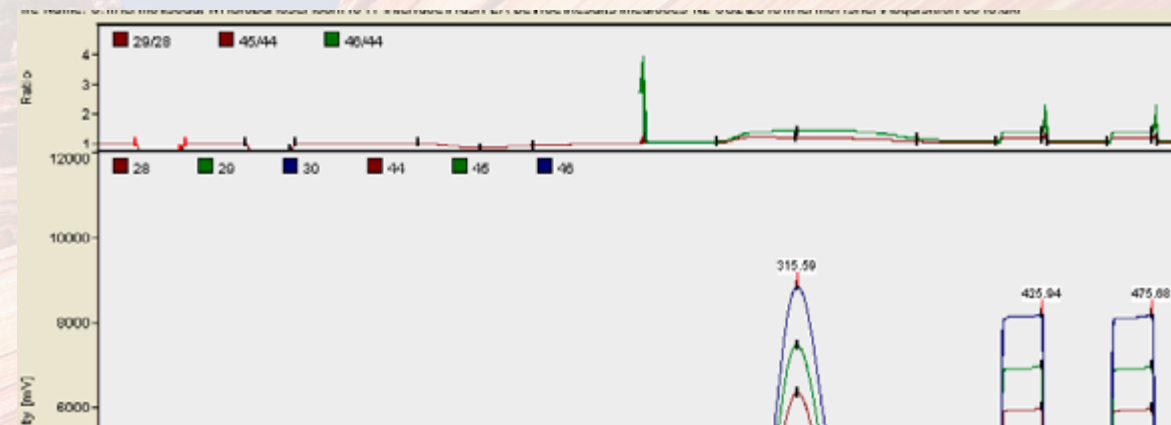
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Nitrogen and carbon isotope determination

SOIL

Chromatogram of soil sample



Thanks to Cristina Grela Docal, IMAR - CMA, Dept. of Life Sciences, University of Coimbra, Coimbra, Portugal.

Analytical - EA-IRMS

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Nitrogen and Carbon isotope determination

SOIL

FLASH 2000 IRMS Parameters		
Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 45°C
Helium Pressure (kPa) 250	Helium Carrier Flow 90 ml/min	Reference Flow 200 ml/min
Oxygen Pressure (kPa) 250	Oxygen Flow 180 ml/min	Oxygen Injection Time 3 sec
Sampling Delay 23 sec	Analysis Time 450 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV: 2 bar CO₂ / N₂ , 30 % dilution for C
- Thermo Scientific DELTA V Advantage
- Thermo Scientific ISODAT 3.0

Sample information

Standard: L-glutamic acid USGS40
Standard weight: 400 µg
Sample weight: 3050 µg for C determination, 20000 µg for N determination

Sample pre-treatment

Soil sample was acidified with HCl for decarbonation.

NC isotope data

Element	Weight (ug)	δ ¹⁵ N/ ¹⁴ N (‰)	δ ¹³ C/ ¹² C (‰)	mean δ ¹⁵ N (‰) S.D.	mean δ ¹³ C (‰) S.D.
C	3059		-26.153		-26.180 0.034
	3072		-26.169		
	3059		-26.218		
N	19991	7.779		7.730 0.134	
	19750	7.579			
	19994	7.833			

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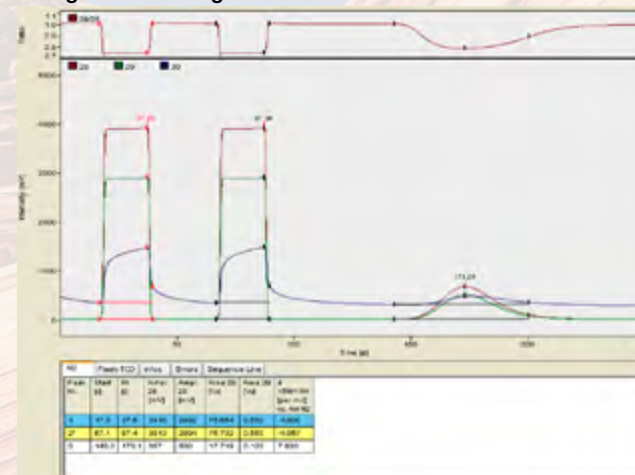
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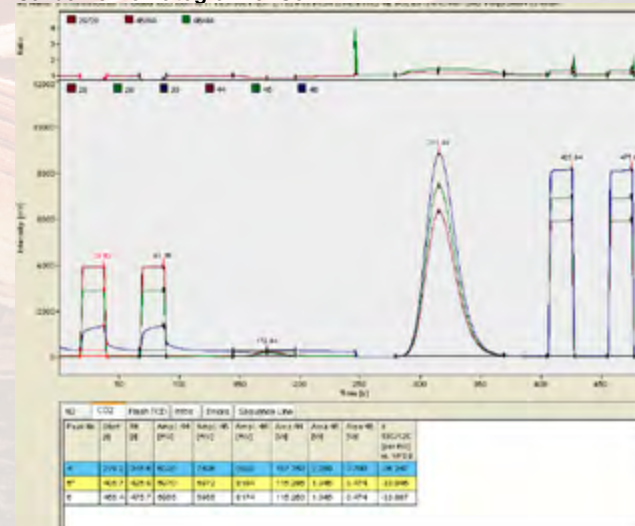
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SOIL

Nitrogen Chromatogram of soil



Carbon chromatogram of Soil



Thanks to Sofia Goncalves, CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, Porto, Portugal, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Hydrogen and oxygen isotope determination

TAP WATER

Thermo Scientific FLASH 2000 HT and Thermo Scientific AS 3000 Liquid Autosampler parameters

Settings for H and O determination	Thermo Scientific AS 3000 Autosampler Settings
Reactor Temperature 1415°C	Injection volume 1 µl
Oven Temperature 72°C	Plunger strokes 3
Helium Carrier Flow 125 ml/min	Rinses 0
Helium Reference Flow 60 ml/min	Injection Depth Standard
Thermo Scientific AS 3000 Liquid Autosampler	Pre-Injection dwell Time 1 sec
Syringe size 0.5 µl	Post-Injection dwell Time 16 sec

IRMS information

- Thermo Scientific ConFlo III
- Thermo Scientific DELTA V Plus IRMS
- Thermo Scientific ISODAT 3.0 Software Suite

Standard information

The following IAEA Water Reference Materials were used for the isotope analysis:

- GISP (Greenland Ice Sheet Precipitation): prepared by the University of Copenhagen from a sample of Greenland snow
- VSMOW2 (Vienna Standard Mean Ocean Water 2)
- SLAP2 (Standard Light Antarctic Precipitation 2)

Hydrogen and oxygen isotope data of tap water

Isotope element	$\delta^2\text{H}$ (‰)	$\delta^{18}\text{O}$ (‰)
Data	-42.465	-42.465
	-41.399	-41.399
	-41.316	-41.316
	-40.106	-40.106
Mean values	-41.322	-41.322
Std.Dev.	0.965	0.965



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Hydrogen and oxygen isotope determination

WATER REFERENCE MATERIALS

Thermo Scientific FLASH 2000 HT and Thermo Scientific AS 3000 Liquid Autosampler parameters	
Settings for H and O determination	Thermo Scientific AS 3000 Autosampler Settings
Reactor Temperature 1415°C	Injection volume 1 µl
Oven Temperature 72°C	Plunger strokes 3
Helium Carrier Flow 125 ml/min	Rinses 0
Helium Reference Flow 60 ml/min	Injection Depth Standard
Thermo Scientific AS 3000 Liquid Autosampler	Pre-Injection dwell Time 1 sec
Syringe size 0.5 µl	Post-Injection dwell Time 16 sec

Reference Materials information

The following IAEA Water Reference Materials were analyzed:

- GISP (Greenland Ice Sheet Precipitation): prepared by the University of Copenhagen, Denmark, from a sample of Greenland snow.
- VSMOW2 (Vienna Standard Mean Ocean Water 2).
- SLAP2 (Standard Light Antactic Precipitation 2).

Certified values

Sample	GISP		VSMOW2		SLAP2	
Isotope element	δ ² H (‰)	δ ¹⁸ O (‰)	δ ² H (‰)	δ ¹⁸ O (‰)	δ ² H (‰)	δ ¹⁸ O (‰)
Value	-189.5	-189.5	0	0	-427.5	-55.50
Std. Dev.	1.2	1.2	0.3	0.02	0.3	0.02



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Hydrogen and oxygen isotope determination

WATER REFERENCE MATERIALS

IRMS information

- Thermo Scientific DELTA V Plus IRMS
- Thermo Scientific ISODAT 3.0 Software Suite

Hydrogen and oxygen isotope data of IAEA Water Reference Materials

Sample	GISP		VSMOW2		SLAP2	
Isotope element	$\delta^2\text{H}$ (‰)	$\delta^{18}\text{O}$ (‰)	$\delta^2\text{H}$ (‰)	$\delta^{18}\text{O}$ (‰)	$\delta^2\text{H}$ (‰)	$\delta^{18}\text{O}$ (‰)
Value	-186.954	-24.667	-0.291	-0.038	-422.132	-55.355
	-186.373	-24.745	0.308	-0.056	-422.353	-55.416
	-187.085	-24.754	-0.016	-0.016	-424.450	-55.890
	-186.620	-24.838	-0.111	0.134	-422.672	-55.517
Mean value	-186.758	-24.751	-0.028	0.006	-422.902	-55.545
Std. Dev.	0.323	0.070	0.251	0.087	1.056	0.240

Thanks to Pietro Mainolfi, ARPA Campania, Salerno, Italy.



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- Caffeine
- Canyon (FeS)
- Graphite
- Sphalertie (NBS122 and NBS123)
- Urea

Nitrogen isotope determination

AMMONIUM SULPHATE (INORGANIC STANDARD)

IRMS information

- Thermo Scientific ConFlo II: the dilution factor for CO₂ was set to about 1:202
- Thermo Scientific DELTA C₂
- Single element mode and Dual element mode

Sample information

Weight: 50 - 90 µg

Comments

The ammonium sulphate was analyzed as it is and dissolved in distilled water (10 mg in 1 ml water).
The water solution was analyzed as it is and also after the addition of glucose.

Ammonium Sulphate - ¹⁵N isotope determinations

No.	Sample (mg)	N (mg)	Conc. N %	δ ¹⁵ N (‰)
1	0.236	0.050	20.850	2.48
2	0.425	0.090	21.630	2.53
3	0.433	0.092	21.180	2.69
4	0.346	0.073	21.180	2.54
5	0.233	0.049	20.970	2.52
6	0.271	0.057	21.180	2.56
Mean			21.17	2.55
Std. dev.			0.243	0.066



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- Sphalertie (NBS122 and NBS123)
- Urea

Nitrogen isotope determination

AMMONIUM SULPHATE (INORGANIC STANDARD)

Solution of 1 ml water with 10 mg Ammonium Sulphate - ^{15}N isotope determinations

No.	Sample (mg)	N (mg)	Conc. N %	$\delta^{15}\text{N}$ (‰)
1	0.050	0.011		2.56
2	0.050	0.011	21.760	2.86
3	0.050	0.011	21.260	2.50
4	0.050	0.011	22.100	2.54
5	0.050	0.011	21.880	2.28
6	0.050	0.011	22.100	2.57
7	0.050	0.011	21.730	2.74
Mean			21.81	2.58
Std. dev.			0.284	0.170

Solution of 1 ml water with 10 mg Ammonium Sulphate and 212 mg Glucose

No.	Sample (mg)	N (mg)	Conc. N %	$\delta^{15}\text{N}$ (‰)	N (mg)	N (mg)
1	1.332	1.000	39.860	39.920	2.64	-11.18
2	1.332	1.040	41.590	39.890	2.80	-11.23
3	1.332	1.030	41.540	40.240	2.28	-10.95
4	1.332	1.040	40.660	39.180	2.50	-11.08
5	1.332	1.030	40.880	39.640	2.43	-11.16
6	1.332	1.060	42.130	39.860	2.46	-10.88
7	1.070	1.070	43.240	40.260	2.37	-11.18
Mean		1.04	41.41	39.86	2.50	-11.09
Std. dev.		0.021	1.012	0.342	0.161	0.122

Note

For more information see Thermo Scientific Application report No. G 17.



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- Urea

Nitrogen isotope determination

AMMONIUM SULPHATE (INORGANIC STANDARD)

Thermo Scientific FLASH 2000 IRMS parameters

Reactor Temperature 1020°C	Helium Carrier Flow 100 ml/min	Reference Flow 100 ml/min
Helium Pressure (kPa) 290	Oxygen Flow 250 ml/min	Oxygen Injection Time 3 sec
Oxygen Pressure (kPa) 260	Analysis Time 500 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 208 sec	Oven Temperature 50°C	

IRMS information

- Thermo Scientific ConFlo IV conditions: for Urea, Sucrose, Marble and Ammonium Sulphate no dilution was used.
- Thermo Scientific DELTA Advantage
- Thermo Scientific ISODAT 3.0

Standard information

Standard:

Standard weight:

Urea, Sucrose, Ammonium sulphate, Carrara Marble

0.15 mg Urea,

0.80 - 0.12 mg Sucrose,

0.28 mg Ammonium Sulphate,

0.25 mg Carrara Marble

Sample weight:

0.27 - 0.30 mg

Nitrogen isotope ratio data

Sample	Weight (mg)	$\delta^{15}\text{N}$ (‰)	mean $\delta^{15}\text{N}$ (‰) S.D
Ammonium sulphate	0.30	20.34	20.28 0.07
	0.27	20.29	
	0.27	20.21	



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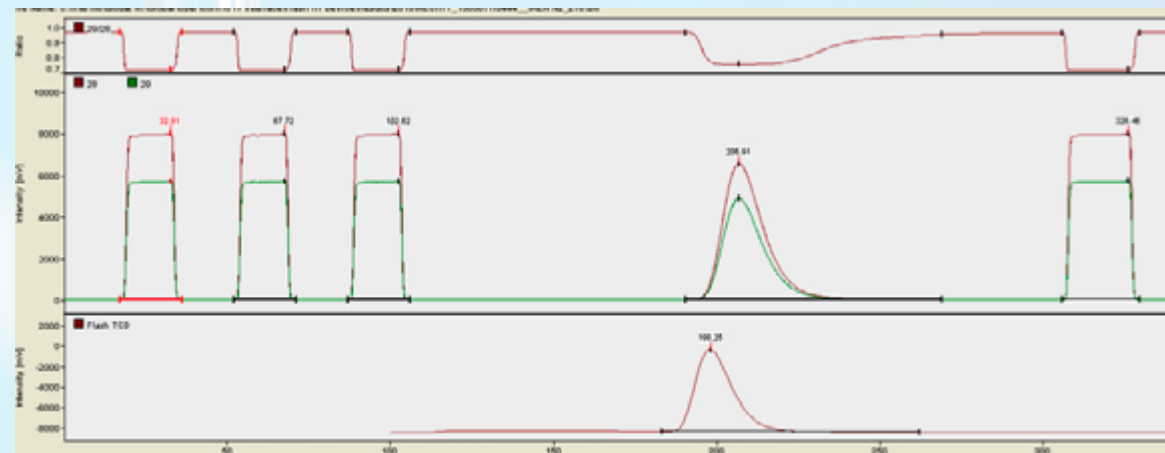
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Nitrogen isotope determination

AMMONIUM SULPHATE (INORGANIC STANDARD)

Chromatogram of Ammonium Sulphate (0.27 mg)



Thanks to Mgr. Zuzana Grolmusová, PhD, Department of special laboratories, State Geological Institute of Dionyz Stur, Mlynska dolina 1, 817 04 Bratislava, e-mail: zuzana.grolmusova@geology.sk, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.



