



**WAGENINGEN EVALUATING PROGRAMS
FOR ANALYTICAL LABORATORIES**

Certificate of Analysis



International Plant-Analytical Exchange

REFERENCE MATERIAL

IPE sample 241



Certificate of Analysis IPE 241

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 determinand 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.

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 241 of Cacao leaf / Theobroma cacao, from Ivory Coast, is prepared for the WEPAL proficiency programs. The sample has been 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
2023	2	2
2018	3	2



Consensus Values IPE 241

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
B	mg/kg	56.0	5.74	10.3	167	55.9	3.87	0.556	0.992
Cu	mg/kg	23.8	2.86	12.0	202	23.7	1.85	0.252	1.06
Fe	mg/kg	163	18.3	11.2	195	161	11.8	1.64	1.01
Mn	mg/kg	499	37.8	7.6	197	500	25.5	3.37	0.674
Zn	mg/kg	63.5	5.88	9.2	198	63.5	3.57	0.522	0.822
Cd	µg/kg	220	34.8	15.8	60	223	22.3	5.62	2.55
Co	µg/kg	6941	750	10.8	56	6962	455	125	1.81
Cr	µg/kg	509	140	27.4	45	522	92.8	26.0	5.11
Hg	µg/kg	17.1	3.60	21.1	29	17.4	2.03	0.837	4.90
Mo	µg/kg	345	92.2	26.7	53	355	55.0	15.8	4.59
Ni	µg/kg	16559	2169	13.1	47	16390	1410	396	2.39
Pb	µg/kg	287	85.0	29.6	48	294	50.3	15.3	5.34
Se	µg/kg	315	56.8	18.0	29	308	38.0	13.2	4.18
Ba	mg/kg	111	12.7	11.4	21	110	8.00	3.47	3.12
V	µg/kg	295	51.8	17.5	20	293	36.5	14.5	4.90
Sr	mg/kg	186	14.3	7.7	16	187	9.50	4.46	2.39
Ca	g/kg	18.5	1.36	7.4	204	18.6	0.880	0.119	0.643
K	g/kg	16.1	1.06	6.6	216	16.1	0.700	0.090	0.562
Mg	g/kg	6.89	0.495	7.2	205	6.86	0.340	0.043	0.627
N - Kjeldahl (as N)	g/kg	20.5	0.848	4.1	132	20.5	0.512	0.092	0.449
N - NO3 (as N)	mg/kg	123	16.8	13.7	11	120	10.0	6.34	5.16
Na	mg/kg	146	27.6	18.8	116	146	16.0	3.20	2.19
P (as P)	g/kg	1.77	0.119	6.7	210	1.78	0.068	0.010	0.582
S (as S)	g/kg	2.51	0.231	9.2	123	2.52	0.150	0.026	1.03

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
C - elementary	g/kg	453	15.6	3.4	62	453	9.74	2.47	0.546
N - elementary	g/kg	21.5	0.935	4.3	93	21.6	0.590	0.121	0.563

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Al	mg/kg	150	29.0	19.4	47	150	17.7	5.30	3.54



Consensus Values IPE 241

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
delta 13C	‰ V-PDB	-31.1	0.181	0.6	9	-31.2	0.070	0.075	0.242
delta 15N	‰ Air	6.33	0.194	3.1	9	6.27	0.100	0.081	1.27

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Crude fibre	g/kg	415	30.4	7.3	15	418	14.1	9.81	2.36
Total ash	g/kg	125	5.99	4.8	30	125	4.07	1.37	1.09



Indicative Values IPE 241

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
As	µg/kg	49.0	15.8	32.4	32	53.2	9.45	3.50	7.15
Li	µg/kg	102	25.1	24.7	8	105	10.5	11.1	10.9
Sb	µg/kg	19.6	6.89	35.2	9	20.8	3.75	2.87	14.7
Ti	mg/kg	7.27	1.76	24.2	12	7.33	0.935	0.634	8.72
Be	µg/kg	22.8	8.37	36.7	7	24.4	2.90	3.95	17.4
Rb	µg/kg	14592	1553	10.6	7	14847	953	734	5.03
Cl (as Cl)	g/kg	0.554	0.221	40.0	33	0.600	0.170	0.048	8.70

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Al	mg/kg	191	48.0	25.1	18	193	26.6	14.1	7.39

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
ADF-ash-free	g/kg	528	51.2	9.7	7	534	29.0	24.2	4.58
NDF-ash-free	g/kg	622	60.2	9.7	6	618	43.0	30.7	4.93
Total fat	g/kg	19.7	15.3	77.9	13	21.4	9.60	5.31	27.0