**WAGENINGEN EVALUATING PROGRAMS**

**FOR ANALYTICAL LABORATORIES**

# Certificate of Analysis


**International Manure and Refuse Sample Exchange Program**

**REFERENCE MATERIAL**

**MARSEP sample 225**

WAGENINGEN
UNIVERSITY & RESEARCH

marsep

# Certificate of Analysis MARSEP 225

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

This MARSEP sample 225 of Compost, from Switzerland, is prepared for the WEPAL proficiency programs. The sample has been used in 6 periods (or rounds). Only results from the last 5 periods are used. This way, the consensus values reflect the latest 'state of the art' analytical techniques used by 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 |
|---|---|---|
| 2019 | 4 | 2 |
| 2016 | 4 | 1 |
| 2015 | 4 | 3 |
| 2012 | 3 | 1 |
| 2010 | 1 | 2 |

marsep

# Consensus Values MARSEP 225

**Method: Inorganic Chemical Composition**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| Ag | µg/kg | 3871 | 710 | 18.3 | 17 | 4000 | 410 | 215 | 5.56 |
| Al | g/kg | 8.91 | 1.61 | 18.1 | 47 | 8.79 | 1.03 | 0.294 | 3.30 |
| As | mg/kg | 2.71 | 0.569 | 20.9 | 54 | 2.80 | 0.308 | 0.097 | 3.56 |
| Ba | mg/kg | 139 | 17.6 | 12.7 | 24 | 140 | 12.0 | 4.49 | 3.24 |
| Be | µg/kg | 186 | 34.1 | 18.3 | 16 | 195 | 21.0 | 10.7 | 5.73 |
| Ca | g/kg | 315 | 16.2 | 5.1 | 128 | 316 | 10.2 | 1.79 | 0.569 |
| Cd | mg/kg | 0.754 | 0.082 | 10.9 | 126 | 0.756 | 0.051 | 0.009 | 1.21 |
| Co | mg/kg | 2.32 | 0.231 | 10.0 | 109 | 2.30 | 0.120 | 0.028 | 1.19 |
| Cr | mg/kg | 24.2 | 3.17 | 13.1 | 131 | 24.1 | 2.05 | 0.346 | 1.43 |
| Cu | mg/kg | 102 | 7.32 | 7.2 | 139 | 102 | 4.63 | 0.777 | 0.763 |
| Fe | g/kg | 10.6 | 0.781 | 7.4 | 81 | 10.6 | 0.430 | 0.109 | 1.02 |
| Hg | µg/kg | 306 | 49.8 | 16.3 | 111 | 304 | 26.2 | 5.90 | 1.93 |
| K | g/kg | 0.749 | 0.194 | 25.8 | 132 | 0.753 | 0.127 | 0.021 | 2.81 |
| Mg | g/kg | 2.65 | 0.214 | 8.1 | 135 | 2.65 | 0.154 | 0.023 | 0.867 |
| Mn | mg/kg | 136 | 14.4 | 10.6 | 76 | 137 | 8.74 | 2.06 | 1.52 |
| Mo | mg/kg | 1.73 | 0.267 | 15.4 | 94 | 1.78 | 0.175 | 0.034 | 1.98 |
| Na | g/kg | 0.311 | 0.047 | 15.0 | 54 | 0.306 | 0.028 | 0.008 | 2.55 |
| Ni | mg/kg | 8.51 | 1.11 | 13.0 | 124 | 8.50 | 0.625 | 0.124 | 1.46 |
| N | g/kg | 9.60 | 0.355 | 3.7 | 130 | 9.59 | 0.209 | 0.039 | 0.406 |
| P | g/kg | 6.93 | 0.438 | 6.3 | 138 | 6.92 | 0.271 | 0.047 | 0.673 |
| Pb | mg/kg | 35.6 | 4.52 | 12.7 | 131 | 35.4 | 3.04 | 0.494 | 1.39 |
| Sb | µg/kg | 1175 | 181 | 15.4 | 17 | 1160 | 111 | 55.0 | 4.68 |
| Sn | mg/kg | 6.22 | 1.29 | 20.7 | 19 | 6.16 | 0.766 | 0.369 | 5.94 |
| Sr | mg/kg | 161 | 21.7 | 13.5 | 12 | 161 | 16.4 | 7.85 | 4.88 |
| V | mg/kg | 9.94 | 1.65 | 16.6 | 35 | 10.0 | 0.800 | 0.349 | 3.51 |
| Zn | mg/kg | 293 | 21.8 | 7.4 | 138 | 293 | 14.3 | 2.32 | 0.792 |
| S | mg/kg | 5169 | 713 | 13.8 | 33 | 5131 | 344 | 155 | 3.00 |
| TC =totalC (org+inorg) | g/kg | 115 | 17.5 | 15.2 | 25 | 115 | 10.7 | 4.36 | 3.81 |

**Method: Other determinations**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| loss-on-ignition | % | 9.38 | 1.01 | 10.8 | 111 | 9.46 | 0.650 | 0.120 | 1.28 |

## Indicative Values MARSEP 225

**Method: Inorganic Chemical Composition**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| B | mg/kg | 7.56 | 3.42 | 45.2 | 27 | 7.76 | 1.49 | 0.822 | 10.9 |
| Bi | µg/kg | 570 | 37.6 | 6.6 | 4 | 571 | 26.0 | 23.5 | 4.13 |
| Li | mg/kg | 4.13 | 2.47 | 59.8 | 11 | 4.70 | 1.39 | 0.931 | 22.5 |
| S - SO4 (as S) | mg/kg | 3808 | 2180 | 57.3 | 9 | 4707 | 1059 | 909 | 23.9 |
| Se | µg/kg | 482 | 140 | 29.0 | 20 | 477 | 83.0 | 39.1 | 8.10 |
| Ti | mg/kg | 80.5 | 49.7 | 61.7 | 8 | 92.3 | 27.5 | 22.0 | 27.3 |
| Tl | µg/kg | 57.9 | 27.4 | 47.3 | 7 | 67.3 | 15.3 | 13.0 | 22.4 |

**Method: Other determinations**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| AOX | mg/kg | 85.3 | 26.6 | 31.2 | 33 | 84.8 | 18.2 | 5.79 | 6.78 |
| dry weight | % | 95.3 | 0.520 | 0.5 | 6 | 95.2 | 0.215 | 0.265 | 0.278 |