ARTIFICIAL FERTILIZERS

water content determination

Artificial fertilizers are chemicals used to enrich the soil with such macroelements as nitrogen, phosphorus, potassium, calcium, etc. To produce them is to mix numerous ingredients in controlled conditions in order to achieve high quality and efficiency. The composition and number of substances in artificial fertilizers is legally regulated. Most artificial fertilizers are of hygroscopic nature so absorption of moisture from the environment is possible. This applies to production and further fertilization. The main problems related to excessive water content in fertilizers is granule cracking, tendency to lump, distribution issues, engineering devices clogging. For this reason the water content in artificial fertilizers must be strictly supervised. The water content testing is therefore necessary during production and final inspection of fertilizers and during their storage. The reliable and fast method that can be applied in these processes includes the use of Radwag moisture analyzers.



The application note includes basic information for validation of the artificial fertilizer drying method with the use of MA R, MA X2, MA X7 and MA 5Y moisture analyzers series by Radwag Wagi Elektroniczne. The application note may be the basis for elaborating own drying method with special regard to distinctive features of the product in question.

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TERMS

ACCURACY of determining water / dry matter content is the difference between the result of the water / dry matter content received in the moisture analyzer method and the result of the water / dry matter content received while drying the same sample through a reference method.

PRECISION is a degree of compliance between independent results of the test, received in specific conditions. The measure of precision is a standard deviation from a series of several measurements.

REFERENCE METHOD

The reference method parameters are usually specified in standards or other discipline-specific documents as the so-called guides. If such documents are unavailable, the drying temperature that does not cause the sample to change colors is used. Such an approach applies to previously dehydrated products and raw products.

SAMPLE PREPARATION

Before testing, the sample must be stored in a tightly sealed container. Most artificial fertilizers take a form of granules. Before testing, mechanically fragment the sample to reach small pieces.

ACCESSORIES

Laboratory dryer, glass weighing vessels with a lid, AS 220.X2 analytical balance, laboratory spoon.

METHOD DESCRIPTION

Place the sample with a mass of ca. 5 g in pre-dried glass weighing vessels. Specify the real mass of the sample in question with the use of the balance whose weighing accuracy is 0.1 mg (AS 220.X2). Put weighing vessels with the sample and lids in the temperature-controlled laboratory dryer. Dry samples at the temperature of 105°C for 3 hours. After this period, remove vessels and put into the desiccator to let them cool down and weigh afterwards. Place samples in the laboratory dryer again and keep on drying them for 30 minutes. Cool them down and weigh again. Repeat the procedure until you obtain a stable sample mass or record the sample mass growth after drying.

RESULTS

Sample name	**ARTIFICIAL FERTILIZERS**			
Type	**LUBOFOS** (for beetroots)	**LUBOFOSKA** (3.5/10/20)	**SUPERFOSFAT** (granulated)	**SUPERFOSFAT** (powdery)
Water content (%)	3.73	2.26	2.07	11.29
Standard deviation (%)	0.03	0.01	0.03	0.10

ARTIFICIAL FERTILIZERS – WATER CONTENT ANALYSIS WITH THE MOISTURE ANALYZER

The water content testing with the use of the moisture analyzer (IR radiation) entails two phenomena: convection and radiation. The sample temperature rises from outer layers to the bottom of the sample. The temperature gradient in the sample structure minimizes through optimization of the thickness of the dried sample and drying temperature.

SAMPLE PREPARATION

Before testing, the sample must be stored in a tightly sealed container. Most artificial fertilizers take a form of granules. Before testing, mechanically fragment the sample to reach small pieces.

ACCESSORIES

MA R, MA X2, MA X7 or MA 5Y moisture analyzer, laboratory spoon, disposable aluminum weighing pans.

METHOD DESCRIPTION

Set drying parameters presented below. Distribute a thin layer of the fragmented sample with a mass of ca. 8 g throughout the weighing pan. Lock the drying chamber manually or automatically.

DRYING PARAMETERS / RESULTS

Sample name	**ARTIFICIAL FERTILIZERS**			
Type	**LUBOFOS** (for beetroots)	**LUBOFOSKA** (3.5/10/20)	**SUPERFOSFAT** (granulated)	**SUPERFOSFAT** (powdery)
Drying profile	Standard			
Drying temperature	130°C		120°C	130°C
Sample mass (g)	~ 12			
End of analysis	Auto 2	Auto 1	Auto 2	Auto 1
Water content (%)	3.84	2.11	2.20	11.24
Standard deviation (%)	0.04	0.11	0.05	0.40
Analysis time $\acute{x}$ (min)	10	6	6	4

ACCURACY OF THE MA R, MA X2, MA X7, MA 5Y METHOD

Type	**LUBOFOS** (for beetroots)	**LUBOFOSKA** (3.5/10/20)	**SUPERFOSFAT** (granulated)	**SUPERFOSFAT** (powdery)
Moisture – Ref. (%)	3.73 ± 0.03	2.26 ± 0.01	2.07 ± 0.03	11.29 ± 0.10
Moisture – MA (%)	3.84 ± 0.04	2.11 ± 0.11	2.20 ± 0.05	11.24 ± 0.40
Analysis accuracy (%)	|0.11|	|0.15|	|0.13|	|0.05|

RESERVATION

The method in question has been verified by the Research Laboratory, yet the results do not include factors arising from diversity of tested samples, operators' personal skills as well as measuring capability used by moisture analyzer users. For this reason Radwag shall not be held responsible for drying parameters but they can be used to elaborate own drying method.