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Nitrogen and Carbon isotope determination

ASPARTIC ACID

Thermo Scientific FLASH 2000 IRMS parameters

Reactor Temperature 1020°C	Helium Carrier Flow 100 ml/min	Reference Flow 100 ml/min
Helium Pressure (kPa) 290	Oxygen Flow 250 ml/min	Oxygen Injection Time 3 sec
Oxygen Pressure (kPa) 260	Analysis Time 500 sec	Thermo Scientific MAS 200R Autosampler
Sampling Delay 208 sec	Oven Temperature 50°C	

IRMS information

- Thermo Scientific ConFlo IV conditions: for Aspartic acid 0% dilution for N₂ and 80 % dilution for CO₂ while for Urea, Sucrose, Marble and Ammonium Sulphate no dilution was used.
- Thermo Scientific DELTA V Advantage
- Thermo Scientific ISODAT 3.0

Standard information

Standard:

Urea, Sucrose, Ammonium Sulphate, Carrara Marble

Standard weight:

0.15 mg Urea,
0.80 - 0.12 mg Sucrose,
0.28 mg Ammonium Sulphate,
0.25 mg Carrara Marble
0.40 mg

Sample weight:

NC isotope ratio data

Sample	Weight (mg)	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)	mean $\delta^{15}\text{N}$ (‰) S.D	mean $\delta^{13}\text{C}$ (‰) S.D
Ammonium sulphate	0.43	1.05	-24.76	1.00 0.05	-24.76 0.01
	0.41	0.99	-24.77		
	0.41	0.95	-24.75		



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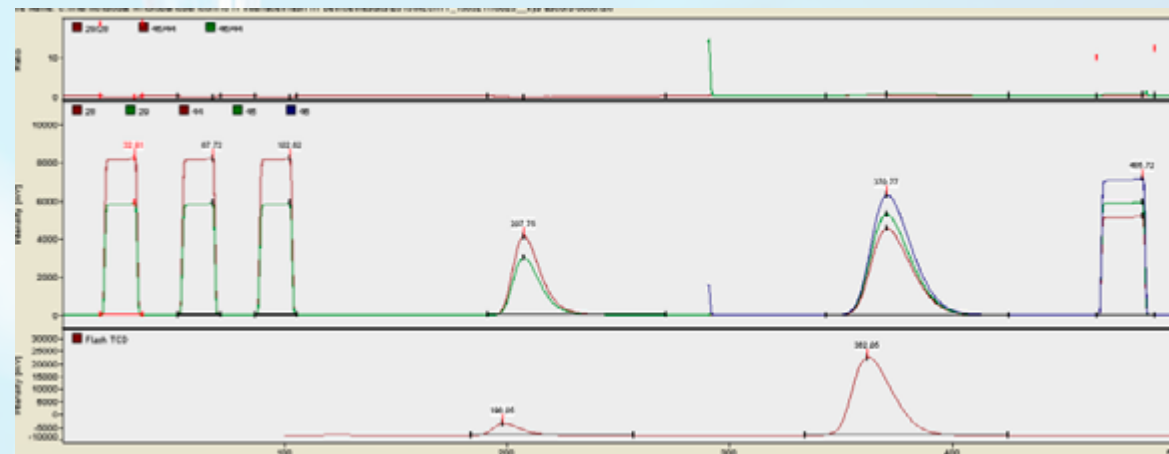
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Nitrogen and Carbon isotope determination

ASPARTIC ACID

Chromatogram of Aspartic acid (0.41 mg)



Thanks to Mgr. Zuzana Grolmusová, PhD, Department of special laboratories, State Geological Institute of Dionyz Stur, Mlynska dolina 1, 817 04 Bratislava, e-mail: zuzana.grolmusova@geology.sk, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific



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Sulfur isotope determination

BARIUM SULPHATE

Thermo Scientific EA 1108 parameters		
Combustion Temperature 1030°C	Oven Temperature 60°C	
Helium Pressure (kPa) 60	Helium Carrier Flow 90 ml/min	
Oxygen Pressure (kPa) 70	Analysis Time 800 sec	
Sampling Delay 15 sec	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo III conditions: Helium pressure 0.95 bar; reference SO₂ at 0.5 bar
- Thermo Scientific DELTA Plus XP
- Thermo Scientific ISODAT NT 2.0

Standard information

Standard:	NBS 127, IAEA SO 5, IAEA SO 6
Standard weight:	0.55 mg
Sample weight:	0.55 mg

Sulfur data of Barium Sulphate

Average of $\delta^{34}\text{S}$ Sulfur of 10 determinations:	12.014 ‰
Std. Dev.:	0.122



Thanks to Centros Científicos y Tecnológicos, Laboratorio de Isótopos Estables, Universidad de Barcelona, Barcelona, Spain.

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Sulfur isotope determination

BARIUM SULPHATE

Thermo Scientific EA 1108 parameters

Reactor Temperature 1400°C	Analysis Time 400 sec	
Helium Pressure (kPa) 300	Oven Temperature 90°C	
Sampling Delay 1 sec	Reference Flow 200 ml/min	
Helium Carrier Flow 100 ml/min	Thermo Scientific MAS 200R Autosampler	

IRMS information

- Thermo Scientific ConFlo IV conditions: vno dilution
- Thermo Scientific DELTA Advantage
- Thermo Scientific ISODAT 3.0

Standard information

Standard:
Sample weight:

NBS 127
0.5 mg

Nitrogen isotope ratio data

Run	$\delta^{18}\text{O}_{\text{VSMOW}}$
1	9,6
2	9,4
3	9,3
4	9,3
5	9,6
6	9,1
7	9,7
8	9,1
9	9,7
10	8,5
Average	9,3
Stdev	0,37



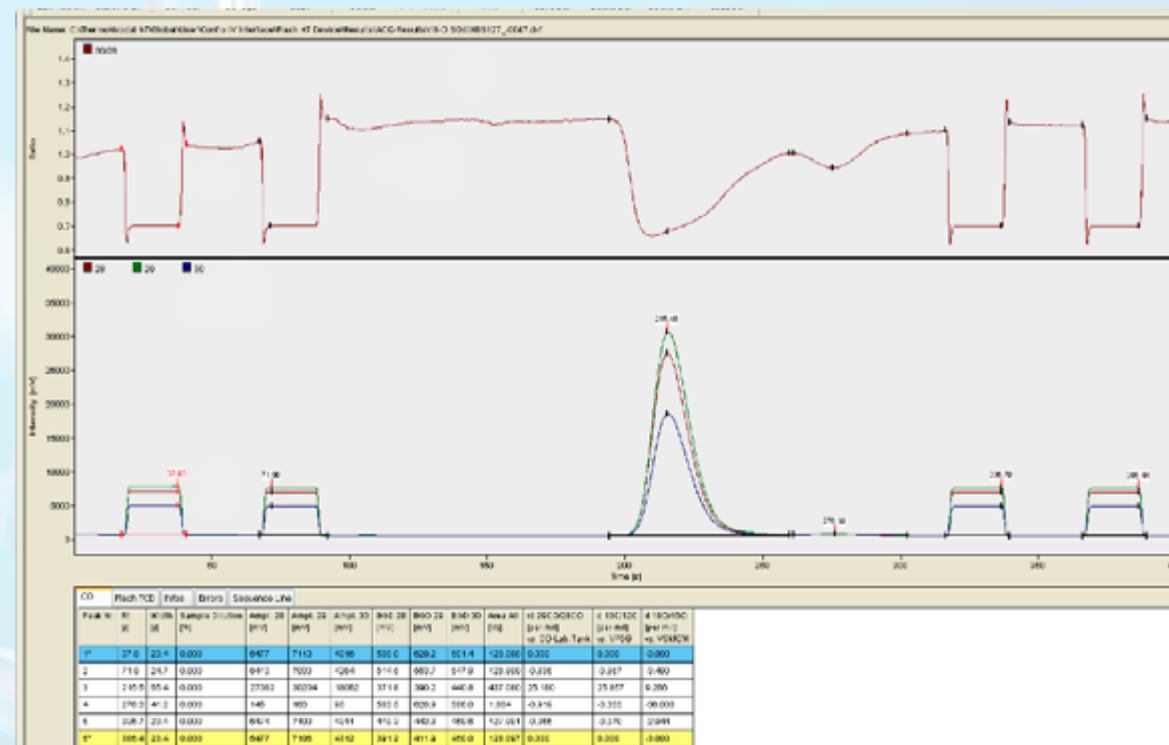
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BARIUM SULPHATE

$\delta^{18}\text{O}$ Chromatogram of barium sulphate



Thanks to Dr. Andre Voropaev, Hydroisotop GmbH, Woelkestr. 9, D-85301 Schweitenkirchen, HRB-Nr: 190354, USt.ID: ID-DE128953441, Tel: +49 8444 92890, AV@Hydroisotop.de, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.

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- Canyon (FeS)
- Graphite
- Sphalertie (NBS122 and NBS123)
- Urea

Sulfur isotope determination

BARIUM SULPHATE REFERENCE MATERIAL (NBS 127)

Sample information

NBS 127 is a Barium Sulphate Reference Material used for sulfur isotope analysis.

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 900°C	Single reactor	Oven Temperature 70°C
Helium Carrier Flow 180 ml/min	Helium Reference Flow 100 ml/min	Thermo Scientific MAS 200R Autosampler
Oxygen Flow 250 ml/min	Oxygen Injection Time 12 sec	
Sampling Delay 12 sec	Analysis Time 300 sec	

IRMS information

- Thermo Scientific ConFlo II
- Thermo Scientific DELTA V
- Dual Inlet System
- Thermo Scientific ISODAT 3.0

Sample weight

3 µg with the addition of 30 µg Vanadium Pentoxide (V_2O_5) (Oxygen donor) (p/n 338 37510)

Sulfur isotope data of Barium Sulphate Reference Material (NBS 127)

Theoretical value	Experimental value	
$\delta^{34}S$ (‰)	$\delta^{34}S$ (‰)	Std. Dev.
20.32	19.58	0.36
	20.01	
	20.30	

Note

Due to the complexity of the matrix, the Sulfur data are acceptable in a range $\pm 1.5\text{‰}$ *Thanks to Carla Martinenghi and Corrado Barbieri, ENI, San Donato Milanese (Milan), Italy.*

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- Urea

Nitrogen and Carbon isotope determination

CAFFEINE

FLASH 1112 IRMS Parameters

Combustion Temperature 1020°C	Reduction Temperature 650°C	Oven Temperature 65°C
Helium Pressure (kPa) 250	Helium Carrier Flow 100 ml/min	Reference Flow 200 ml/min
Oxygen Pressure (kPa) 250	Oxygen Flow 250 ml/min	Oxygen Injection Time 4 sec
Sampling Delay 12 sec	Analysis Time 600 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV: SmartEA; Auto-dilution, dynamic for both N₂ and CO₂ with a target intensity of 4000 mV
- Thermo Scientific DELTA Plus XP
- Thermo Scientific ISODAT 3.0 SP0.88

Sample information

Standard:

Caffeine in-house standard calibrated against USGS40, USGS41 and LSVEC

Weight:

0.80 mg

Nitrogen isotope ratio data

$\delta^{15}\text{N}$ (‰)	Mean $\delta^{15}\text{N}$ (‰) S.D.
-1.8	-1.9 0.11
-2.0	
-2.0	



Analytical - EA-IRMS

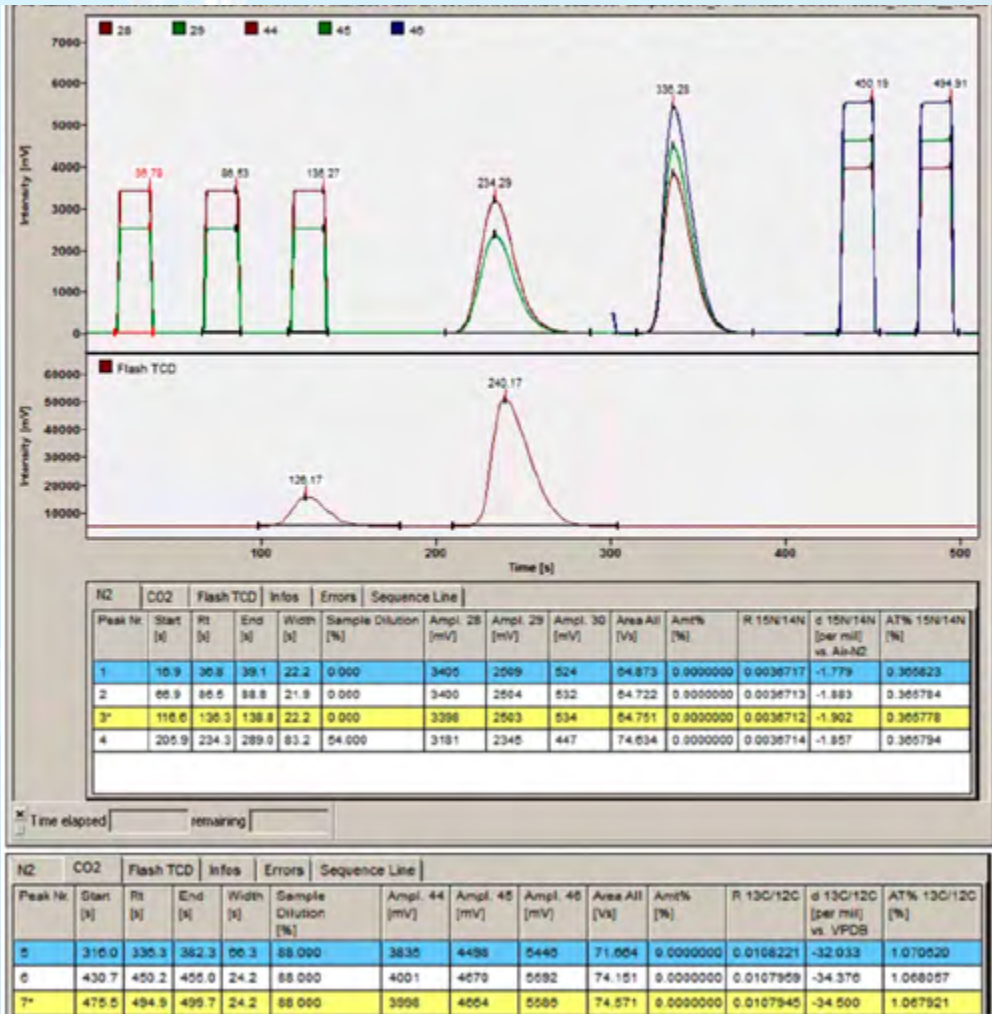
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Nitrogen and Carbon isotope determination

CAFFEINE

Chromatogram of Caffeine



Thanks to Victor Evrard, PhD, Lab Manager, Basel, Sustainable Land Use Group, Department of Environmental Sciences, University of Basel, Schönbeinstrasse 6, CH-4056 Basel, Switzerland, and Giovanni Calderone, Technical support specialist - Gas IRMS, Unity Lab Services, Part of Thermo Fisher Scientific.

