WAGENINGEN EVALUATING PROGRAMS

FOR ANALYTICAL LABORATORIES

Certificate of Analysis

International Plant-Analytical Exchange

REFERENCE MATERIAL

IPE sample 203

WAGENINGEN
UNIVERSITY & RESEARCH

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 °C and milled to pass a 0.5 mm sieve.

This IPE sample 203 of Cabbage (leaf + Stalk) / Brassica oleracea from Netherlands is prepared for the WEPAL proficiency programs. The sample is used in 10 periods (or rounds). Only results from the last 5 periods are used. In this way the consensus values will reflect the latest 'state of the art' in the analytical techniques used in the laboratories. The results on which the values in this report are based were taken from the periods given in the following table.

Year	Round	Number
2023	4	4
2020	4	1
2020	3	3
2020	2	2
2020	1	4

Consensus Values   IPE 203

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
B	mg/kg	49.5	3.66	7.4	357	49.6	2.51	0.24	49.10	-	49.86
Cu	mg/kg	2.59	0.428	16.5	404	2.63	0.297	0.027	2.55	-	2.63
Fe	mg/kg	66.0	5.22	7.9	424	66.3	3.60	0.32	65.5	-	66.5
Mn	mg/kg	65.9	4.09	6.2	437	65.9	2.79	0.24	65.50	-	66.27
Zn	mg/kg	51.1	3.17	6.2	440	51.2	2.17	0.19	50.83	-	51.42
As	µg/kg	40.2	9.29	23.1	64	41.2	6.85	1.45	37.9	-	42.6
Cd	µg/kg	144	19.0	13.2	121	143	13.0	2.2	140.4	-	147.2
Co	µg/kg	60.6	10.81	17.8	75	60.1	7.58	1.56	58.1	-	63.1
Cr	µg/kg	2850	407	14.3	95	2890	282	52	2768	-	2934
Hg	µg/kg	10.4	1.58	15.2	63	10.4	1.11	0.25	9.99	-	10.78
Li	µg/kg	735	124.5	16.9	22	717	87.5	33.2	680	-	790
Mo	µg/kg	15100	1320	8.7	144	15000	940	140	14926	-	15362
Pb	µg/kg	241	37.6	15.6	95	243	26.4	4.8	234	-	249
Ba	mg/kg	5.87	0.489	8.3	34	5.91	0.322	0.105	5.70	-	6.04
Sb	µg/kg	35.2	7.87	22.4	21	37.5	5.76	2.15	31.6	-	38.8
Sr	mg/kg	32.2	2.93	9.1	28	32.0	2.05	0.69	31.0	-	33.3
Rb	µg/kg	20900	1460	7.0	16	21100	950	460	20100	-	21650
Ca	g/kg	17.9	1.01	5.6	457	17.9	0.70	0.06	17.82	-	18.01
Cl (as Cl)	g/kg	2.09	0.267	12.8	72	2.10	0.187	0.039	2.03	-	2.15
K	g/kg	47.6	2.86	6.0	472	47.5	2.00	0.16	47.36	-	47.88
Mg	g/kg	4.70	0.249	5.3	460	4.70	0.170	0.014	4.68	-	4.72
N - Kjeldahl (as N)	g/kg	29.1	1.32	4.5	275	29.0	0.90	0.10	28.90	-	29.21
N - NO3 (as N)	mg/kg	4730	367	7.8	24	4700	275	94	4572	-	4881
Na	mg/kg	1020	74	7.3	283	1010	51	6	1007	-	1025
P (as P)	g/kg	4.91	0.261	5.3	470	4.90	0.178	0.015	4.89	-	4.93
S (as S)	g/kg	8.25	0.600	7.3	285	8.22	0.418	0.044	8.18	-	8.32

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
C - elementary	g/kg	413	14.2	3.4	168	413	9.7	1.4	410.7	-	415.1
N - elementary	g/kg	31.9	1.02	3.2	236	31.9	0.70	0.08	31.79	-	32.05

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
delta 13C	‰ V-PDB	-32.1	0.20	0.6	32	-32.1	0.14	0.04	-32.20	-	-32.05
delta 15N	‰ Air	1.57	0.281	17.8	31	1.54	0.190	0.063	1.47	-	1.68

Consensus Values   IPE 203

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Crude fibre	g/kg	124	10.7	8.6	33	124	7.2	2.3	119.9	-	127.5
Total ash	g/kg	155	3.4	2.2	60	154	2.4	0.5	154.2	-	156.0
Total fat	g/kg	47.8	9.13	19.1	23	49.6	6.40	2.38	43.8	-	51.7

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Ni	µg/kg	194	66.6	34.4	55	203	47.3	11.2	176	-	212
Se	µg/kg	58.8	19.97	34.0	52	63.2	14.98	3.46	53.2	-	64.3
Sn	µg/kg	91.0	14.73	16.2	13	94.1	10.44	5.11	82.1	-	99.8
V	µg/kg	23.7	7.37	31.1	19	24.4	5.34	2.11	20.1	-	27.2

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Al	mg/kg	20.2	6.76	33.5	37	21.3	4.77	1.39	17.9	-	22.4

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Al	mg/kg	17.8	5.59	31.4	96	18.1	3.96	0.71	16.7	-	18.9

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
ADF-ash-free	g/kg	180	22.6	12.5	14	176	15.9	7.5	167	-	193
NDF-ash-free	g/kg	193	35.9	18.6	13	195	25.0	12.4	171	-	214

Method: Inorganic Chemical Composition

Element	Unit	Median	MAD	N		Results smaller than (<)	
						Median of <	**N**
I	µg/kg	57.0	14.00	7		75.0	8
Bi	µg/kg	-	-	0		59.0	7
Ti	mg/kg	2.67	2.446	11		6.25	13
Ag	µg/kg	3.10	0.030	3		10.00	6
Be	µg/kg	-	-	0		100	19
N - NH4 (as N)	mg/kg	140	29.1	4			
SO4 (as SO4)	g/kg	24.2	1.46	5			

Method: Real totals

Element	Unit	Median	MAD	N		Results smaller than (<)	
						Median of <	**N**
Si	mg/kg	155	37.3	6		500	9

Method: Acid extractable (So-called totals)

Element	Unit	Median	MAD	N
Si	mg/kg	232	136.3	14

Method: Nutritional values

Element	Unit	Median	MAD	N
Total monosaccharides	g/kg	142	8.0	3
Polysaccharides (starch)	g/kg	36.0	1.00	3