WEPAL-QUASIMEME

Certificate of Analysis

International Plant-Analytical Exchange

REFERENCE MATERIAL

IPE sample 237

2026-Jul-30

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, the mean and standard deviation are calculated using all reported data when at least 4 results are left after removal of reported 'lower than' (<) and 0 (= zero) values. No outliers are removed.

This report is divided into two sections: Consensus Values and Indicative Values. The division is made on the reliability of the data. Consensus Values are based on at least 8 results and a maximum relative uncertainty of 6.25%. Indicative Values are based on a maximum relative uncertainty of 35% and a minimum of 4 and maximum of 7 results, or a relative uncertainty greater than 6.25% when there are at least 8 results.

For each measurand the following parameters are given: mean, standard deviation, coefficient of variation, number of results, median, MAD (Median of Absolute Deviation), the uncertainty of the mean (consensus or indicative) value and the relative uncertainty.

Please note: Most WEPAL-QUASIMEME reference materials are found to be stable over the long term (>10 years) for most measurand/matrix combinations. There are a few exceptions known to us as being less stable over the long term. These are organotins in sediment (MS6), ASP in shellfish (BT7), some PAHs and PCBs in sediment (SETOC) and N-NH_4 (as N) & N-NO_3 (as N) in clay soils (ISE).

All values, expressed on a weight basis (kg or %), are reported as oven-dried (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 237 of Cacao leaf / Theobroma cacao, from Ecuador, is prepared for the WEPAL proficiency programs. The sample has been used in 3 rounds. The results on which the values in this report are based were taken from the rounds given in the following table:

Year	Round	Number
2026	2	2
2021	3	3
2017	4	3

Consensus Values IPE 237

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
B	mg/kg	61.0	4.56	7.5	218	60.8	2.75	0.386	0.633
Cu	mg/kg	23.5	1.94	8.3	273	23.5	1.31	0.147	0.624
Fe	mg/kg	116	12.7	10.9	266	116	7.85	0.970	0.834
Mn	mg/kg	307	19.7	6.4	270	305	12.3	1.50	0.488
Zn	mg/kg	78.8	6.17	7.8	274	79.0	3.94	0.466	0.591
As	µg/kg	103	12.3	12.0	50	103	7.25	2.18	2.12
Cd	µg/kg	2535	244	9.6	89	2525	153	32.4	1.28
Co	µg/kg	3772	308	8.2	71	3780	204	45.7	1.21
Cr	µg/kg	228	68.7	30.1	48	242	39.5	12.4	5.43
Hg	µg/kg	10.5	2.27	21.5	33	10.9	1.11	0.493	4.68
Li	µg/kg	256	31.3	12.2	11	253	15.0	11.8	4.60
Mo	µg/kg	297	39.1	13.2	72	300	23.3	5.76	1.94
Ni	µg/kg	7481	662	8.9	58	7480	434	109	1.45
Pb	µg/kg	155	32.4	20.9	57	156	20.9	5.37	3.46
Se	µg/kg	93.1	16.1	17.2	36	93.8	10.8	3.35	3.59
Ba	mg/kg	55.9	4.27	7.6	29	55.4	2.49	0.991	1.77
V	µg/kg	368	31.4	8.6	22	365	14.5	8.38	2.28
Sr	mg/kg	120	11.1	9.2	21	119	6.35	3.02	2.52
Rb	µg/kg	3355	346	10.3	10	3341	193	137	4.08
Ca	g/kg	17.6	1.10	6.2	278	17.6	0.651	0.083	0.468
Cl (as Cl)	g/kg	0.824	0.178	21.6	42	0.835	0.124	0.034	4.16
K	g/kg	17.3	1.19	6.9	289	17.2	0.698	0.088	0.509
Mg	g/kg	6.31	0.350	5.6	280	6.30	0.202	0.026	0.415
N - Kjeldahl (as N)	g/kg	20.6	0.832	4.0	180	20.6	0.525	0.078	0.377
Na	mg/kg	189	28.4	15.0	160	188	15.6	2.80	1.49
P (as P)	g/kg	2.29	0.146	6.4	286	2.29	0.093	0.011	0.472
S (as S)	g/kg	2.60	0.227	8.7	155	2.60	0.140	0.023	0.875

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
C - elementary	g/kg	469	12.1	2.6	103	469	7.00	1.48	0.317
N - elementary	g/kg	21.4	0.797	3.7	142	21.4	0.435	0.084	0.390

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Al	mg/kg	86.0	14.4	16.8	53	86.0	7.70	2.48	2.88

Consensus Values IPE 237

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
delta 13C	‰ V-PDB	-28.3	0.263	0.9	17	-28.3	0.110	0.080	0.282
delta 15N	‰ Air	4.75	0.429	9.0	17	4.76	0.240	0.130	2.74

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Crude fibre	g/kg	320	20.8	6.5	18	324	14.0	6.13	1.91
ADF-ash-free	g/kg	460	51.0	11.1	13	459	32.7	17.7	3.84
NDF-ash-free	g/kg	553	78.1	14.1	13	562	61.7	27.1	4.89
Total ash	g/kg	111	5.94	5.4	44	111	3.51	1.12	1.01

Indicative Values IPE 237

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
I	µg/kg	469	89.7	19.1	10	486	55.5	35.4	7.55
Sb	µg/kg	8.05	5.52	68.5	10	8.74	2.31	2.18	27.1
Sn	µg/kg	97.1	19.4	20.0	10	99.0	11.0	7.69	7.91
Ti	mg/kg	4.26	0.771	18.1	10	4.45	0.540	0.305	7.15
Be	µg/kg	4.40	1.61	36.6	5	4.22	1.03	0.900	20.4
N - NO3 (as N)	mg/kg	43.0	35.7	83.1	8	49.7	22.7	15.8	36.7
SO4 (as SO4)	g/kg	2.97	1.48	49.7	5	3.20	0.754	0.826	27.8

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Al	mg/kg	123	36.3	29.5	25	129	28.3	9.08	7.37
Si	mg/kg	9214	804	8.7	4	9100	375	503	5.46
S - elementary	g/kg	2.57	0.410	15.9	4	2.57	0.187	0.256	9.95

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
NDF-ash-containing	g/kg	606	143	23.6	5	577	79.1	79.8	13.2
Total fat	g/kg	38.9	15.2	39.1	18	37.6	9.99	4.48	11.5