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Carbon isotope determination

CANYON DIABLO REFERENCE MATERIAL

Sample information

The Trolite (FeS) from the Canyon Diablo meteorite is used as Reference Material for Sulfur isotope analysis

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 900°C	Single reactor	Oven Temperature 70°C
Helium Carrier Flow 180 ml/min	Helium Reference Flow 100 ml/min	Thermo Scientific MAS 200R Autosampler
Oxygen Flow 250 ml/min	Oxygen Injection Time 12 sec	
Sampling Delay 12 sec	Analysis Time 300 sec	

IRMS information

- Thermo Scientific ConFlo II
- Thermo Scientific DELTA V
- Dual Inlet System
- Thermo Scientific ISODAT 3.0

Sample weight

3 µg with the addition of 30 µg Vanadium Pentoxide (V_2O_5) (Oxygen donor) (p/n 338 37510)

Sulfur isotope data of Canyon Diablo Reference Material

Theoretical value	Experimental value	
$\delta^{34}S$ (‰)	$\delta^{34}S$ (‰)	Std. Dev.
13	13.67	0.068
	13.77	
	13.80	



Analytical - EA-IRMS

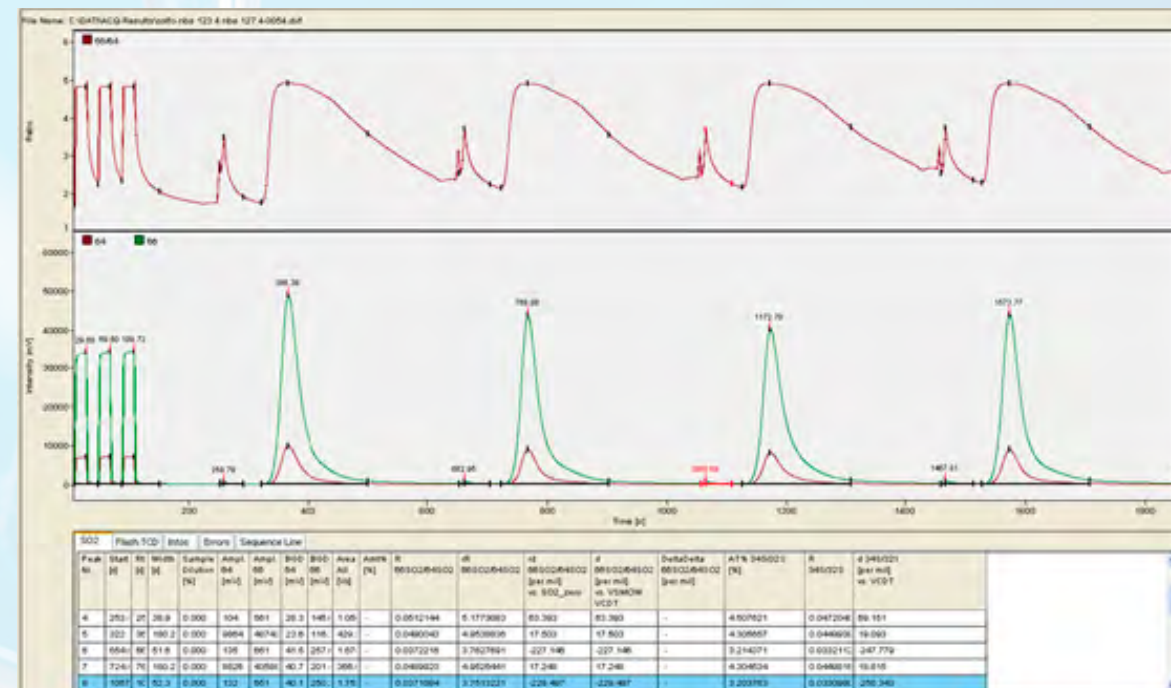
Pure Chemicals

- Ammonium Sulphate
- Aspartic Acid
- Barium Sulphate
- Barium Sulphate Reference (NBS127)
- Caffeine
- Canyon (FeS)
- Graphite
- Sphalerite (NBS122 and NBS123)
- Urea

Carbon isotope determination

CANYON DIABLO REFERENCE MATERIAL

Sulfur chromatogram of Canyon Diablo Reference Material



Thanks to Carla Martinenghi and Corrado Barbieri, ENI, San Donato Milanese (Milan), Italy.

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- Urea

Carbon isotope determination

GRAPHITE

Sample information

The sample is an internal Reference Material prepared by Geoscience and Earth Resources - CNR, Pisa, Italy.

Thermo Scientific FlashEA 1112 parameters

Furnace Temperature 1050°C	Single reactor	Oven Temperature 50°C
Helium Pressure (kPa) 200	Helium Carrier Flow 140 ml/min	Helium Reference Flow 140 ml/min
Oxygen Pressure (kPa) 200	Oxygen Flow 250 ml/min	Oxygen Injection Time 6 sec
Sampling Delay 12 sec	Analysis Time 400 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo III: 0.8 bar Helium, 1 bar CO₂
- Thermo Scientific DELTA Plus XP2
- Thermo Scientific ISODAT 2.02

Carbon isotope data of Graphite

Theoretical value	Theoretical value	Experimental value	
$\delta^{13}\text{C}$ (‰)	Std. Dev.	$\delta^{13}\text{C}$ (‰)	Std. Dev.
-29.05	± 0.07	-29.07	0.03
		-29.05	
		-29.02	

Thanks to Luigi Dallai, Ilaria Baneschi, Massimo Guidi and Chiara Boschi; Geoscience and Earth Resources - CNR, Pisa, Italy.



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Carbon isotope determination

GRAPHITE

Sample information

The sample is an internal Reference Material prepared by ENI, San Donato Milanese (Milan), Italy.

Thermo Scientific FlashEA 1112 parameters

Combustion Temperature 900°C	Reduction Temperature 640°C	Oven Temperature 45°C
Helium Carrier Flow 140 ml/min	Helium Reference Flow 100 ml/min	
Oxygen Flow 250 ml/min	Oxygen Injection Time 14 sec	
Sampling Delay 14 sec	Analysis Time 270 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo II
- Thermo Scientific DELTA XP
- Dual Inlet System
- Thermo Scientific ISODAT 3.0

Carbon isotope data of Graphite

Theoretical value	Experimental value	
$\delta^{13}\text{C}$ (‰)	$\delta^{13}\text{C}$ (‰)	Std. Dev.
-26.65	26.60	0.02
	-26.64	
	-26.61	



Analytical - EA-IRMS

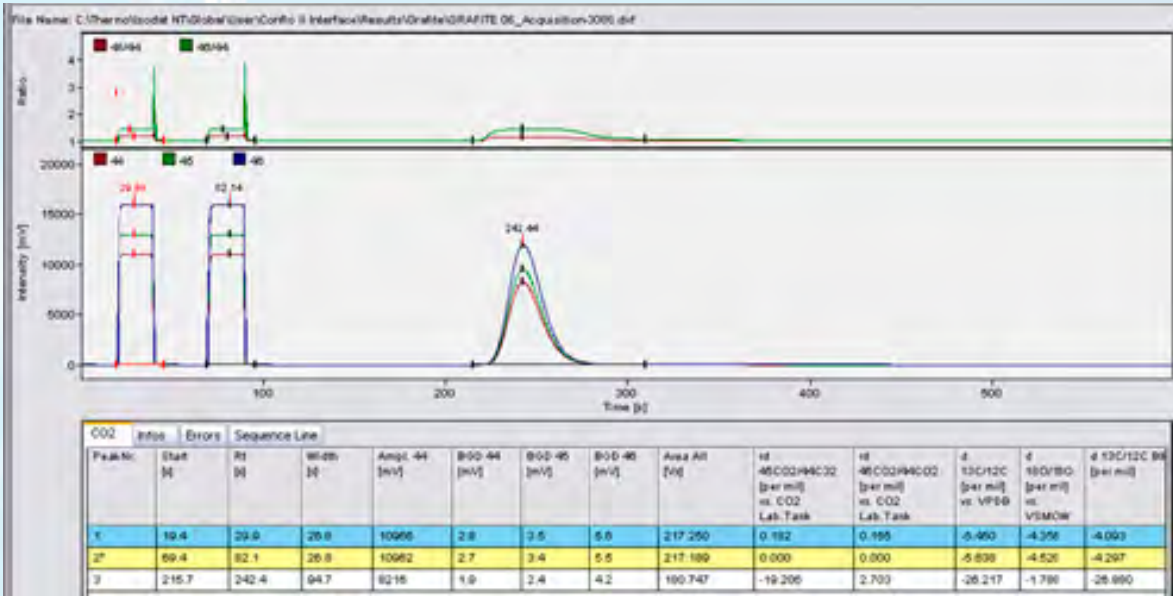
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Carbon isotope determination

GRAPHITE

Carbon chromatogram of Graphite sample



Thanks to Carla Martinenghi and Corrado Barbieri, ENI, San Donato Milanese (Milan), Italy.

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Sulfur isotope determination

SPHALERITE REFERENCE MATERIALS (NBS 122 AND NBS 123)

Sample information

NBS 122 and NBS 123 are Sphalerite Reference Materials used for sulfur isotope analysis.

Thermo Scientific FlashEA 1112 parameters		
Furnace Temperature 900°C	Single reactor	Oven Temperature 70°C
Helium Carrier Flow 180 ml/min	Helium Reference Flow 100 ml/min	
Oxygen Flow 250 ml/min	Oxygen Injection Time 12 sec	
Sampling Delay 12 sec	Analysis Time 300 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo II
- Thermo Scientific DELTA V
- Dual Inlet System
- Thermo Scientific ISODAT 3.0

Sample weight

3 µg with the addition of 30 µg Vanadium Pentoxide (V_2O_5) (Oxygen donor) (p/n 338 37510)

Sulfur isotope data of Sphalerite Reference Materials

Reference Material	Theoretical value	Experimental value	
	$\delta^{34}S$ (‰)	$\delta^{34}S$ (‰)	Std. Dev.
NBS 122	0.25	-0.94	0.25
		-0.45	
		-0.58	
NBS 123	17.09	18.82	0.04
		18.74	
		18.76	

Note

Due to the complexity of the matrix, the Sulfur data are acceptable in a range of $\pm 1.5\%$.

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Thanks to Carla Martinenghi and Corrado Barbieri, ENI, San Donato Milanese (Milan), Italy.

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Carbon isotope determination

UREA (ORGANIC STANDARD)

IRMS information

- Thermo Scientific ConFlo II
- Thermo Scientific DELTA S with dual inlet system
- Rapid single element mode

Sample information

Weight:

21 - 100 µg

Urea: Carbon data

Sample amount 100 µg Urea					Sample amount 43 µg Urea				
Analysis Time for each sample 90 sec					Analysis Time for each sample 90 sec				
Sample (mg)	C (mg)	Ion int. (v)	$\delta^{13}\text{C}$ (‰)	Conc C%	Sample (mg)	C (mg)	Ion int. (v)	$\delta^{13}\text{C}$ (‰)	Conc C%
0.10	0.02	2.185	-49.20	19.25	0.043	0.0086	1.112	-48.86	19.84
0.10	0.02	2.572	-49.35	18.81	0.043	0.0086	1.144	-48.87	19.81
0.10	0.02	2.575	-49.28	19.14	0.043	0.0086	1.134	-49.17	19.47
0.10	0.02	2.636	-49.34	19.12	0.043	0.0086	1.151	-49.33	19.76
0.10	0.02	2.644	-49.25	20.03	0.043	0.0086	1.123	-49.49	19.22
0.10	0.02	2.763	-49.18	19.40	0.043	0.0086	1.123	-49.31	18.98
0.10	0.02	2.691	-49.14	18.87	0.043	0.0086	1.167	-48.76	19.85
0.10	0.02	2.685	-49.16	19.35	0.043	0.0086	1.173	-49.30	20.13
0.10	0.02	2.721	-49.32	19.45	0.043	0.0086	1.161	-49.44	19.84
0.10	0.02	2.633	-49.11	18.73	0.043	0.0086	1.141	-48.96	19.33
Mean			-49.23	19.20	Mean			-49.15	19.57
Std.dev.			0.08	0.36	Std.dev.			0.25	0.34



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Carbon isotope determination

UREA (ORGANIC STANDARD)

Urea: Nitrogen data

Sample amount 43 µg Urea					Sample amount 21.5 µg Urea				
Analysis Time for each sample 66 sec					Analysis Time for each sample 66 sec				
Sample (mg)	N (mg)	Ion int. (v)	$\delta^{15}\text{N}$ (‰)	Conc N%	Sample (mg)	N (mg)	Ion int. (v)	$\delta^{15}\text{N}$ (‰)	Conc N%
0.043	0.02	1.480	-0.68	42.89	0.0215	0.010	1.343	-0.91	43.96
0.043	0.02	1.523	-0.88	44.45	0.0215	0.010	1.314	-0.61	43.48
0.043	0.02	1.470	-0.73	43.54	0.0215	0.010	1.347	-0.79	44.55
0.043	0.02	1.480	-0.77	43.38	0.0215	0.010	1.325	-0.65	43.73
0.043	0.02	1.400	-1.03	41.95	0.0215	0.010	1.344	-0.82	44.87
0.043	0.02	1.438	-0.78	42.38	0.0215	0.010	1.365	-0.64	45.31
0.043	0.02	1.427	-0.73	41.85	0.0215	0.010	1.375	-0.61	44.88
0.043	0.02	0.999	-0.77		0.0215	0.010	1.385	-0.72	45.35
0.043	0.02	1.484	-0.68	43.65	0.0215	0.010	1.365	-0.68	44.46
0.043	0.02	1.565	-1.00	45.54	0.0215	0.010	1.360	-1.13	45.19
Mean			-0.81	43.29	Mean			-0.76	44.58
Std.dev.			0.12	1.13	Std.dev.			0.16	0.63

Note

For more information see Thermo Scientific Application report No. G18



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Nitrogen and carbon isotope determination

UREA (ORGANIC STANDARD)

Thermo Scientific FLASH 2000 HT parameters

Combustion Temperature 1020°C	Oven Temperature 45°C	Helium Reference Flow 25 ml/min
Helium Pressure (kPa) 250	Helium Carrier Flow 90 ml/min	Oxygen Injection Time 1 sec
Oxygen Pressure (kPa) 250	Oxygen Flow 180 ml/min	Thermo Scientific MAS 200R Autosampler
Sampling Delay 22 sec	Analysis Time 450 sec	

IRMS information

- Thermo Scientific ConFlo IV conditions: dynamic dilution, for urea 0% dilution for N₂ and CO₂
- Thermo Scientific DELTA V Advantage IRMS2
- Thermo Scientific ISODAT 3.0 Software Suite2

Sample information

A urea water solution was prepared with 2 mg of urea dissolved in 20 ml water (solution 100 µg/µl). Then 4 µl of the solution was introduced into the tin container, when dry the capsule was closed and analyzed.

