DRY MASS
QUICKER AND EASIER
WITH A MOISTURE ANALYZER

Dry mass and dissolving substances are parameters which not long ago were characteristics to drinking water quality, surface water, gutter or soil. Presently, the importance of above parameters has decreased. Norms for dry mass or dissolved substances are specified in just a few standards.

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Dry mass and dissolving substances are parameters which not long ago were characteristics to drinking water quality, surface water, gutter or soil. Presently, the importance of above parameters has decreased. Norms for dry mass or dissolved substances are specified in just a few legal acts.

Environment Ministry regulation on means of classification of uniform surface water status from 20th August 2008, has determined maximal permissible values for dissolving substances in flowing water class I – 500 mg/l and class II – 800 mg/l. Regulation of Health Ministry on natural mineral water, natural spring water, and determination of their mineral components is denoted as dry mass. It is a basis for classification of mineral water:

- Water with low mineral content < 500 mg/l
- Water with average mineral content 500 – 1000 mg/l
- Water with high mineral content >1500 mg/l

One of the parameters for acceptance of water for storage on storage yards with specific category is concentration value of dissolving substances in water extracts. It is obtained by standard wash-out tests. In this case maximal permissible values is very wide and accepts values between 2500 mg/kg and 100 000 mg/kg of wastes.

On the other hand, even while quick scrolling through web sites of laboratories which perform environmental tests, sets a conclusion, that there is still a need for determination of dry mass and dissolved substance. Laboratories do such tests according to standard norm PN-78 C-04541 or their own procedures.

Polish norm specified a procedure according to which water should be evapourated and dried till dry mass in such a volume, that its remaining substances are within 10-250 mg. Then, the remaining should be dried till obtaining of dry mass in constant temperature set at 105 ºC.

If Ph of gutter is below 4,3 or more alkaline than 10, its factor should be corrected before starting the tests. The procedure says, that such analytical sample should be gradually inserted to evapourating dish. Other means, like the ones specified by renown organizations (like US EPA or Standards Methods) provide similar conditions for matching dry mass, with exception for higher drying temperature (180 ºC) for determination of dissolved substances. In case of dry mass

determination, drying temperature is set for 105ºC. long lasting tests with application of standard drying method, and fairly low requirements for measurement accuracy and precision, have lead the attention to moisture analyzers, which are accessible on the market.

Moisture analyzers are laboratory measuring instruments which are used for determination of dry mass, and moisture content in multiple substances. Determination of these values is performed by a measuring process of a sample in heating time. A moisture analyzer precisely determines start mass of a sample, and provides continuous measurement during intensive heating process with a halogen lamp. Depending on sample structure, its size, and water permeability feature, drying process can be performed in one of few accessible drying profiles. For above reasons, application of a moisture analyzer for determination of dry mass from water seemed to be a proper approach. The laboratory operates, initially dried a vessel for water, and then poured water into it. Then water sample was cooled down in exsiccator and weighed. A moisture analyzer cases evapouration of water from a sample, and then continues to hold set temperature until stable dry mass readout of sediment is obtained. As it is done, a moisture analyzer gives a corresponding indication on its display.

The tests were performed with a moisture analyzer MAC 50/1 manufactured by RADWAG. The moisture analyzer provided for tests had increased maximal capacity from 50 g to 75 g, for application of standard laboratory glass (Petry's pan). It was possible to evapourate samples with maximal capacity of 30ml. standard temperature profile was used.

The process of dry mass determination was perfoemd for six types of market accessible mineral water (Cisowianka, Carrefour, Kryniczanka, Muszynianka, Wielka Pieniawa and Źródła Muszyny), municipal water and reference solution of sodium chloride c(NaCl) = 2000 mg/l. the main component of each water is hydrogencarbonate anion (500 mg/l – 14000 mg/l). Sulfate concentration has varied from a couple to 30 mg/l, and chloride concentration was usually 2 – 3 times lower. Ca^{2+} concentration in water Wielka Pieniawa even 10 times. Among univalent cations, the Na^{+} kept the concentration level of dozens of mg/l and concentration of K^{+} was at a couple of mg/l.

As comparison, dry mass matching process has been performed according to norm PN-78 C-04541. All results are included in below chart no.1.

Chart 1. Dry mass determination process for mineral water and municipal water samples

Sample	**Dry mass [mg/L]**	
	PN-78 C-04541	**MAC – moisture analyzer**
Cisowianka	445,3 (SD = 4,6)	486 (SD = 46)
Carrefour	1215 (SD = 22)	1208 (SD = 21)
Kryniczanka	1521 (SD = 39)	1549 (SD = 16)
Muszynianka	1148 (SD = 14)	1189 (SD = 36)
Wielka Pieniawa	904 (SD = 4)	911 (SD = 65)
Źródła Muszyny	1196 (SD = 24)	1225 (SD = 73)
Municipal water	579 (SD = 12)	537 (SD = 21)
Solution c(NaCl)=2000mg/L	2007 (SD = 15)	2020 (SD = 26)

The results obtained by application of a moisture analyzer do not differ in statistics from results obtained by reference method. Matching precision reaches 10 %, but results obtained with application of a moisture analyzer usually are less precise.

An average recovery from NaCl reference solution was 101,0% (100,4% in case of procedure no. PN-78 C-04541). A very important advantage of moisture analyzer drying method is shortening procedure time from 6 hours (traditional method) to 3 hours. Additionally, the process has become less labour-consuming, as there is no need to dry a sample for 2 or 3 times in an exsiccator and than weigh it. The limiting factor in case of a moisture analyzer is that it is only possible to dose a water sample once, which eliminates the possibility of match substances in low mineralized water (<300 mg/l). According to opinion of the operators, it would be very advantageous, to add to moisture analyzer equipment a vessel for testing 50 ml water samples. Such instrument and equipment would create a very useful combination for routine testing of dry mass with acceptable accuracy and precision, and a matching limit that allows for testing vast majority of water types accessible on market..

As response to moisture analyzer operators from Radom Technical University, RADWAG on thorough tests has offered aluminum weighing pans which hold approximately 50 ml of water. Such pans are higher than standard ones. Thanks to such application, there is no need to increase moisture analyzer maximal capacity (no need to use relatively heavy Petry's pans). Presently, the tests can be performed on standard devices with no need to modify them for specific applications. As water sample increases its volume during testing procedure, the accuracy of dry mass determination has also increased better repeatability of tests (increase of dry mass by evpouration of larger amount of tested water).