



**WAGENINGEN EVALUATING PROGRAMS
FOR ANALYTICAL LABORATORIES**

Certificate of Analysis



International Plant-Analytical Exchange

REFERENCE MATERIAL

IPE sample 199



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 199 of Oak-wood / *Quercus robur* from Finland is prepared for the WEPAL proficiency programs. The sample is used in 4 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	4	2
2018	4	4
2014	1	1
2010	1	4



Consensus Values IPE 199



Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
B	mg/kg	3.35	0.819	24.5	262	3.44	0.574	0.063	3.25	- 3.44
Ba	mg/kg	5.28	0.392	7.4	37	5.29	0.263	0.081	5.15	- 5.41
Ca	g/kg	0.697	0.0848	12.2	396	0.700	0.0600	0.0053	0.689	- 0.706
Cd	µg/kg	82.2	6.57	8.0	94	82.6	4.55	0.85	80.9	- 83.6
Co	µg/kg	30.9	5.68	18.4	65	30.0	4.00	0.88	29.5	- 32.3
Fe	mg/kg	41.6	7.35	17.6	371	42.0	5.03	0.48	40.9	- 42.4
K	g/kg	0.416	0.0719	17.3	384	0.420	0.0500	0.0046	0.409	- 0.423
Mg	g/kg	0.172	0.0173	10.1	386	0.170	0.0115	0.0011	0.170	- 0.174
Mn	mg/kg	70.9	5.71	8.0	388	71.0	3.90	0.36	70.3	- 71.5
Na	mg/kg	95.1	18.38	19.3	225	97.0	12.98	1.53	92.7	- 97.5
Sr	mg/kg	3.42	0.358	10.5	41	3.43	0.253	0.070	3.31	- 3.53
V	µg/kg	41.4	7.97	19.2	24	43.5	6.10	2.03	38.1	- 44.8
Zn	mg/kg	8.68	1.079	12.4	374	8.80	0.750	0.070	8.57	- 8.79

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
C - elementary	g/kg	503	12.6	2.5	115	503	8.5	1.5	501.1	- 505.8

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
delta 13C	‰ V-PDB	-26.0	0.18	0.7	18	-26.0	0.12	0.05	-26.11	- -25.94

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
Crude fibre	g/kg	697	33.5	4.8	24	694	23.5	8.5	683	- 711
Total ash	g/kg	3.15	0.666	21.2	44	3.20	0.455	0.126	2.94	- 3.35



Indicative Values IPE 199

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Ag	µg/kg	32.7	3.50	10.7	8	34.1	2.60	1.54	29.9	-	35.6
Bi	µg/kg	54.7	7.96	14.6	11	54.9	5.13	3.00	49.4	-	60.0
Cr	µg/kg	314	128.0	40.8	66	330	92.6	19.7	283	-	346
Cu	mg/kg	0.886	0.3735	42.1	311	0.930	0.2600	0.0265	0.845	-	0.928
Li	µg/kg	56.5	16.17	28.6	12	56.6	11.65	5.83	46.4	-	66.7
Ni	µg/kg	165	75.8	46.1	51	183	54.2	13.3	143	-	186
P (as P)	g/kg	0.0539	0.0158	29.3	343	0.0585	0.0115	0.0011	0.0522	-	0.0555
Pb	µg/kg	89.8	37.89	42.2	81	97.1	27.21	5.26	81.4	-	98.1
Rb	µg/kg	1760	57	3.2	12	1770	38	20	1722	-	1793
S (as S)	g/kg	0.0600	0.0165	27.6	195	0.0620	0.0120	0.0015	0.0577	-	0.0623
Sb	µg/kg	5.77	1.471	25.5	12	5.82	1.010	0.531	4.85	-	6.70

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Al	mg/kg	36.5	10.81	29.6	35	36.8	7.20	2.28	32.8	-	40.2

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Al	mg/kg	22.7	6.00	26.4	76	22.9	4.20	0.86	21.3	-	24.1

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
ADF-ash-free	g/kg	742	31.2	4.2	13	735	21.9	10.8	723	-	760
NDF-ash-free	g/kg	897	26.3	2.9	11	901	18.0	9.9	880	-	915



Informative Values IPE 199



Method: Inorganic Chemical Composition

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
As	µg/kg	20.1	9.15	30	100.0	52
Be	µg/kg	1.82	1.405	6	20.00	19
Cl (as Cl)	g/kg	0.210	0.1450	45	0.400	23
Cs	µg/kg	18.3	1.40	5		
F	mg/kg	0.630	0.1600	3		
Hg	µg/kg	2.57	0.870	33	20.00	35
I	µg/kg	80.6	40.50	6	50.0	5
Mo	µg/kg	26.9	12.26	53	159.5	62
N - Kjeldahl (as N)	g/kg	0.835	0.3016	224	1.400	27
N - NH4 (as N)	mg/kg	10.9	2.49	4		
N - NO3 (as N)	mg/kg	5.35	1.973	11	48.84	13
Se	µg/kg	10.40	6.845	22	50.00	37
Sn	µg/kg	27.5	10.40	15	100.0	7
SO4 (as SO4)	g/kg	0.100	0.0350	7		
Ti	mg/kg	1.055	0.4425	8	10.000	7

Method: Real totals

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
N - elementary	g/kg	0.990	0.3800	159	1.041	14

Method: Acid extractable (So-called totals)

Element	Unit	Median	MAD	N
Si	mg/kg	91.1	54.02	5

Method: Other determinations

Element	Unit	Median	MAD	N
delta 15N	‰ Air	-1.35	1.750	10

Method: Nutritional values

Element	Unit	Median	MAD	N
NDF-ash-containing	g/kg	892	26.0	5
Total fat	g/kg	9.80	4.80	19