Carbon isotope data of Graphite

Isotope element	$\delta^{15}\text{N}$ (‰)	$\delta^{13}\text{C}$ (‰)
Value	-0.736	-6.145
	-0.725	-6.153
	-0.727	-6.169
	-0.794	-5.890
	-0.759	-6.203
	-0.746	-6.257
	-0.769	-6.231
	-0.766	-6.179
	-0.731	-6.201
	-0.793	-6.258
Std.Dev.	0.026	0.106



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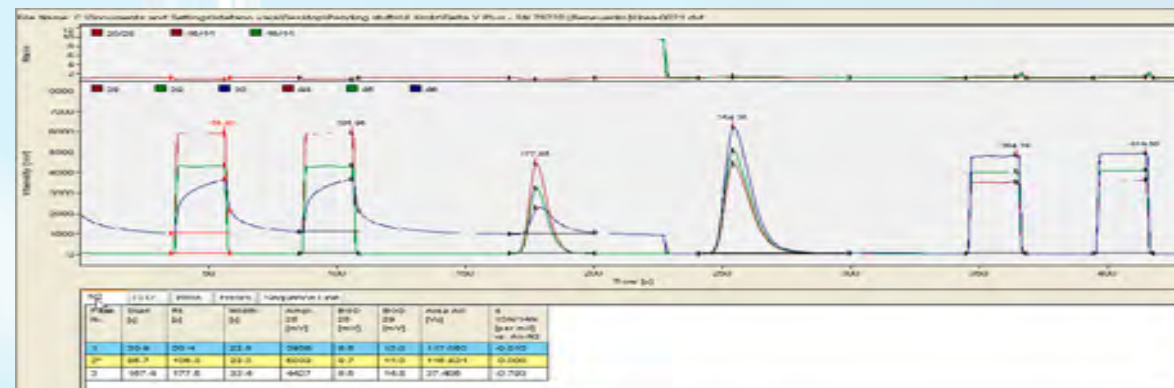
Pure Chemicals

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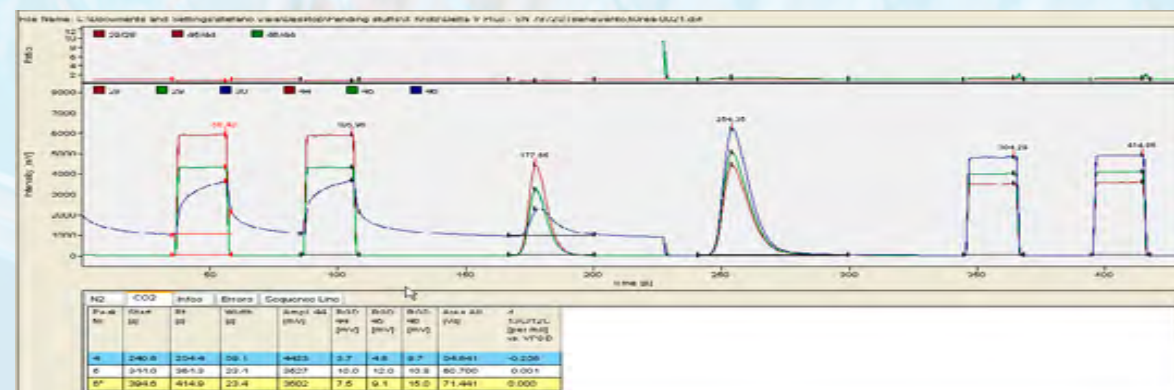
Nitrogen and carbon isotope determination

UREA (ORGANIC STANDARD)

Nitrogen chromatogram of Urea



Carbon chromatogram of Urea



Thanks to Stefano Vaia, Technical Support Specialist - Gas IRMS, Unity Lab Services, Thermo Fisher Scientific.



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Carbon isotope determination

UREA (ORGANIC STANDARD)

Thermo Scientific FLASH 2000 HT parameters

Combustion Temperature 1020°C	Oven Temperature 50°C	GC column PP-QS, 4 m
Helium Pressure (kPa) 250	Helium Carrier Flow 90 ml/min	Helium Reference Flow 250 ml/min
Oxygen Pressure (kPa) 250	Oxygen Flow 200 ml/min	Oxygen Injection Time 3 sec
Sampling Delay 18 sec	Analysis Time 500 sec	Thermo Scientific MAS 200R Autosampler

IRMS information

- Thermo Scientific ConFlo IV conditions: dynamic dilution, for urea 0% dilution for N₂ and CO₂
- Thermo Scientific DELTA V Advantage IRMS2
- Thermo Scientific ISODAT 3.0 Software Suite2

Sample information

Weight: 0.1 mg

Note

The standard deviation was less than 0.15



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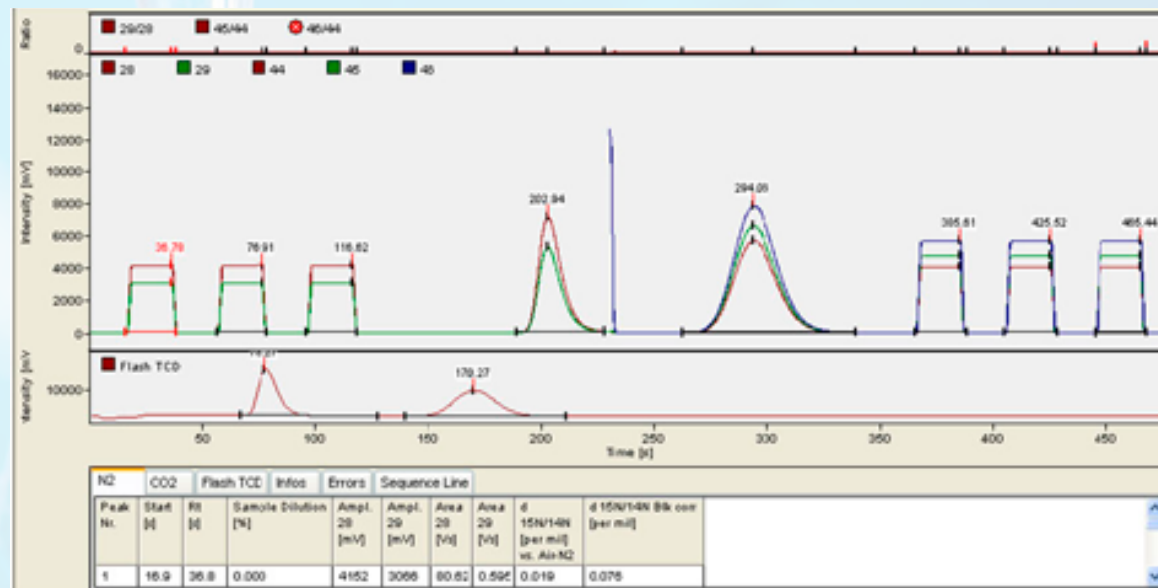
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UREA (ORGANIC STANDARD)

Nitrogen chromatogram of Urea



Thanks to Giovanni Calderone, Technical Support Specialist - Gas IRMS, Unity Lab Services, part of Thermo Fisher Scientific.



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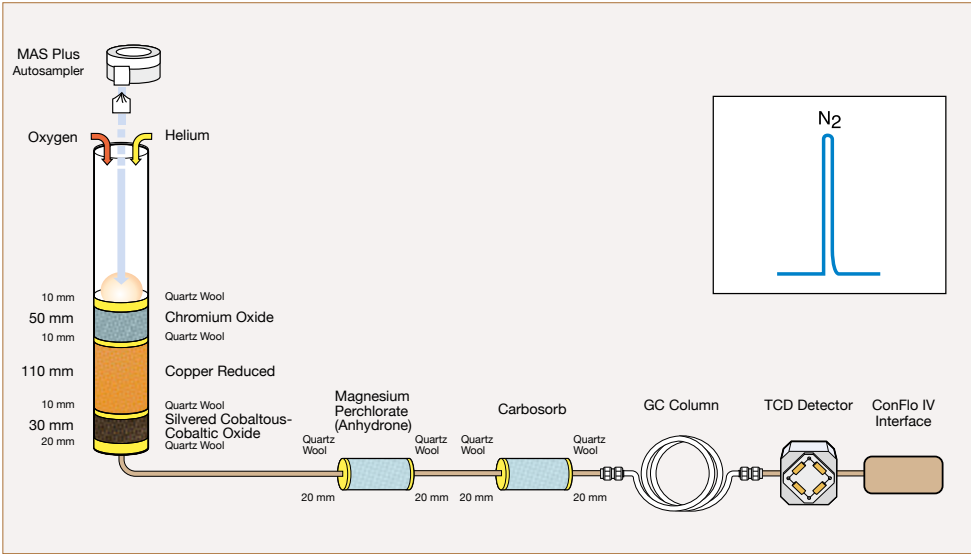
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ANALYTICAL CONFIGURATIONS - N-ONLY DETERMINATION (SINGLE REACTOR)



Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	250
Flow (ml/min)	He carrier	180
	He reference	70
	Oxygen	250
Temperature (°C)	Left furnace	1020
	Right furnace	0
	GC Oven	65
Cycle (Run Time)	480 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Chromium oxide (25 g)	338 22900
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
Reduced Copper (100 g)	338 35300
Quartz wool (5q)	338 22200
Magnesium Perchloride (Anhydrous, 100 g)	338 21900
Empty quartz reactor (set of 2)	468 20070
Prepacked oxidation reactor NC determination	468 20076
Prepacked reduction reactor NC determination	468 20077
Adsorption filter for IRMS / HT	281 13102
IRMS Separation Column (ss; 3 m; 6 x 5 mm)	260 08205

Note
The analytical conditions reported here below are general parameters used for the Thermo Scientific FLASH 2000 coupled to IRMS. Please refer to the relative conditions suggested according to the application.



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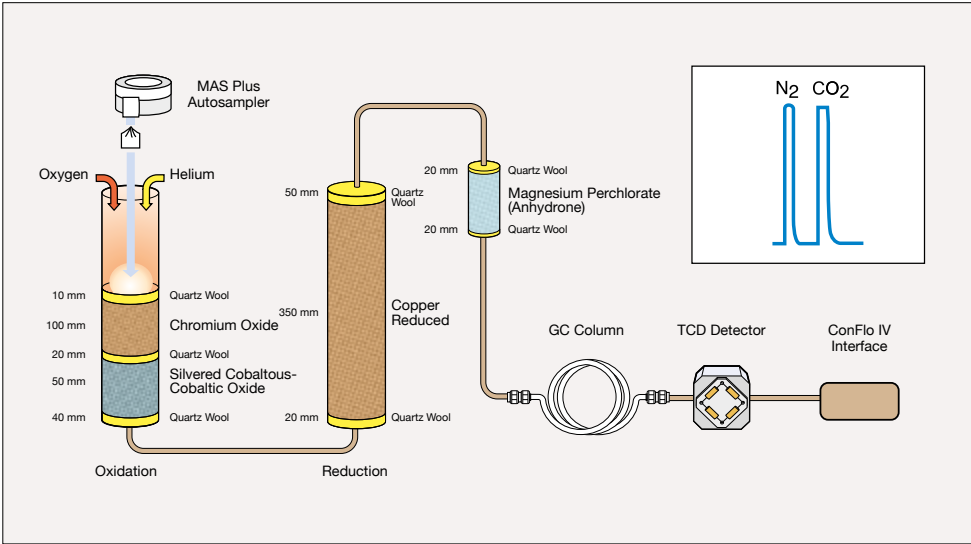
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ANALYTICAL CONFIGURATIONS - NC DETERMINATION



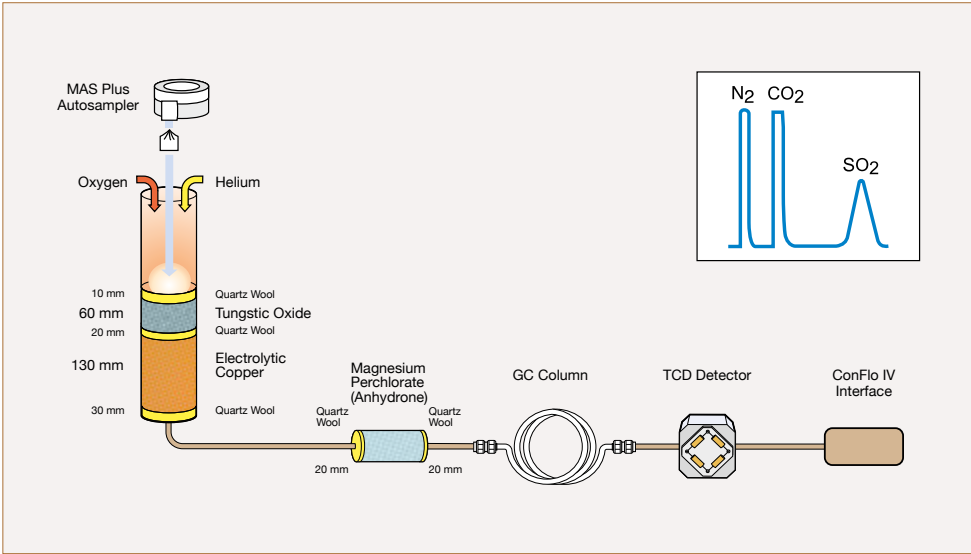
Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	250
Flow (ml/min)	He carrier	180
	He reference	70
	Oxygen	250
Temperature (°C)	Left furnace	1020
	Right furnace	0
	GC Oven	65
Cycle (Run Time)	480 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Chromium oxide (25 g)	338 22900
Silvered cobaltous-cobaltic oxide (25 g)	338 24500
High quality copper (50 g)	338 35312
Reduced Copper (100 g)	338 35300
Quartz wool (5 g)	338 22200
Magnesium Perchloride (Anhydrous, 100 g)	338 21900
Empty quartz reactor (set of 2)	468 20070
Prepacked reactor NC determination (Argon sealed)	468 02009
Adsorption filter for IRMS / HT	281 13102
IRMS Separation Column (ss; 3 m; 6 x 5 mm)	260 08205

Note
The analytical conditions reported here below are general parameters used for the Thermo Scientific FLASH 2000 coupled to IRMS. Please refer to the relative conditions suggested according to the application.



ANALYTICAL CONFIGURATIONS - NCS DETERMINATION



Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	250
Flow (ml/min)	He carrier	180
	He reference	70
	Oxygen	250
Temperature (°C)	Left furnace	1020
	Right furnace	0
	GC Oven	65
Cycle (Run Time)	480 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Quartz wool (5 g)	338 22200
Tungsten oxide (25 g)	338 24600
Electrolytic copper (80 g)	338 35314
Magnesium Perchloride (Anhydrous, 100 g)	338 21900
Prepacked reactor NCS determination	468 02021
Adsorption filter for IRMS / HT	281 13102
Vanadium Pentoxide	338 37510
Sulfinert Separation Column (2 m)	128 9970

Note
The analytical conditions reported here below are general parameters used for the Thermo Scientific FLASH 2000 coupled to IRMS. Please refer to the relative conditions suggested according to the application.



