WAGENINGEN EVALUATING PROGRAMS

FOR ANALYTICAL LABORATORIES

Certificate of Analysis

International Plant-Analytical Exchange

REFERENCE MATERIAL

IPE sample 237

WAGENINGEN
UNIVERSITY & RESEARCH

Certificate of Analysis IPE 237

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 237 of Cacao leaf / Theobroma cacao from Ecuador is prepared for the WEPAL proficiency programs. The sample is used in 2 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
2021	3	3
2017	4	3

Consensus Values IPE 237

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
As	µg/kg	101	12.4	12.3	34	101	8.6	2.7	96.6 - 105
B	mg/kg	61.0	4.08	6.7	146	60.9	2.80	0.42	60.4 - 61.7
Ba	mg/kg	56.3	4.16	7.4	20	56.0	2.82	1.16	54.4 - 58.2
Ca	g/kg	17.7	1.11	6.3	191	17.6	0.77	0.10	17.50 - 17.82
Cd	µg/kg	2520	308	12.2	63	2510	221	49	2440 - 2595
Cl (as Cl)	g/kg	0.843	0.2034	24.1	27	0.850	0.1370	0.0489	0.762 - 0.923
Co	µg/kg	3780	301	8.0	47	3790	210	55	3693 - 3869
Cr	µg/kg	230	54.5	23.8	34	242	39.5	11.7	211 - 249
Cu	mg/kg	23.5	1.92	8.2	187	23.4	1.35	0.18	23.21 - 23.76
Fe	mg/kg	116	11.9	10.2	185	115	8.1	1.1	113.9 - 117.4
Hg	µg/kg	10.7	1.85	17.4	20	10.8	1.22	0.52	9.81 - 11.5
K	g/kg	17.3	1.15	6.7	203	17.3	0.79	0.10	17.19 - 17.51
Mg	g/kg	6.30	0.336	5.3	194	6.28	0.235	0.030	6.25 - 6.35
Mn	mg/kg	308	19.6	6.4	186	305	13.5	1.8	305.1 - 310.8
Mo	µg/kg	298	38.6	13.0	51	301	27.0	6.8	287 - 308
N - Kjeldahl (as N)	g/kg	20.6	0.79	3.8	126	20.6	0.54	0.09	20.44 - 20.72
Na	mg/kg	191	28.9	15.1	108	190	20.0	3.5	186 - 197
Ni	µg/kg	7360	817	11.1	37	7310	563	168	7092 - 7637
P (as P)	g/kg	2.30	0.144	6.2	199	2.30	0.100	0.013	2.28 - 2.32
Pb	µg/kg	163	36.1	22.1	41	164	25.4	7.0	152 - 174
S (as S)	g/kg	2.61	0.224	8.6	102	2.60	0.157	0.028	2.56 - 2.65
Se	µg/kg	94.4	13.23	14.0	21	95.8	9.17	3.61	88.4 - 100
Zn	mg/kg	79.2	5.94	7.5	189	79.3	4.09	0.54	78.4 - 80.1

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Al	mg/kg	126	29.7	23.6	17	129	19.0	9.0	111 - 141
C - elementary	g/kg	470	9.9	2.1	69	469	6.5	1.5	467.5 - 472.2
N - elementary	g/kg	21.5	0.63	2.9	91	21.4	0.43	0.08	21.32 - 21.58

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Al	mg/kg	83.8	11.41	13.6	37	83.7	7.56	2.34	80.0 - 87.6

Consensus Values IPE 237

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Total ash	g/kg	112	6.3	5.6	30	111	4.2	1.4	109.2 - 113.9

Indicative Values IPE 237

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Li	µg/kg	256	28.8	11.3	8	257	19.9	12.7	232 - 279
Rb	µg/kg	3450	281	8.1	8	3400	195	124	3222 - 3679
Sr	mg/kg	119	10.2	8.6	15	119	6.9	3.3	113 - 124
V	µg/kg	360	24.2	6.7	15	359	17.0	7.8	347 - 373

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
ADF-ash-free	g/kg	458	50.4	11.0	9	458	34.3	21.0	420 - 496
Crude fibre	g/kg	321	24.5	7.6	14	327	17.0	8.2	307 - 335
NDF-ash-free	g/kg	584	122.0	20.9	9	572	91.1	50.8	493 - 676
Total fat	g/kg	44.5	13.42	30.2	12	45.4	9.29	4.84	36.1 - 52.9

Informative Values IPE 237

Method: Inorganic Chemical Composition

Element	Unit	Median	MAD	N	Results smaller than (<) Median of <	N
Ag	µg/kg	9.74	5.765	4		
Be	µg/kg	4.22	0.940	3	25.00	8
Bi	µg/kg	-	-	0	30.0	5
I	µg/kg	480	40.0	7		
N - NO3 (as N)	mg/kg	53.7	36.94	5		
Sb	µg/kg	10.20	3.116	9		
Sn	µg/kg	106	13.0	7		
SO4 (as SO4)	g/kg	3.95	2.874	3		
Ti	mg/kg	4.70	0.530	7		

Method: Acid extractable (So-called totals)

Element	Unit	Median	MAD	N
Si	mg/kg	440	391.3	5

Method: Other determinations

Element	Unit	Median	MAD	N
delta 13C	‰ V-PDB	-28.3	0.11	7
delta 15N	‰ Air	5.00	0.190	7

Method: Nutritional values

Element	Unit	Median	MAD	N
NDF-ash-containing	g/kg	704	108.3	3