WAGENINGEN EVALUATING PROGRAMS

FOR ANALYTICAL LABORATORIES

Certificate of Analysis

International Manure and Refuse Sample Exchange Program

REFERENCE MATERIAL

MARSEP sample 267

WAGENINGEN
UNIVERSITY & RESEARCH

marsep

Certificate of Analysis MARSEP 267

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

This MARSEP sample 267 of Sewage Sludge from Switzerland is prepared for the WEPAL proficiency programs. The sample is used in 9 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. 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
2020	2	2
2018	1	3
2015	4	1
2013	4	4

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Consensus Values MARSEP 267

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Al	g/kg	14.7	1.26	8.6	54	14.6	0.84	0.21	14.31 - 14.99
As	mg/kg	6.10	0.641	10.5	58	6.18	0.430	0.105	5.93 - 6.27
B	mg/kg	27.8	4.39	15.8	37	28.0	3.08	0.90	26.4 - 29.3
Ba	mg/kg	404	54.9	13.6	24	411	37.8	14.0	381 - 427
Be	µg/kg	222	24.6	11.1	19	222	17.7	7.1	210 - 234
TC =totalC (org+inorg)	g/kg	277	13.9	5.0	25	278	9.8	3.5	271 - 282
Ca	g/kg	56.5	2.67	4.7	121	56.2	1.88	0.30	56.0 - 57.0
Cd	mg/kg	1.48	0.131	8.8	127	1.49	0.090	0.015	1.46 - 1.51
Co	mg/kg	7.56	0.440	5.8	105	7.56	0.290	0.054	7.48 - 7.65
Cr	mg/kg	57.0	5.52	9.7	122	56.8	3.80	0.63	56.0 - 57.9
Cu	mg/kg	435	19.3	4.4	133	435	13.0	2.1	432.1 - 438.7
Fe	g/kg	76.0	3.41	4.5	89	75.6	2.35	0.45	75.2 - 76.7
Hg	µg/kg	1170	96	8.2	112	1150	66	11	1147 - 1183
Mg	g/kg	5.11	0.282	5.5	128	5.11	0.195	0.031	5.06 - 5.16
Mn	mg/kg	369	18.5	5.0	85	368	12.4	2.5	365 - 373
Mo	mg/kg	6.54	0.752	11.5	106	6.45	0.522	0.091	6.39 - 6.68
N	g/kg	34.6	0.88	2.5	122	34.6	0.60	0.10	34.47 - 34.79
Na	g/kg	0.384	0.0400	10.4	58	0.393	0.0275	0.0066	0.374 - 0.395
Ni	mg/kg	57.2	3.84	6.7	120	57.1	2.65	0.44	56.5 - 57.9
P	g/kg	32.9	2.02	6.1	136	32.7	1.40	0.22	32.56 - 33.24
Pb	mg/kg	83.9	5.55	6.6	122	84.0	3.90	0.63	82.9 - 84.9
S	mg/kg	7930	891	11.2	43	7730	647	170	7659 - 8208
Sb	µg/kg	4710	772	16.4	23	4450	549	201	4381 - 5047
Se	µg/kg	1960	340	17.4	23	2000	245	89	1809 - 2102
Sn	mg/kg	30.2	5.15	17.0	19	29.7	3.67	1.48	27.8 - 32.7
V	mg/kg	14.1	2.10	14.9	37	14.2	1.40	0.43	13.4 - 14.8
Zn	mg/kg	893	44.1	4.9	133	894	30.0	4.8	885 - 900

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
AOX	mg/kg	307	13.8	4.5	28	307	9.5	3.3	302 - 312
loss-on-ignition	%	51.9	0.69	1.3	108	51.9	0.48	0.08	51.75 - 52.02

Indicative Values MARSEP 267

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Ag	µg/kg	18900	660	3.5	11	18900	400	250	18477 - 19351
K	g/kg	1.33	0.372	27.9	131	1.32	0.250	0.041	1.27 - 1.40
Sr	mg/kg	272	36.4	13.4	11	279	25.6	13.7	248 - 296
Tl	µg/kg	77.5	18.99	24.5	11	80.0	13.50	7.16	64.9 - 90.1

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
dry weight	%	93.7	0.92	1.0	14	93.4	0.67	0.31	93.1 - 94.2

Informative Values MARSEP 267

Method: Inorganic Chemical Composition

Element	Unit	Median	MAD	N
Bi	µg/kg	3560	120	4
Li	mg/kg	6.79	0.438	6
S - SO4 (as S)	mg/kg	7650	828	7
Ti	mg/kg	162	82.0	9

Method: Other determinations

Element	Unit	Median	MAD	N
residu-on-ignition	%	47.8	0.88	6