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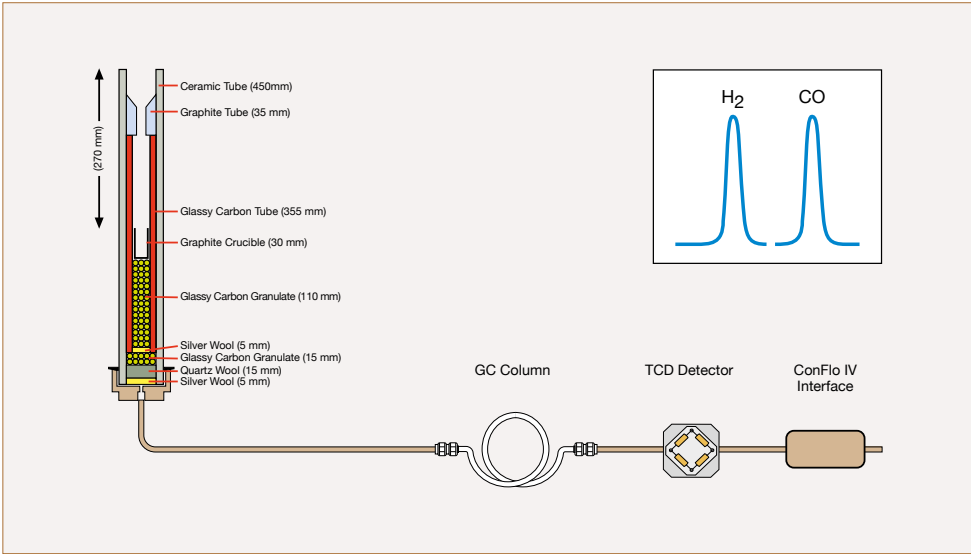
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ANALYTICAL CONFIGURATIONS - OH DETERMINATION



Analytical conditions		
Pressure (kPa)	He	250
	Oxygen	250
Flow (ml/min)	He carrier	180
	He reference	70
	Oxygen	250
Temperature (°C)	Left furnace	1020
	Right furnace	0
	GC Oven	65
Cycle (Run Time)	480 sec	
Oxygen Injection Time	5 sec	
Sample Delay Time	12 sec	

List of consumables	p/n
Carbosorb (CO2 adsorber) for O/H (50 g)	338 35236
O/H Separation Column (SS; 1 m; 6x5 mm)	260 07900
Glassy Carbon Granulate	1117401*
Silver wool	1117430*
Graphite crucible	1117332*
Reactor Flash HT (containing ceramic tube, glassy carbon tube, graphite tube)	1197480*

- Note**
- The analytical conditions reported here below are general parameters used for the Thermo Scientific FLASH 2000 coupled to IRMS. Please refer to the relative conditions suggested according to the application
 - The HT pyrolysis chemicals for O/H determination constituted to ceramic reactor, glassy carbon reactor, graphite crucible, glassy carbon granulate, silver wool, etc., can be ordered directly from Thermo Fisher Scientific GmbH, Bremen, Germany.
- *Thermo Scientific consumables can be ordered from Thermo Fisher Scientific, Hanna-Kunath-Str. 11, 28199 Bremen, Germany



Analytical - EA-IRMS

Ecology and Biology

- Bird Feathers
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- Glass Fiber Filter
- Wood

Nitrogen/Carbon/Sulfur isotope ratio determination

BIRD FEATHERS

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	60°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/2

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	30%
CO ₂ dilution:	96%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
100				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information
Sample weight: 1.0 mg

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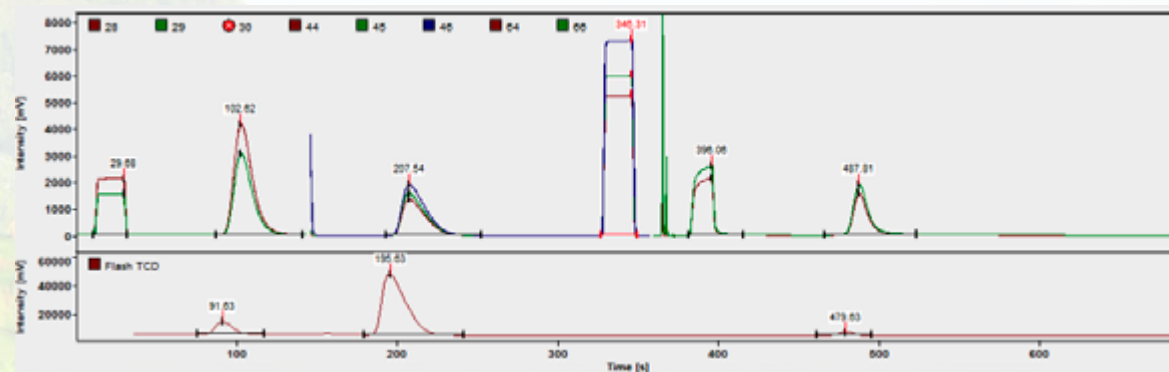
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Nitrogen/Carbon/Sulfur isotope ratio determination

BIRD FEATHERS

Chromatogram of Bird Feathers



Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

Analytical - EA-IRMS

Ecology and Biology

- Bird Feathers
- Bone Collagen
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- Wood

Nitrogen/Carbon/Sulfur isotope ratio determination

BONE COLLAGEN

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	90°C
Ramped GC Oven start temperature (SP1)	50°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	50%
CO ₂ dilution:	89%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
120				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information
Sample weight: 5.0 mg



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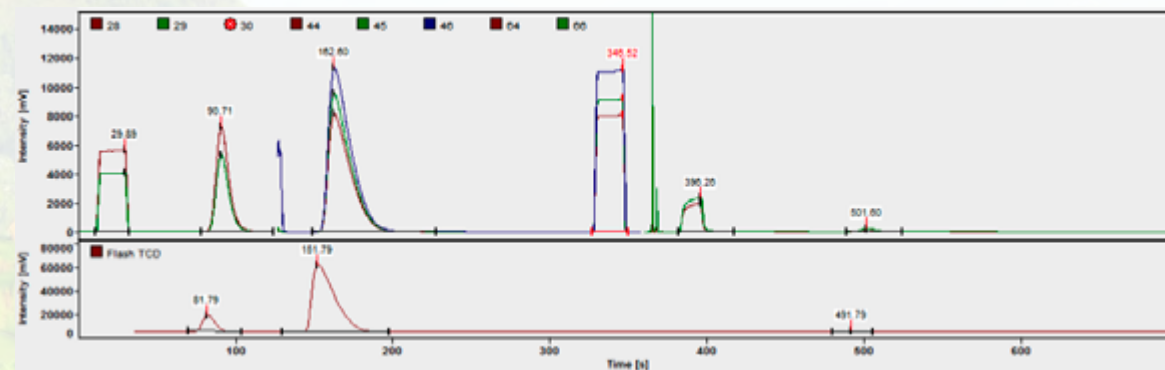
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Nitrogen/Carbon/Sulfur isotope ratio determination

BONE COLLAGEN

Chromatogram of Bone Collagen



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GLASS FIBER FILTERS (GFF)

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	60°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	0%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
150				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information

Sample weight: -5.0 mg

Note

N and S amount depend on filtered material. In this example we show air filter.



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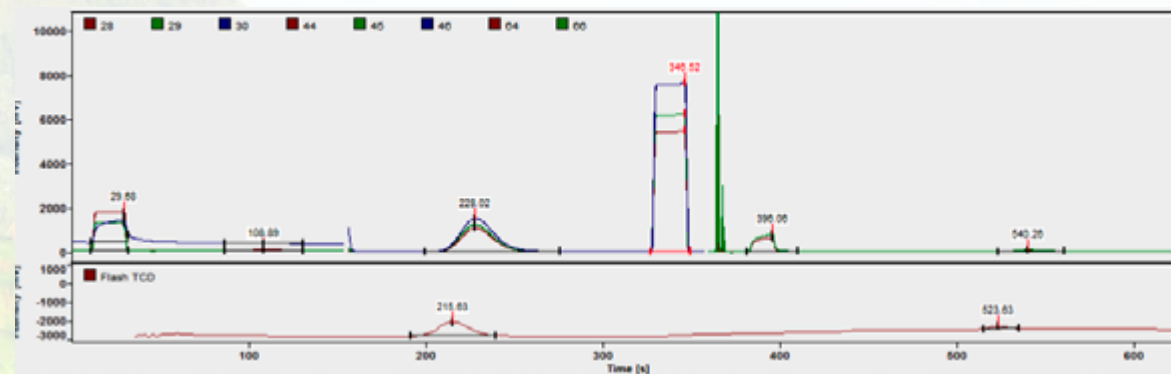
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GLASS FIBER FILTERS (GFF)

Chromatogram of Glass Fiber Filters



Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

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- Wood

Nitrogen/Carbon/Sulfur isotope ratio determination

WOOD

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	90°C
Ramped GC Oven start temperature (SP1)	50°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O2 injection setup (Flow/Delay/Inj Time):	250/8/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	98%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
115				CO ₂
310		●		
320	●			
340	●			
370				SO ₂
380	●			
400	●			
570		●		

Sample information

Sample weight: 8.0 - 10 mg



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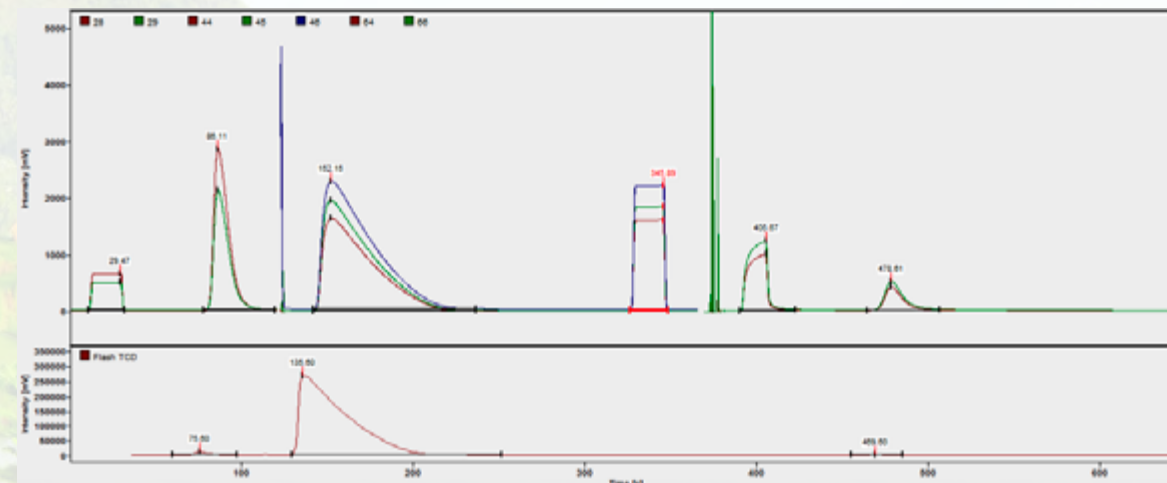
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Nitrogen/Carbon/Sulfur isotope ratio determination

WOOD

Chromatogram of Wood



Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

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- Animal Feed
- Glass Fiber Filter
- Oil (NSO Fraction)
- Soil (lowC)

Nitrogen/Carbon/Sulfur isotope ratio determination

ANIMAL FEED

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	90°C
Ramped GC Oven start temperature (SP1)	50°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	89%
CO ₂ dilution:	98%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22		●		
35			●	
140				CO ₂
430		●		
440	●			
460		●		
480				SO ₂
490	●			
510		●		
740			●	

Sample information
Sample weight: 8.0 - 10 mg



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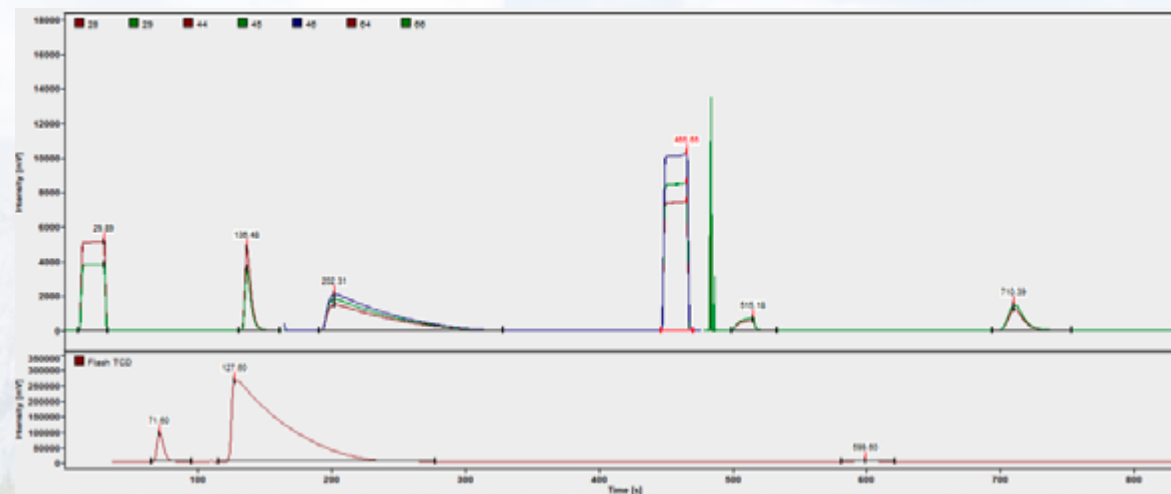
Environmental Pollution

- Animal Feed
- Glass Fiber Filter
- Oil (NSO Fraction)
- Soil (lowC)

Nitrogen/Carbon/Sulfur isotope ratio determination

ANIMAL FEED

Chromatogram of Animal Feed



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany. Analyzed with smartEATM Option.

Analytical - EA-IRMS

Environmental Pollution

- Animal Feed
- Glass Fiber Filter
- Oil (NSO Fraction)
- Soil (lowC)

Nitrogen/Carbon/Sulfur isotope ratio determination

GLASS FIBER FILTERS (GFF)

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	60°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	0%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
150				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information

Sample weight: -5.0 mg

Notes

N and S amount depend on filtered material. In this example we show air filter.



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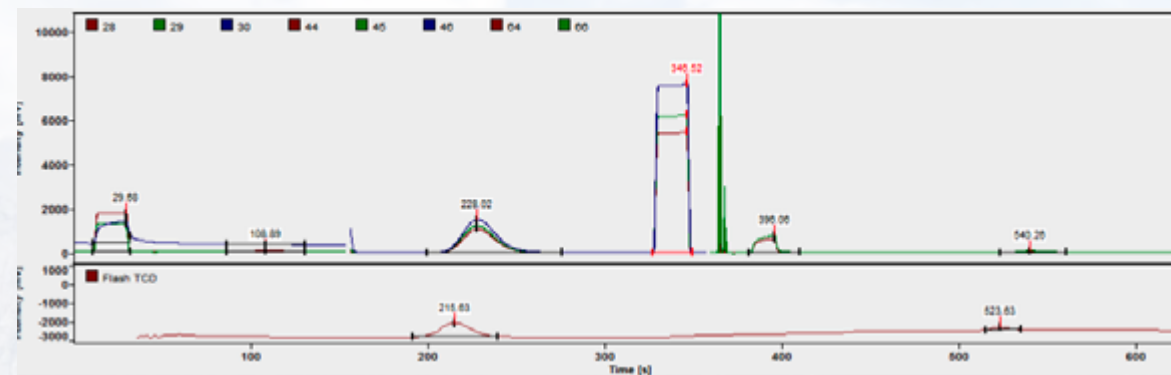
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- Animal Feed
- Glass Fiber Filter
- Oil (NSO Fraction)
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Nitrogen/Carbon/Sulfur isotope ratio determination

GLASS FIBER FILTERS (GFF)

Chromatogram of Glass Fiber Filters



Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

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- Oil (NSO Fraction)
- Soil (lowC)

Nitrogen/Carbon/Sulfur isotope ratio determination

OIL (NSO FRACTION)

EA IsoLink CNSOH parameters

EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	50°C
Ramped GC Oven start temperature (SP1)	55°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/3

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	90%
SO ₂ dilution:	0%

Time Event List

Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
135				CO ₂
290		●		
300	●			
320	●			
350				SO ₂
380	●			
400	●			
550		●		

Sample information

Sample weight: 1.5 mg



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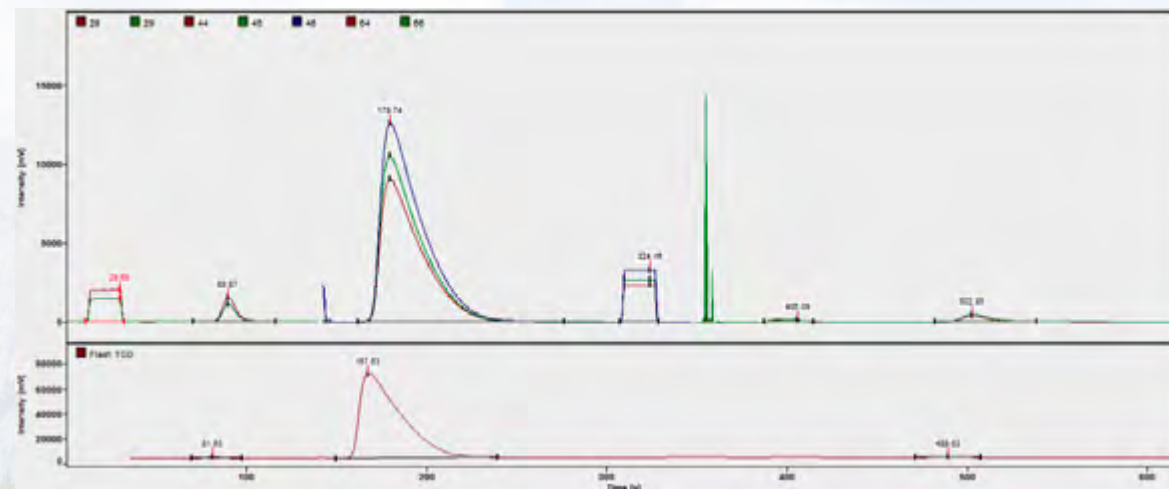
Environmental Pollution

- Animal Feed
- Glass Fiber Filter
- Oil (NSO Fraction)
- Soil (lowC)

Nitrogen/Carbon/Sulfur isotope ratio determination

OIL (NSO FRACTION)

Chromatogram of Oil (NSO Fraction)



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.
Preconcentration method used: flow reduced to 25 ml/min after 95s.

