



**WAGENINGEN EVALUATING PROGRAMS
FOR ANALYTICAL LABORATORIES**

Certificate of Analysis

BIMEP

International Biomass Exchange Program

REFERENCE MATERIAL

BIMEP sample 422

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 BIMEP samples are dried at 40 °C and milled to pass a 0.5 mm sieve.

This BIMEP sample 422 of Saw dust / Quercus robur from Finland is prepared for the WEPAL proficiency programs. The sample is used in 15 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. It will also give a better estimate of the concentrations of non-stable or volatile determinands. The results on which the values in this report are based were taken from the periods given in the following table.

Year	Round	Number
2020	1	2
2017	4	4
2016	1	3
2014	4	3
2014	3	1

Consensus Values BIMEP 422

Method: General Analysis

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Ash	% (m/m)	0.303	0.0679	22.4	49	0.313	0.0473	0.0121	0.283	-	0.322
Moisture	% (m/m)	7.55	0.426	5.6	50	7.50	0.300	0.075	7.43	-	7.67
Calorific Value (gross)	MJ/kg	20.2	0.35	1.7	47	20.3	0.22	0.06	20.13	-	20.33
Volatile Matter	% (m/m)	84.6	0.97	1.2	35	84.8	0.70	0.21	84.22	-	84.89

Method: Elementary Analysis

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Carbon (C)	% (m/m)	51.0	1.21	2.4	42	50.9	0.86	0.23	50.66	-	51.41
Hydrogen (H)	% (m/m)	6.14	0.244	4.0	40	6.16	0.165	0.048	6.06	-	6.22

Method: Minor Elements

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Mn	mg/kg	70.5	12.13	17.2	18	71.1	7.66	3.57	64.5	-	76.5

Indicative Values BIMEP 422

Method: Elementary Analysis

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Oxygen (O)	% (m/m)	42.6	1.68	3.9	10	42.3	1.17	0.66	41.4	-	43.8

Method: Major Elements

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Ca	g/kg	0.766	0.3481	45.4	15	0.700	0.2440	0.1124	0.574	-	0.958
K	g/kg	0.396	0.0372	9.4	15	0.400	0.0270	0.0120	0.375	-	0.416
Mg	g/kg	0.179	0.0377	21.1	15	0.180	0.0250	0.0122	0.158	-	0.199
Na	g/kg	0.0807	0.0275	34.0	15	0.0920	0.0220	0.0089	0.0656	-	0.0958
P	g/kg	0.0565	0.0182	32.2	15	0.0580	0.0120	0.0059	0.0465	-	0.0665

Method: Minor Elements

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Cd	mg/kg	0.0820	0.0207	25.3	8	0.0880	0.0150	0.0092	0.0651	-	0.0989
Zn	mg/kg	9.05	2.557	28.2	14	9.22	1.840	0.854	7.59	-	10.5



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Informative Values BIMEP 422

Method: Elementary Analysis

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
Nitrogen (N)	% (m/m)	0.1000	0.0435	42		
Cl	g/kg	0.100	0.0650	29	0.250	6
S	g/kg	0.1050	0.0435	24	0.1000	12

Method: Water Soluble Elements

Element	Unit	Median	MAD	N
Cl	g/kg	0.0990	0.0245	4
K	g/kg	0.293	0.0650	7
Na	g/kg	0.0980	0.0210	7

Method: Major Elements

Element	Unit	Median	MAD	N
Al	g/kg	0.0455	0.0255	14
Fe	g/kg	0.0670	0.0305	14
Si	g/kg	0.166	0.0580	13

Method: Minor Elements

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
As	mg/kg	0.298	0.1190	4	0.400	8
Ba	mg/kg	8.09	3.605	10		
Be	mg/kg	-	-	0	0.100	8
Co	mg/kg	-	-	0	0.100	7
Cr	mg/kg	1.90	0.600	7		
Cu	mg/kg	1.36	0.879	12		
F	mg/kg	12.0	5.00	8		
Hg	mg/kg	0.0024	0.0009	5	0.0100	7
Mo	mg/kg	0.125	0.0075	4	0.250	5
Ni	mg/kg	0.888	0.6625	10		
Pb	mg/kg	0.630	0.5255	10	0.900	5
Sb	mg/kg	-	-	0	0.500	9
Se	mg/kg	-	-	0	0.300	10
Sn	mg/kg	0.386	0.1100	3	0.100	7
Te	mg/kg	0.240	0.1300	5		
Ti	mg/kg	3.43	1.644	13		



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			Informative Values		BIMEP 422	
V	mg/kg	0.410	0.2195	6	0.250	6