SLUDGE

dry matter content determination

The wastewater treatment plant processes the input product, that is sewage, into the output product, that is pure water, dry matter of sludge, mineral-organic fertilizer, biogas. Sludge handling in the wastewater treatment plant is concerned with physical, chemical and biological processes that reduce the volume of deposits and eliminate potential emergence of burdensome aromas. The biological method of sewage treatment consists in growing microorganisms in the form of flocculent suspension – activated sludge. Activated sludge microorganisms use pollution existing in deposits in oxygen processes of metabolism as sources of energy or building substances. The amount of activated sludge emerging in physicochemical and biochemical processes must be periodically inspected because too high density of the deposit prevents successful aeration of the activated sludge chamber. The measure of the activated sludge amount is the dry matter of the deposit that can be quickly and precisely specified with the use of Radwag moisture analyzers.



The application note includes basic information for validation of the sludge 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 sludge dry matter content has been specified in line with the requirements of the PN-EN 12880 “Specification of sludge – dry residue and water content determination” standard.

SAMPLE PREPARATION

Liquid sludge is usually a mixture that is subject to sedimentation relatively early. Before testing, fluid samples were mixed and a homogeneous part of each sample was collected for testing. The remaining samples of sludge that did not require mixing were dried in the condition of that time (solid, partially semi-fluid).

ACCESSORIES

Dryer, quartz sand, weighing vessels with a lid, rods, AS 220.X2 balance, laboratory spoon.

METHOD DESCRIPTION

Weigh glass vessels with a glass rod and pre-dried quartz sand in the amount of ca 15 g.
Mix the semi-fluid sample with a mass of ca. 5 g and then place in glass weighing vessels on pre-dried quartz sand. Mix the sample with sand by means of the glass rod that must be left in the vessel. The application of sand as a foundation is aimed at eliminating the creation of the shell on the surface of the sample in question. Weigh vessels again and 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). Place weighing vessels with the sample and lids in the temperature-controlled laboratory dryer. Dry samples at the temperature of 105^{o}C for 3 hours. After this period, remove vessels and place in 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 the down and weigh again. Repeat the procedure until you obtain a stable sample mass or record the sample mass growth after drying. Calculate the dry matter content as the quotient of the post-drying sample mass (m2) and pre-drying sample mass (m1).

RESULTS

Sample name	Deposit after drying	Fermented deposit after centrifuging	Deposit from dephosphatation chamber
Dry matter (%)	98.32	5.96	0.84
Standard deviation (%)	0.14	0.25	0.05

SLUDGE – DRY MATTER CONTENT ANALYSIS WITH THE MOISTURE ANALYZER

The scope of optimizing the sludge drying method depends on the structure of the specific sample, solid body – semi-fluid sample. As a rule optimization aims to obtain the precise result as quickly as possible.

SAMPLE PREPARATION

The sample must be stored in tightly sealed containers (packaging). Mix semi-fluid samples before testing, solid samples must be mechanically fragmented into smaller particles.

ACCESSORIES

MA R, MA X2, MA X7 or MA 5Y moisture analyzer, glass weighing vessels with a lid, laboratory spoon, quartz sand.

METHOD DESCRIPTION

Set drying parameters presented below. Mechanically fragmented solid samples – collect the sample with a mass of ca. 1.5 ÷ 2 g and distribute a thin layer of the sample throughout the weighing pan. With regard to samples whose dry matter content is ca. 20% ÷ 30%, distribute a thin layer of the sample with a mass of ca. 2 ÷ 3 g throughout the weighing pan. Semi-fluid samples – place the sample in the amount of ca. 2 ÷ 3 g on quartz sand. Lock the drying chamber manually or automatically.

DRYING PARAMETERS / RESULTS

Sample name	Deposit after drying	Fermented deposit after centrifuging	Deposit from dephosphatation chamber
Drying profile	Standard		
Drying temperature	90°C	105°C	105°C
Sample mass (g)	~ 2.5	~ 2.2	~ 1.8
End of analysis	Auto 2		
Dry matter (%)	97.10	5.89	0.79
Standard deviation (%)	0.37	0.12	0.02
Analysis time $\acute{x}$ (min)	03:35	08:24	14:05

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

Sample name	Deposit after drying	Fermented deposit after centrifuging	Deposit from dephosphatation chamber
Dry matter (%) – Ref.	98.32 ± 0.14	5.96 ± 0.25	0.84 ± 0.05
Dry matter (%) – MA	97.10 ± 0.37	5.89 ± 0.12	0.79 ± 0.02
Analysis accuracy (%)	|1.22|	|0.07|	|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.