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- Oil (NSO Fraction)
- Soil (lowC)

Nitrogen/Carbon/Sulfur isotope ratio determination

SOIL (LOW C)

EA IsoLink CNSOH parameters

EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	50°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/8

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	78%
SO ₂ dilution:	0%

Time Event List

Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
135				CO ₂
300	●			
315		●		
320	●			
350				SO ₂
370	●			
390	●			
550		●		

Sample information

Sample weight: 50.0 mg



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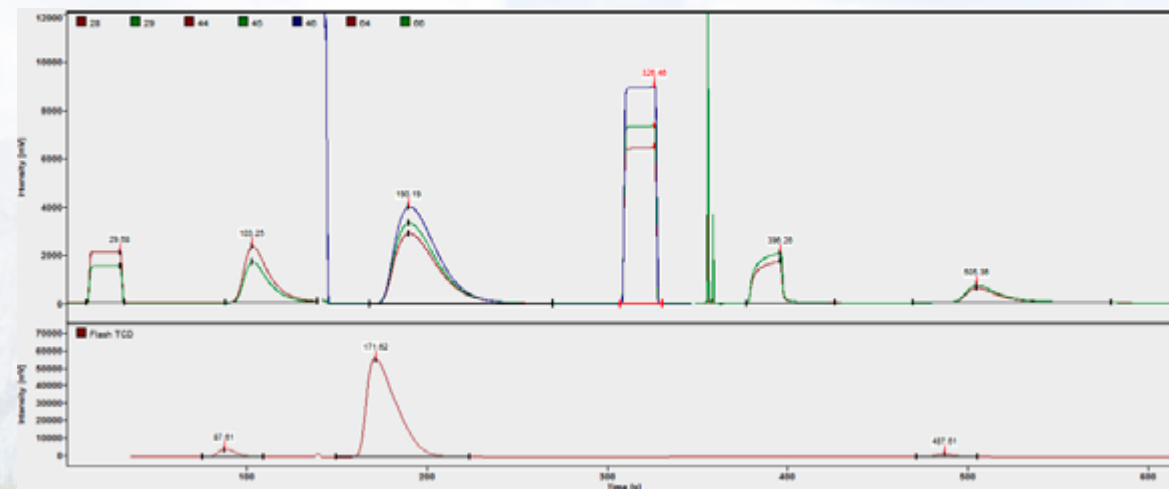
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- Animal Feed
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- Oil (NSO Fraction)
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Nitrogen/Carbon/Sulfur isotope ratio determination

SOIL (LOW C)

Chromatogram of Soil (low C)



Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

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- Animal Feed
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- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

ANIMAL FEED

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	70°C
Ramped GC Oven start temperature (SP1)	50°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	89%
CO ₂ dilution:	98%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
140				CO ₂
430		●		
440	●			
460	●			
480				SO ₂
490	●			
510	●			
740		●		

Sample information
Sample weight: 8.0 - 10 mg

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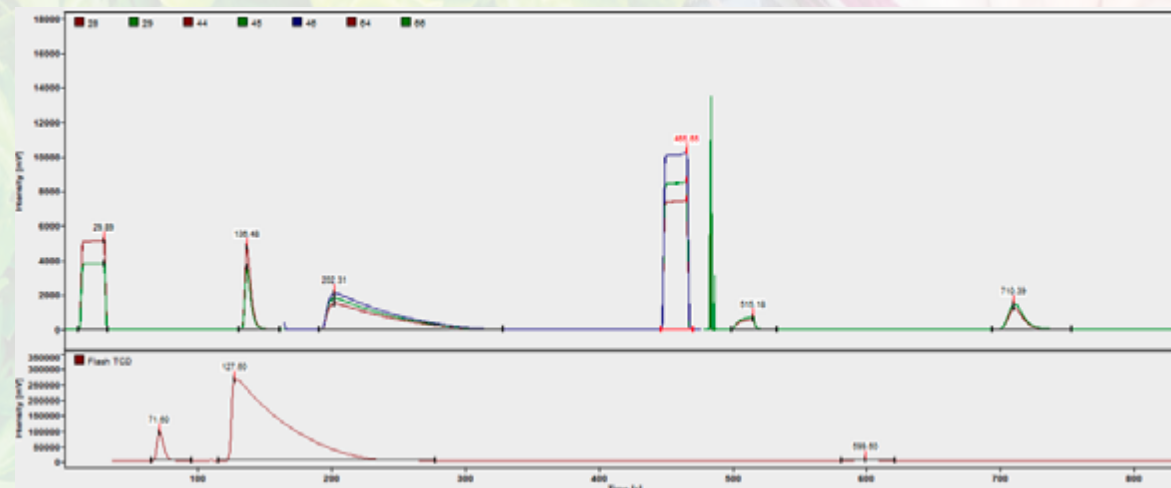
Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

ANIMAL FEED

Chromatogram of Animal Feed



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany. Analyzed with smartEATM Option.

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- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

CASEIN

EA IsoLink CNSOH parameters

EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	70°C
Ramped GC Oven start temperature (SP1)	50°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	30%
CO ₂ dilution:	96%
SO ₂ dilution:	0%

Time Event List

Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
100				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information

Sample weight: 1.0 mg



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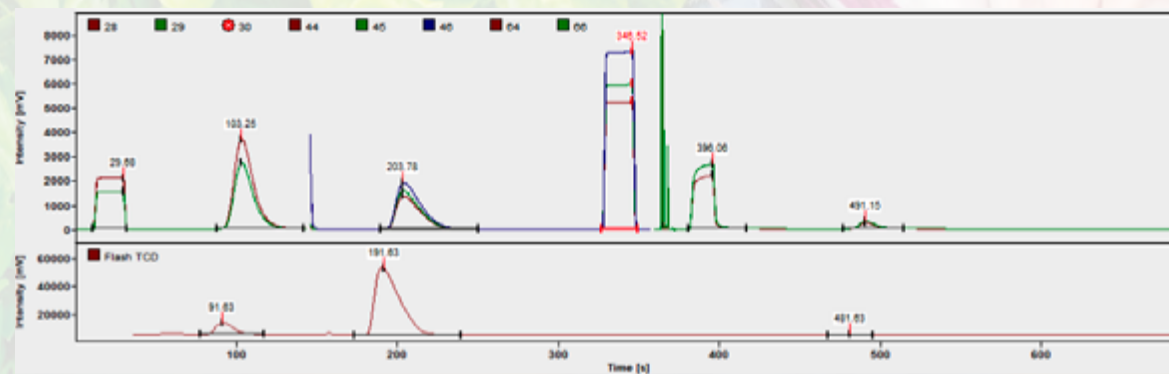
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- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

CASEIN

Chromatogram of Casein

*TSupplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.*

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- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Carbon isotope ratio determination

HONEY

EA IsoLink CNSOH parameters	
EA Configuration	NC
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	70°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	No ramping required
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/2

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	50%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
100				CO ₂
320	●			
330		●		
340	●			

Sample information

Sample weight: 0.2 - 0.5 mg

Note

Honey samples are best transferred into the tin capsules by using a pointed metal rod.



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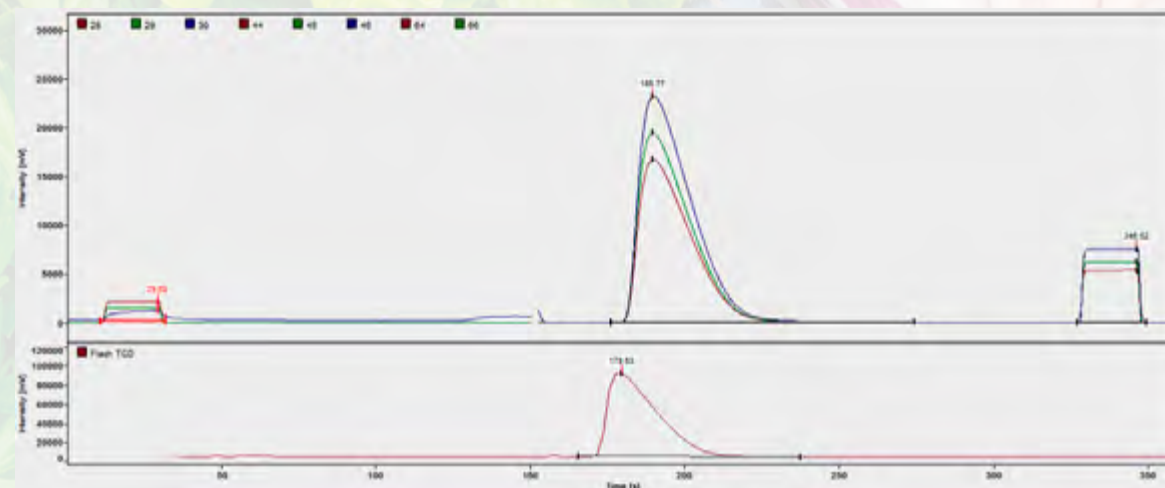
Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Carbon isotope ratio determination

HONEY

Chromatogram of Honey



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

Note

Generally, honey is analyzed for ^{13}C isotope determination only. In this case use reactor packing of silvered cobaltous/cobaltic oxide (PN 46802005) to remove SO_2 traces. Isodat method does not require magnet field switches. In combination with protein analysis detection of fraudulent addition of invert sugar syrups can be obtained. Please refer to protein analysis in this cookbook for a reference to the official guideline on honey analysis by AOAC 998.12.

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Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Carbon isotope ratio determination

HONEY PROTEIN

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	70°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	No ramping required
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/2

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	33%
CO ₂ dilution:	78%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
100				CO ₂
320	●			
330		●		
340	●			

Sample information

Sample weight: 0.5 mg

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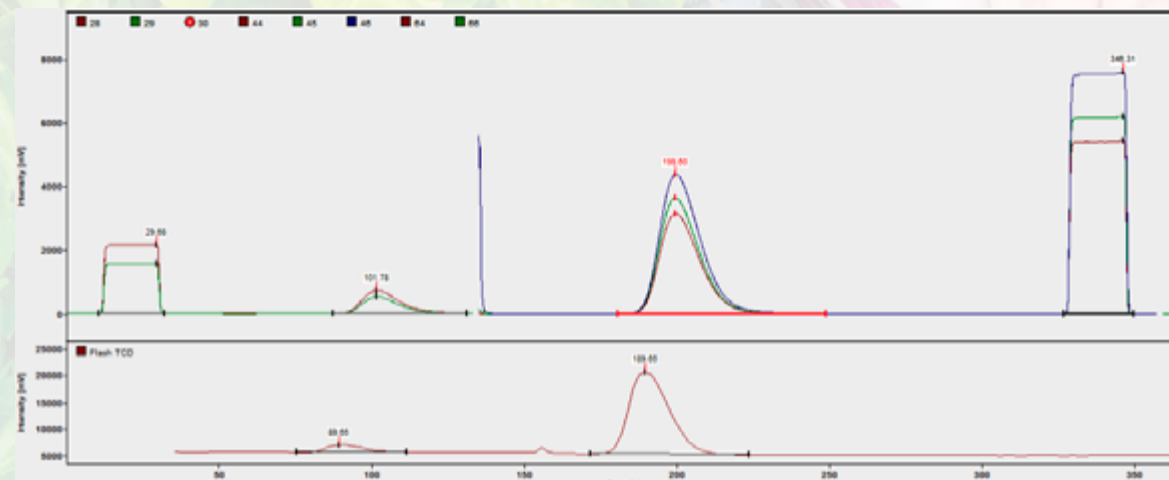
Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Carbon isotope ratio determination

HONEY PROTEIN

Chromatogram of Honey Protein



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

Note

Generally, honey protein is analyzed for ^{13}C isotope determination only. In this case use reactor packing of silvered cobaltous/cobaltic oxide (PN 46802005) to remove SO_2 traces. Isodat method does not require magnet field switches. The proteins in the honey sample were extracted following the AOAC 998.12 guideline (Association of Analytical Communities Handbook).

Reference

Association of Analytical Communities (AOAC) official methods of analysis method 998.12: C-4 plant sugars in honey, internal standard stable carbon isotope ratio method. AOAC Int. Gaithersburg MD (USA). 1999, Chap. 44, 27–30.

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- Animal Feed
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- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

MEAT PROTEIN

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	70°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	30%
CO ₂ dilution:	95%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
100				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information
Sample weight: 0.8 - 1.0 mg



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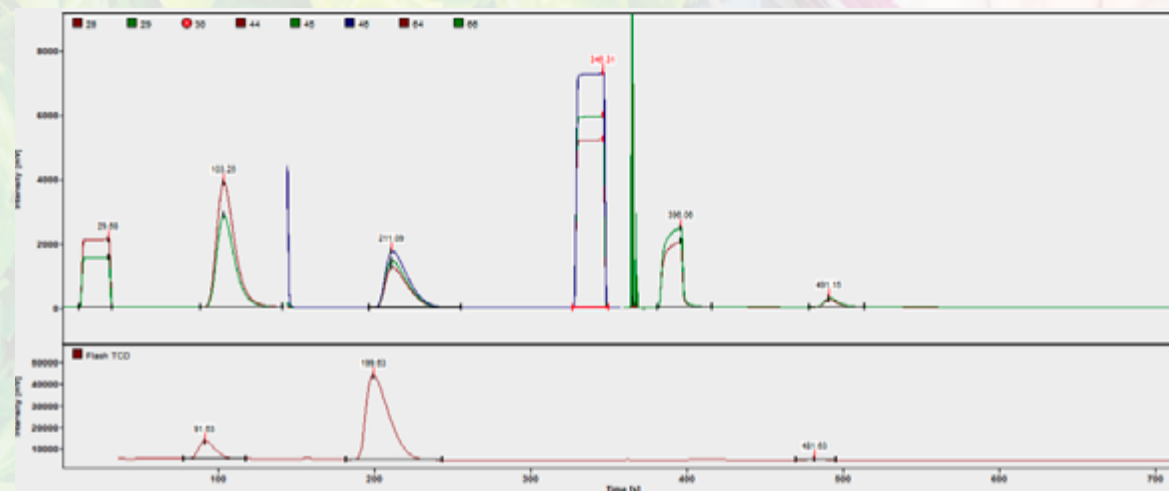
Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

MEAT PROTEIN

Chromatogram of Meat Protein



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

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- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

OLIVE OIL

EA IsoLink CNSOH parameters

EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	70°C
Ramped GC Oven start temperature (SP1)	55°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/3

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	95%
SO ₂ dilution:	0%

Time Event List

Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
100				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information

