FREEZE-DRIED FRUITS

water content determination

Freeze-drying is considered as one of the most effective methods of preserving products and keeping their nutritional value. As a result of ice sublimation, a structure of empty pores emerges in the product. It demonstrates increased moisture sorption from the surrounding when compared to other products that are preserved through other methods (e.g. convection drying), which may result in water content instability. The analysis of water content in freeze-dried products must be precise to assure proper corrections in the freeze-drying control system. On the other hand the food industry desires the short water content analysis time because this is the only way you can instantly react to any deviations from the product quality. These two basic requirements are satisfied by Radwag moisture analyzers, that is MA R, MA X2, MA X7 and MA 5Y.



The application note includes basic information for validation of the freeze-dried fruits 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 of a soft structure, for example dried fruits or freeze-dried products.

SAMPLE PREPARATION

The sample must be stored in tightly sealed containers (packaging). Mechanically fragment the sample into small pieces, when necessary. For grinding, use an electric grinder. When fragmenting the sample, do not generate excessive heat.

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. 3 ÷ 4 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 into the temperature-controlled laboratory dryer. Dry samples at the temperature of 80 °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	**FREEZE-DRIED FRUITS**					
Type	**Strawberry**	**Chokeberry**	**Apple**	**Basil**	**Corn**	**Raspberry**
Water content (%)	2.81	1.42	2.93	7.95	4.69	3.88
Standard deviation (%)	0.09	0.24	0.18	0.18	0.12	0.10

FREEZE-DRIED FRUITS – 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

The sample must be stored in tightly sealed containers (packaging). Mechanically fragment the sample into small pieces, when necessary. For grinding, use an electric grinder. When fragmenting the sample, do not generate excessive heat.

ACCESSORIES

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

METHOD DESCRIPTION

Set drying parameters presented below. Collect the sample with a mass of ca. 1.5 ÷ 2 g and distribute a thin layer of the sample throughout the weighing pan. Lock the drying chamber manually or automatically.

DRYING PARAMETERS / RESULTS

Sample name	**FREEZE-DRIED FRUITS**					
Type	**Strawberry**	**Chokeberry**	**Apple**	**Basil**	**Corn**	**Raspberry**
Drying profile	Standard					
Drying temperature	70°C	80°C			90°C	75°C
Sample mass (g)	~ 1.58	~ 1.24	~ 2.16	~ 1.94	~ 2.28	~ 1.78
End of analysis	Auto 2		Auto 3		Auto 2	Auto 3
Water content (%)	2.79	1.45	2.86	7.97	4.59	4.01
Standard deviation (%)	0.23	0.14	0.06	0.14	0.22	0.08
Analysis time $\acute{x}$ (min)	5	3	11	7	3	6

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

Sample name	**FREEZE-DRIED FRUITS**					
Type	**Strawberry**	**Chokeberry**	**Apple**	**Basil**	**Corn**	**Raspberry**
Water content (%) Met. Ref.	2.81 ± 0.09	1.42 ± 0.24	2.93 ± 0.18	7.95 ± 0.18	4.69 ± 0.12	3.88 ± 0.10
Water content (%) MA	2.79 ± 0.23	1.45 ± 0.14	2.86 ± 0.06	7.97 ± 0.14	4.59 ± 0.22	4.01 ± 0.08
Analysis accuracy (%)	|0.03|	|0.03|	|0.07|	|0.02|	|0.07|	|0.13|

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.