WAGENINGEN EVALUATING PROGRAMS

FOR ANALYTICAL LABORATORIES

Certificate of Analysis

International Plant-Analytical Exchange

REFERENCE MATERIAL

IPE sample 209

WAGENINGEN
UNIVERSITY & RESEARCH

Certificate of Analysis IPE 209

General Information

In this report an overview is given of analytical data for this sample collected in our proficiency testing program. The consensus values are calculated using a robust statistical model. With this NDA model mean and standard deviation are calculated using all reported data when at least 8 results are left after removal of reported 'lower than' (<) and 0 (= zero) values. No outliers are removed.

This report is divided into three sections: Consensus Values, Indicative Values and Values for Information. The division is made on the reliability of the data. Consensus Values are based on at least 16 results while the coefficient of variation is smaller than 25 %. Indicative Values are based on at least 8 and less than 16 results or a coefficient of variation between 25 % and 50 %. Other values, based on more than 2 and less than 8 results or a coefficient of variation higher than 50 %, are given for information only.

In the sections with Consensus Values and Indicative Values the following parameters are given: mean, standard deviation, coefficient of variation, number of results, median and MAD (Median of Absolute Deviation) and the uncertainty in the consensus values. The confidence limits (at 95 % probability) are calculated for these determinands.
In the section with Information Values the following parameters are given: median, MAD and number of results. For determinands which have at least 5 results reported as smaller than (<) the median of these ‘smaller than results’ is calculated. In some cases this median of ‘<’ values is much smaller than median and mean of the indicative values. This may be caused by a too optimistic (too low) value for the detection limit reported by a (small) majority of participating laboratories who report ‘<’-values.

All values, expressed on a weight basis (kg or %), are reported in oven dry (105 °C) material. Moisture is reported in the material as received.

Sample information

WEPAL reference materials are from natural sources only. There is no spiking, mixing or other alterations of the samples. For sample preparation the IPE samples are dried at 70 ºC and milled to pass a 0.5 mm sieve.

This IPE sample 209 of Barly (grain) / Hordeum vulgare from Netherlands is prepared for the WEPAL proficiency programs. The sample is used in 3 periods (or rounds). The results on which the values in this report are based were taken from the periods given in the following table.

Year	Round	Number
2022	1	1
2017	4	1
2012	4	1

Consensus Values IPE 209

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Ba	mg/kg	3.35	0.332	9.9	24	3.36	0.235	0.085	3.21 - 3.49
Ca	g/kg	0.374	0.0679	18.2	273	0.380	0.0490	0.0051	0.366 - 0.382
Cd	µg/kg	79.9	8.08	10.1	74	79.6	5.72	1.17	78.0 - 81.8
Cu	mg/kg	4.80	0.637	13.3	279	4.79	0.440	0.048	4.73 - 4.88
Fe	mg/kg	41.9	5.13	12.2	277	42.2	3.57	0.39	41.3 - 42.5
K	g/kg	4.00	0.303	7.6	306	4.01	0.209	0.022	3.97 - 4.04
Mg	g/kg	1.34	0.095	7.1	301	1.34	0.065	0.007	1.32 - 1.35
Mn	mg/kg	66.5	5.23	7.9	287	66.0	3.60	0.39	65.9 - 67.1
Mo	µg/kg	232	22.6	9.8	76	234	16.1	3.2	226 - 237
N - Kjeldahl (as N)	g/kg	18.9	1.12	5.9	190	19.0	0.78	0.10	18.77 - 19.09
Ni	µg/kg	707	92.3	13.1	53	707	65.0	15.8	681 - 732
P (as P)	g/kg	4.22	0.303	7.2	309	4.20	0.210	0.022	4.18 - 4.25
S (as S)	g/kg	1.36	0.141	10.4	182	1.36	0.098	0.013	1.34 - 1.38
Sr	mg/kg	1.36	0.132	9.7	24	1.38	0.090	0.034	1.30 - 1.41
Zn	mg/kg	47.9	4.13	8.6	289	47.9	2.79	0.30	47.4 - 48.3

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
C - elementary	g/kg	447	15.9	3.6	104	446	11.3	1.9	444.4 - 450.5
N - elementary	g/kg	19.8	0.74	3.7	149	19.8	0.52	0.08	19.70 - 19.94

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Crude fibre	g/kg	24.0	4.91	20.4	21	25.0	3.42	1.34	21.8 - 26.2
Total ash	g/kg	18.7	1.96	10.5	38	18.6	1.41	0.40	18.1 - 19.4

Indicative Values IPE 209

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Cl (as Cl)	g/kg	0.500	0.1663	33.3	49	0.490	0.1100	0.0297	0.452 - 0.547
Co	µg/kg	6.75	3.286	48.7	37	7.45	2.450	0.675	5.66 - 7.84
Rb	µg/kg	1240	87	7.1	12	1230	60	32	1184 - 1294
Se	µg/kg	17.0	5.77	34.0	27	16.9	3.92	1.39	14.7 - 19.3

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
delta 13C	‰ V-PDB	-26.2	0.34	1.3	11	-26.2	0.26	0.13	-26.42 - -25.97
delta 15N	‰ Air	3.62	0.239	6.6	11	3.63	0.174	0.090	3.46 - 3.77

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
ADF-ash-free	g/kg	32.2	4.34	13.5	14	32.3	2.99	1.45	29.8 - 34.7
NDF-ash-free	g/kg	113	30.6	27.0	13	116	22.7	10.6	95.1 - 132
Total fat	g/kg	26.1	4.43	17.0	15	26.5	3.00	1.43	23.6 - 28.5

Informative Values IPE 209

Method: Inorganic Chemical Composition

Element	Unit	Median	MAD	N	Results smaller than (<) Median of <	N
Ag	µg/kg	5.77	1.219	6		
As	µg/kg	7.35	2.548	26	50.00	30
B	mg/kg	1.49	0.847	170	3.00	51
Be	µg/kg	0.610	0.2735	6	20.000	16
Bi	µg/kg	9.41	3.505	4	30.00	7
Cr	µg/kg	69.9	36.00	34	200.0	31
Cs	µg/kg	1.16	0.080	5		
Ga	µg/kg	12.6	10.77	3		
Hg	µg/kg	2.00	1.370	23	5.00	25
I	µg/kg	43.0	33.00	5	50.0	6
Li	µg/kg	10.96	6.725	12	300.00	7
N - NH4 (as N)	mg/kg	28.2	19.06	6		
N - NO3 (as N)	mg/kg	14.6	6.40	12	50.5	8
Na	mg/kg	23.7	9.49	134	75.0	41
Pb	µg/kg	21.2	13.51	43	100.0	30
Sb	µg/kg	3.26	2.497	10	50.00	11
Sn	µg/kg	43.7	35.73	9	100.0	5
SO4 (as SO4)	g/kg	0.260	0.0620	3		
Ti	mg/kg	0.190	0.1200	7	8.125	6
V	µg/kg	7.85	3.690	13	50.00	16

Method: Real totals

Element	Unit	Median	MAD	N	Results smaller than (<) Median of <	N
Al	mg/kg	6.00	3.400	27	6.20	8
Si	mg/kg	54.2	13.00	3		

Method: Acid extractable (So-called totals)

Element	Unit	Median	MAD	N	Results smaller than (<) Median of <	N
Al	mg/kg	2.80	1.500	37	10.00	18
Si	mg/kg	100	47.3	5		

Method: Nutritional values

Element	Unit	Median	MAD	N
NDF-ash-containing	g/kg	144	39.2	4