Sample weight: 0.5 mg



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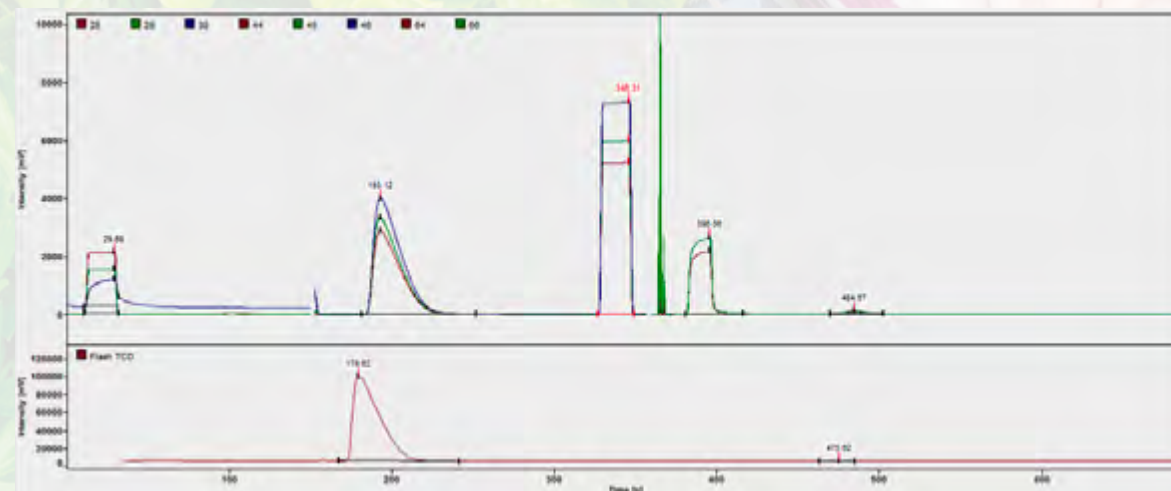
Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

OLIVE OIL

Chromatogram of Olive Oil



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

Note

Generally, olive oil is analyzed for ^{13}C isotope determination only. In this case use reactor packing of silvered cobaltous/cobaltic oxide (PN 46802005) to remove SO_2 traces. Isodat method does not require magnet field switches

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Food Origin and Authenticity

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- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

RICE

EA IsoLink CNSOH parameters

EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	70°C
Ramped GC Oven start temperature (SP1)	60°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	30%
CO ₂ dilution:	95%
SO ₂ dilution:	0%

Time Event List

Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
100				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information

Sample weight: 1.0 mg



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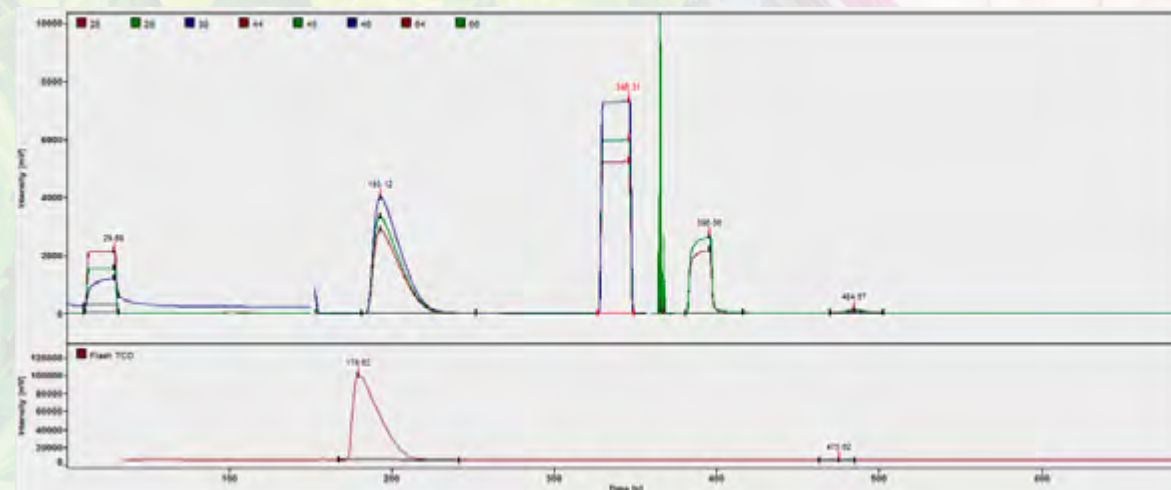
Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

RICE

Chromatogram of Rice



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

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- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

SUGAR (C - ONLY)

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	50°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/3

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	50%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
10	●			
30		●		
50	●			
70		●		
80			●	
380	●			
400		●		
420	●			
440		●		

Sample information
Sample weight: 0.3 mg



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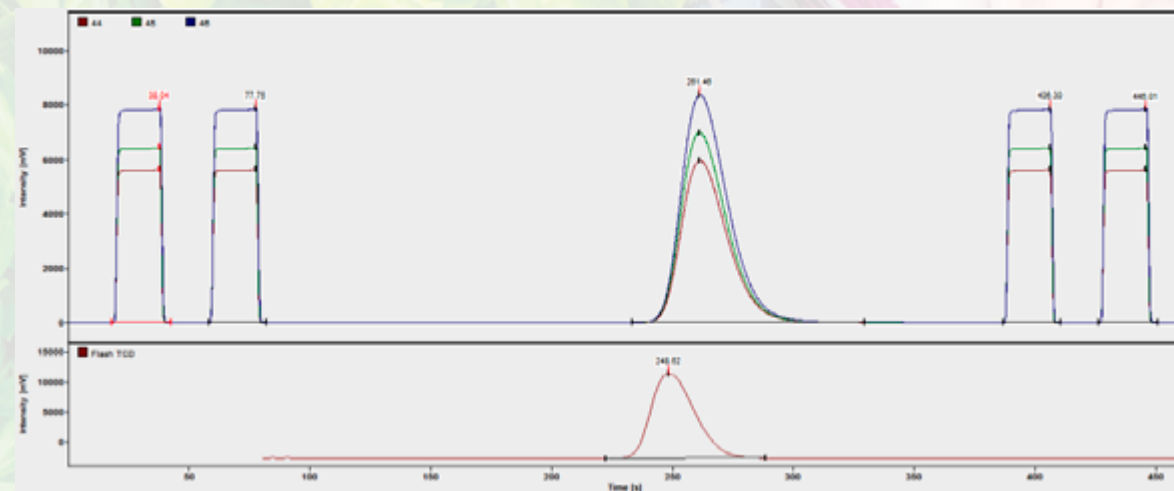
Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen/Carbon/Sulfur isotope ratio determination

SUGAR (C - ONLY)

Chromatogram of Sugar



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

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- Animal Feed
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- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Hydrogen/Oxygen isotope ratio determination

SUGAR (OH)

EA IsoLink CNSOH parameters	
EA Configuration	HO, CO only
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1420°C
GC oven temperature	45°C
Ramped GC Oven start temperature (SP1)	Not used
Ramped GC Oven end temperature (SP2)	Not used
Carrier Flow	100 ml/min
Reference flow	100 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	0/0/0

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

H dilution:	0%
CO dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
10	●			
30		●		
50	●			
70		●		
80			●	
180				CO
380	●			
400		●		
420	●			
440		●		

Sample information

Sample weight: 0.1 mg



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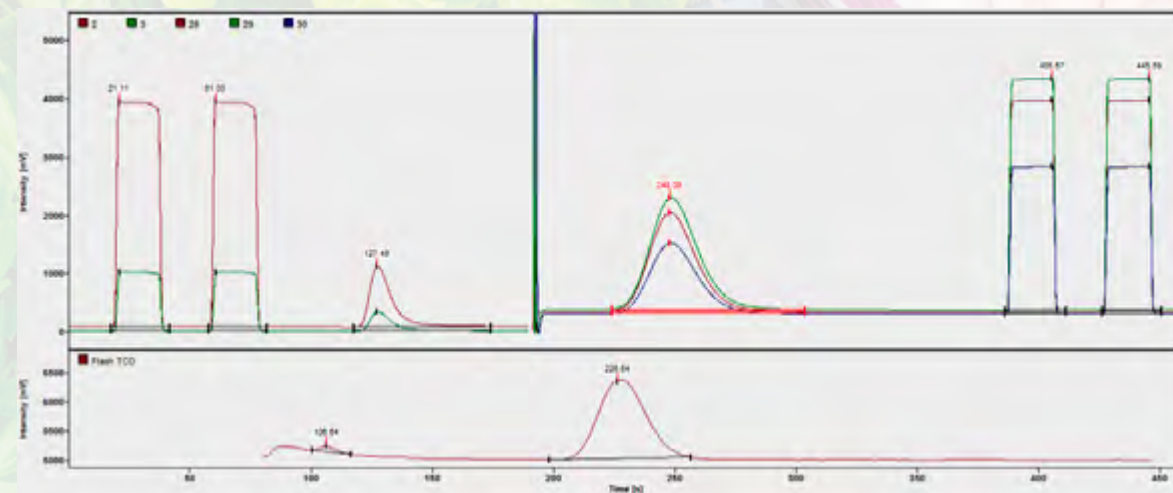
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Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

SUGAR (OH)

Chromatogram of Sugar



Hydrogen/Oxygen isotope ratio determination

Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

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Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen isotope ratio determination

TOMATO

EA IsoLink CN, CN/OH and CNSOH parameters	
EA Configuration	N-only
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	50°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/3

Please note, that this analysis was undertaken using the N-only configuration, which includes a Carbosorb chemical absorber to remove CO₂ from the gas stream in the Elemental Analyzer. Please refer to the “N-Only” configuration for set-up guidelines.

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
--------------------------	----

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
10	●			
30		●		
50	●			
70		●		
80			●	
380	●			
400		●		
420	●			
440		●		

Sample information
Sample weight: 5.0 mg



Analytical - EA-IRMS

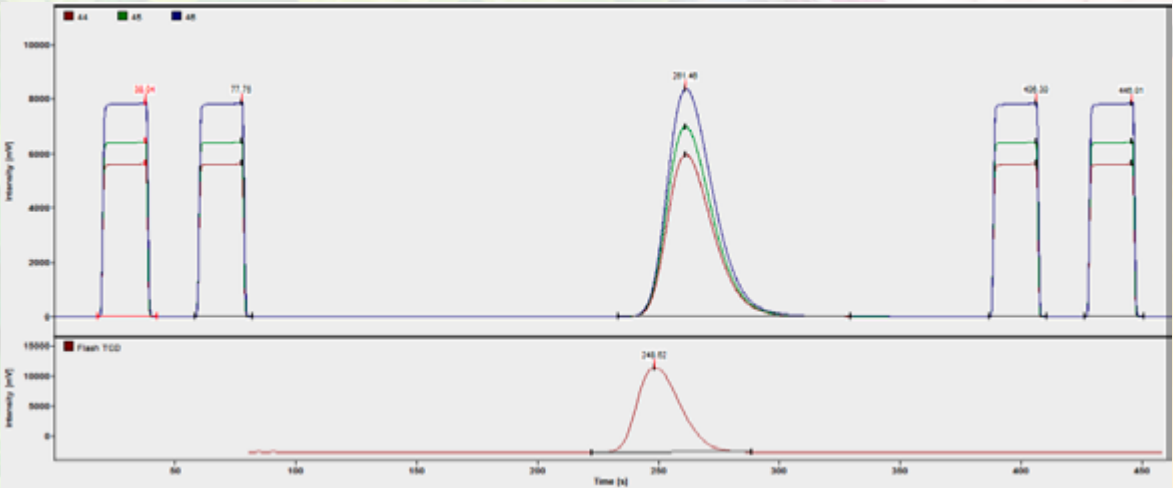
Food Origin and Authenticity

- Animal Feed
- Caesin
- Honey
- Honey Protein
- Meat Protein
- Olive Oil
- Rice
- Sugar (C - only)
- Sugar (OH)
- Tomato

Nitrogen isotope ratio determination

TOMATO

Chromatogram of Tomato



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

Analytical - EA-IRMS

Forensics

- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Nitrogen/Carbon/Sulfur isotope ratio determination

BONE COLLAGEN

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	90°C
Ramped GC Oven start temperature (SP1)	50°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	50%
CO ₂ dilution:	89%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
120				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information

Sample weight: 5.0 mg



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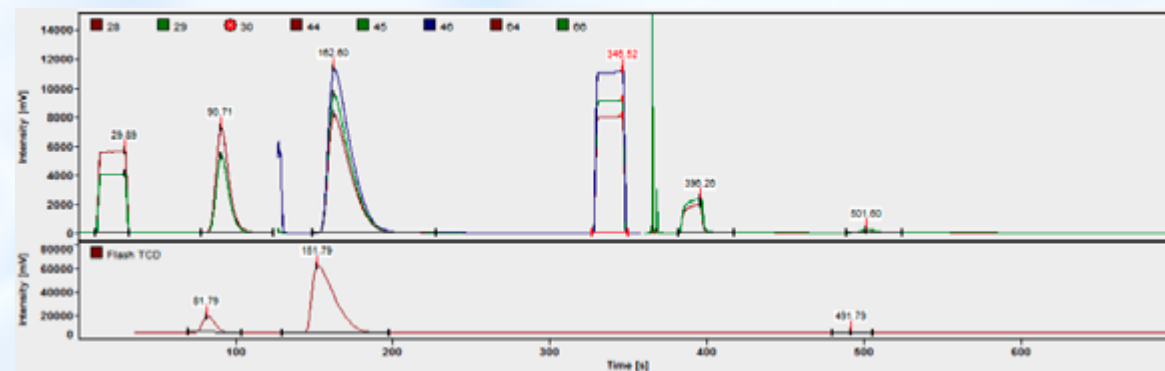
Forensics

- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Nitrogen/Carbon/Sulfur isotope ratio determination

BONE COLLAGEN

Chromatogram of Bone Collagen

*Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.*

Analytical - EA-IRMS

Forensics

- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Nitrogen/Carbon isotope ratio determination

COLOR PIGMENT (COMB.)

EA IsoLink CNSOH parameters	
EA Configuration	NC
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	90°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/2

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	50%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22		●		
35			●	
110				CO ₂
290	●			
310		●		

Sample information

Sample weight: 0.15 - 0.20 mg



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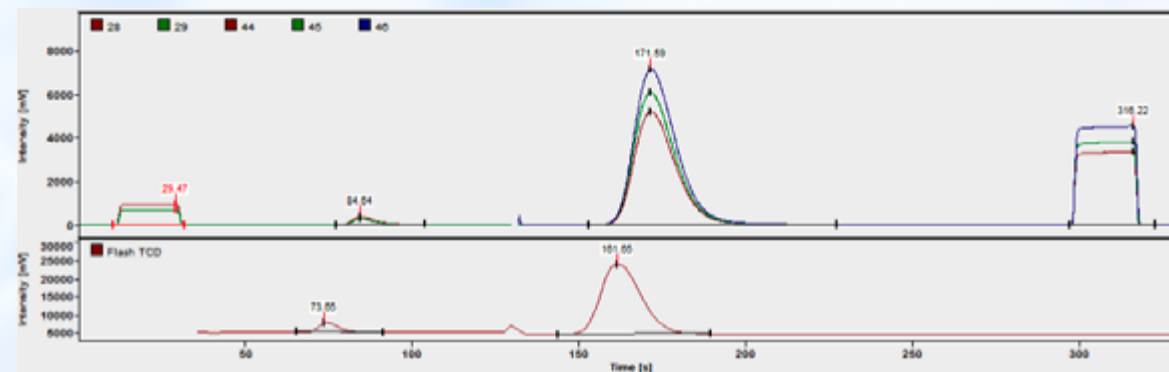
Forensics

- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Nitrogen/Carbon isotope ratio determination

COLOR PIGMENT (COMB.)

Chromatogram of Color Pigment



Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.



