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# ANALYSIS OF METHODS AND MEANS OF MEASURING CONTROL OF THE MOISTURE OF AGRICULTURAL PRODUCTS

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***Анотація***

*Проаналізовано та досліджено методи й засоби контролю вологості зерна. Виконана постановка задачі контролю вологості зерна. Проведений аналіз і обрані значущі параметри, що впливають на вологість зерна.*

**Ключові слова**: зерно, вимірювання, вологість, контроль вологості, методи вимірювання.

***Abstract***

*Methods and means of grain moisture control are analyzed and investigated. The problem of grain moisture control was formulated. The analysis and selected significant parameters that affect grain moisture.*

**Keywords:** grain, measurement, humidity, humidity control, measurement methods.

Modern technological methods of production of agricultural products are largely related to the moisture content. Excess or absence of moisture in the material is reflected in its physico-chemical, physico-mechanical and operational properties, as well as in quality indicators. The fast and accurate determination of the water content of a particular material, both during production and during operation is the most important task [1].

Different methods have been developed to determine the moisture content of bulk materials, which are divided into two groups - direct and indirect. Direct include methods in which the separation of material into dry matter and water. Indirect include methods that measure quantities or properties functionally related to the humidity of materials. The direct methods of determining moisture by the principle of action can be divided into several groups. Thermophysical methods are based on the evaporation of water from the sample of the analyzed material. The difference between the weight of the material before drying and the remaining mass of dry matter is calculated by the mass of evaporated water. Different devices are used for drying, differing both in design and in the form of heat transfer of the material. Distillation methods are based on the joint distillation of the analyte of water and an organic water-immiscible solvent. Chemical methods - based on the chemical interaction of water with certain reagents (metallic sodium, Fischer's reagent). The water content of the test sample is determined by the equivalent amount of the substance formed as a result of the reaction.

From indirect methods, practical applications in the food industry have been obtained by electrometric methods in which electrical conductivity and permittivity are measured [2].

The conductivity method or the conductometric method is based on the dependence of the electrical resistance of the grain on the degree of humidity: the higher the humidity, the less the resistivity of the material, and the higher its electrical conductivity. The dielectric constant or capacitive method is based on a significant difference in the dielectric constant of water (e = 81) and solids (for dry grain, for example, e varies between 3-5), therefore, with increasing moisture content of the material, its dielectric constant increases. The method of measuring humidity by means of nuclear magnetic resonance (NMR) is based on the absorption by a strong constant magnetic field of energy of a weak alternating radio-frequency field due to the magnetism of the nuclei of the analyte. The content of hydrogen in the sample is determined by the intensity and configuration of the curve of the output signal. The ultra-high frequency (microwave) method is based on the absorption of energy by water contained in a sample placed in the space between the wall of the microwave generator and the receiver. The most important advantages of microwave moisture meters are: the possibility of contactless measurements (in free space), high sensitivity, small influence on the results of measurements of the chemical

composition of the material. Existing microwave methods are divided into: free space methods - the test material is placed between two antennas; resonator methods - the test material is placed in the resonator; waveguide methods - the material under study is placed in the segment of the waveguide line; probe methods - the probe is immersed in the test material.

## Conclusion

The growing demands on the quality and competitiveness of domestic agricultural products are raising new demands for devices and devices for rapid humidity control in most technological processes. Modern technological processes require universal devices that control the humidity of a wide range of agricultural materials. It is quite obvious that the widespread introduction of the necessary means and instruments of humidity control in the national economy and their proper operation will give a tangible technical and economic effect.

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