Analytical - EA-IRMS

Forensics

- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Oxygen isotope ratio determination

COLOR PIGMENT (PY)

EA IsoLink CNSOH parameters	
EA Configuration	HO, CO only
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1420°C
GC oven temperature	45°C
Ramped GC Oven start temperature (SP1)	Not used
Ramped GC Oven end temperature (SP2)	Not used
Carrier Flow	100 ml/min
Reference flow	100 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	0/0/0

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

H dilution:	0%
CO dilution:	0%

Time Event List								
Time (sec.)	Reference Automatic	Sample Split On	SampOil 1 On	SampOil 2 On	SampOil 3 On	GC - Start	Start Flash	Switch Gas
10	●							
30	●							
40							●	
100								CO
110	●	●	●	●	●			
150	●	●	●	●	●			
310	●							
330	●							

Sample information

Sample weight: 0.20 mg

Note

Inject reference gas CO put in full dilution before CO sample peak to suppress N₂ in source.



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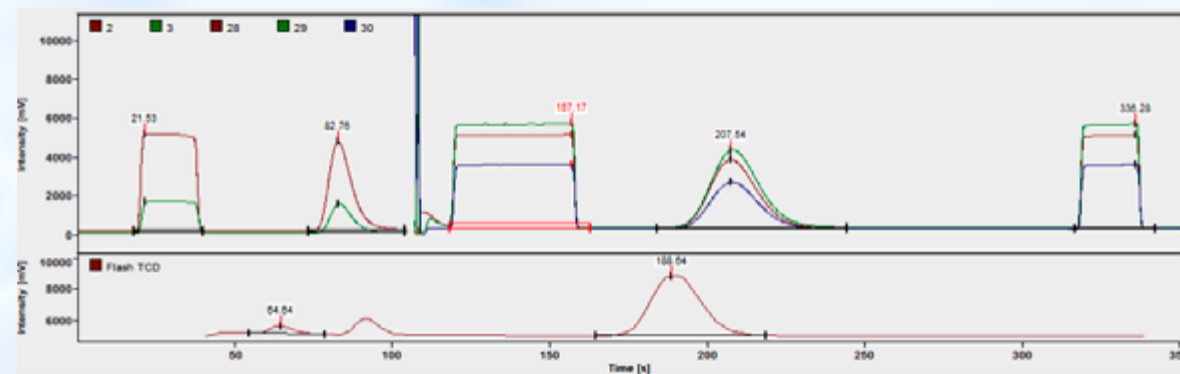
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- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Oxygen isotope ratio determination

COLOR PIGMENT (PY)

Chromatogram of Color Pigment



Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.

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- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Nitrogen/Carbon/Sulfur isotope ratio determination

HAIR

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	50°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/3

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	60%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
120				CO ₂
320	●			
330		●		
340	●			
360				SO ₂
370	●			
390	●			
600		●		

Sample information
Sample weight: 0.75 mg



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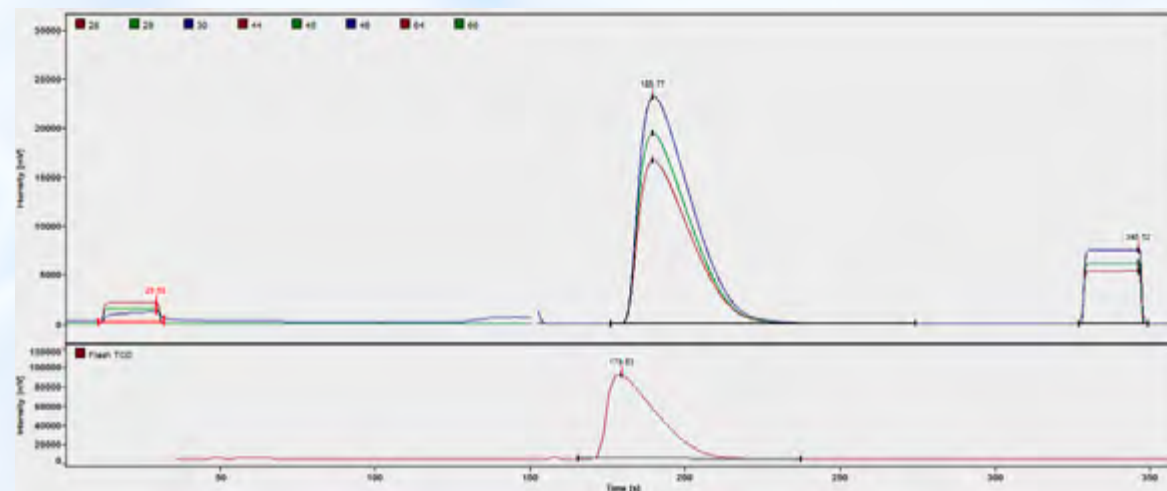
Forensics

- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Nitrogen/Carbon/Sulfur isotope ratio determination

HAIR

Chromatogram of Hair

*Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.*

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- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Nitrogen/Carbon/Sulfur isotope ratio determination

WOOD

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	90°C
Ramped GC Oven start temperature (SP1)	50°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/5

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	98%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22		●		
35			●	
115				CO ₂
310		●		
320	●			
340		●		
370				SO ₂
380	●			
400		●		
570			●	

Sample information
Sample weight: 8.0 - 10 mg



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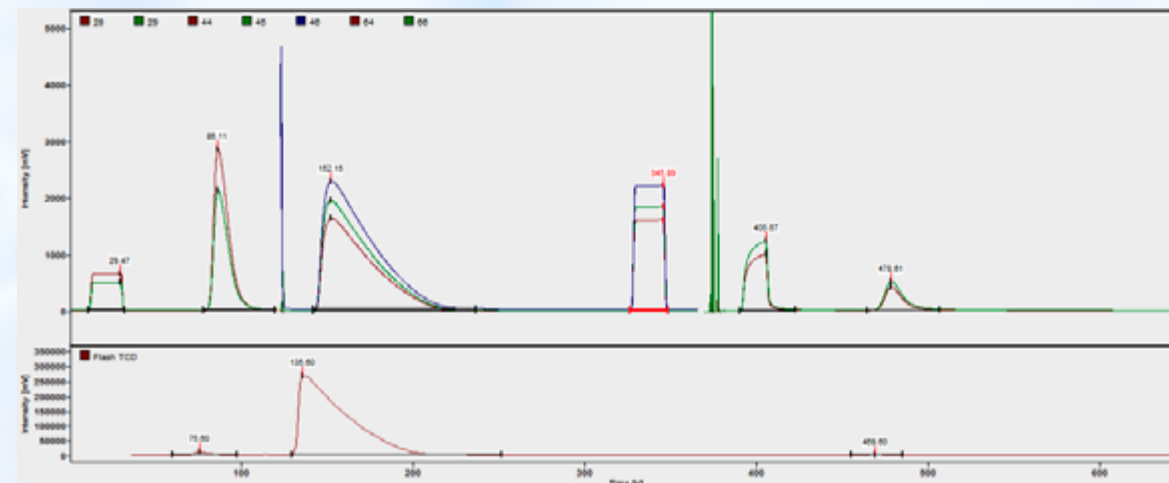
Forensics

- Bone Collagen
- Color Pigment (Comb.)
- Color Pigment (Py)
- Hair
- Wood

Nitrogen/Carbon/Sulfur isotope ratio determination

WOOD

Chromatogram of Wood

*Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.*

Analytical - EA-IRMS

Geology and Geoscience

- Oil (NSO Fraction)
- Silicates
- Soil (Low C)

Nitrogen/Carbon/Sulfur isotope ratio determination

OIL (NSO FRACTION)

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	50°C
Ramped GC Oven start temperature (SP1)	55°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/8/3

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	90%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
135				CO ₂
290		●		
300	●			
320	●			
360				SO ₂
380	●			
400	●			
660		●		

Sample information
Sample weight: 1.5 mg



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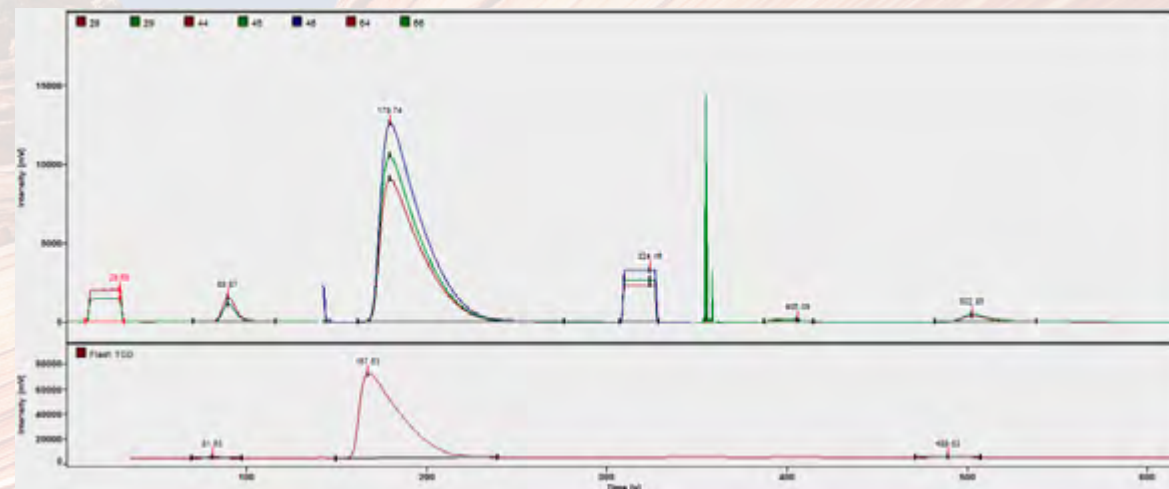
Geology and Geoscience

- Oil (NSO Fraction)
- Silicates
- Soil (Low C)

Nitrogen/Carbon/Sulfur isotope ratio determination

OIL (NSO FRACTION)

Chromatogram of Oil (NSO Fraction)



Thanks to Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.
Preconcentration method used: flow reduced to 25 ml/min after 95s.

Analytical - EA-IRMS

Geology and Geoscience

- Oil (NSO Fraction)
- Silicates
- Soil (Low C)

Oxygen isotope ratio determination

SILICATES

EA IsoLink CNSOH parameters	
EA Configuration	HO, CO only
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1450°C
GC oven temperature	50°C
Ramped GC Oven start temperature (SP1)	Not used
Ramped GC Oven end temperature (SP2)	Not used
Carrier Flow	100 ml/min
Reference flow	100 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	0/0/0

- Information
- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
 - Thermo Scientific ConFlo IV conditions:

CO dilution:	0%
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Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
10	●			
30		●		
50	●			
70		●		
80			●	

Sample information

Sample weight: 0.8 - 1.8 mg

Note

Add at least 6 silver capsules filled with 2 mg of NiC to condition reactor before analysis or replace 1 cm of glassy carbon granules with 1 cm of NiC. Add between 0.3 - 0.8 mg of graphite to each sample.

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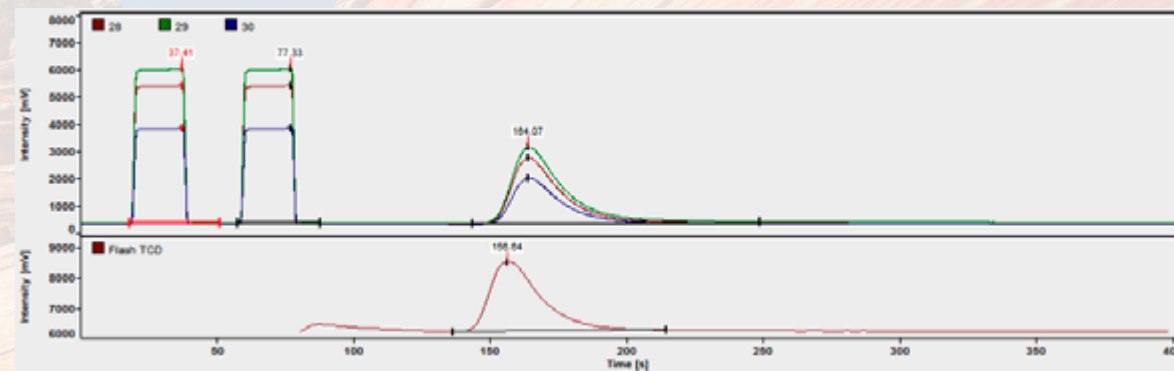
Geology and Geoscience

- Oil (NSO Fraction)
- Silicates
- Soil (Low C)

Oxygen isotope ratio determination

SILICATES

Chromatogram of Silicates

*Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.*

Analytical - EA-IRMS

Geology and Geoscience

- Oil (NSO Fraction)
- Silicates
- Soil (Low C)

Nitrogen/Carbon/Sulfur isotope ratio determination

SOIL (LOW C)

EA IsoLink CNSOH parameters	
EA Configuration	NCS
He pressure	300 kPa
O ₂ pressure	300 kPa
Reactor Temperature	1020°C
GC oven temperature	50°C
Ramped GC Oven start temperature (SP1)	70°C
Ramped GC Oven end temperature (SP2)	240°C
Carrier Flow	180 ml/min
Reference flow	70 ml/min
O ₂ injection setup (Flow/Delay/Inj Time):	250/10/8

Information

- Thermo Scientific DELTA V Plus with Isodat Software v3.0, SP 94.12 or higher
- Thermo Scientific ConFlo IV conditions:

N ₂ dilution:	0%
CO ₂ dilution:	78%
SO ₂ dilution:	0%

Time Event List				
Time (sec.)	Ref. Automatic	GC - Start	Start Flash	Switch Gas
2	●			
22	●			
35			●	
135				CO ₂
300	●			
315		●		
320		●		
350				SO ₂
370	●			
390		●		
660		●		

Sample information

Sample weight: 50.0 mg

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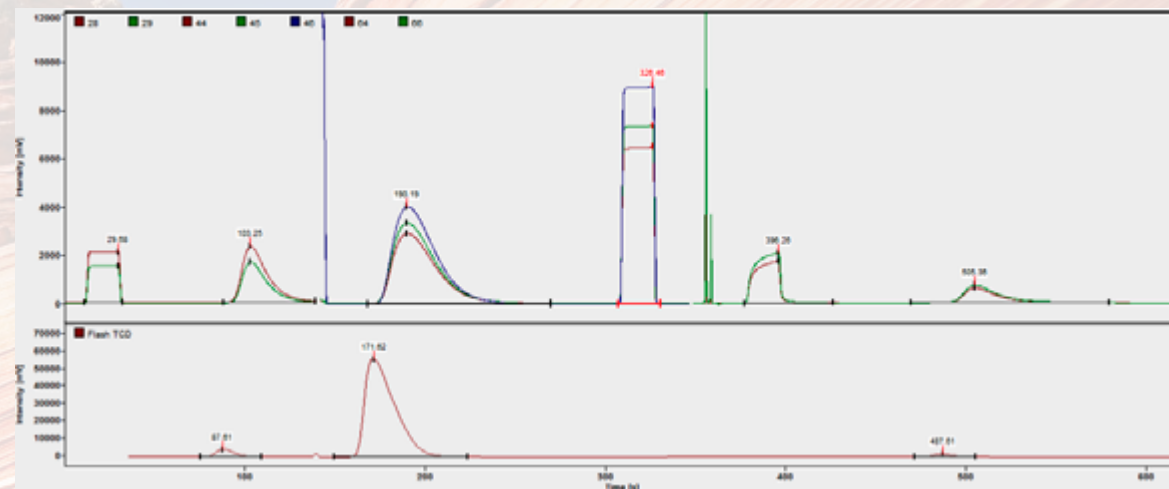
Geology and Geoscience

- Oil (NSO Fraction)
- Silicates
- Soil (Low C)

Nitrogen/Carbon/Sulfur isotope ratio determination

SOIL (LOW C)

Chromatogram of Soil (low C)



Supplied by Applications Lab, Thermo Fisher Scientific (Bremen) GmbH, Germany.