6. Ziyodullaev M. Z. Analysis and improvement of departmental normative legal acts regulating the activities of Internal Affairs bodies for the protection of public order and security // actual issues of protection of public order and ensuring the safety of citizens: Rep. scientific and practical conf. mat. - T., 2015. - P. 39.

7. Khojakulov S. B. Improving the general prevention of offenses: Monograph. - T.: Academy of the Ministry of internal Affairs of the Republic of Uzbekistan, 2019. - 31 p.

Shamuratov Jamshidbek and Masharipov Bahtiyor, Masters of Tashkent State Technology University, Uzbekistan

METHODS AND MEANS OF MEASUREMENT OF HUMIDITY OF OIL

J. Shamuratov, B. Masharipov

Abstract: The article provides an overview of the methods and techniques for measuring oil moisture content. Thus, more information is given to Dina-Starka, dielectric, optical and electrical techniques. The above methods are covered in detail and there are conclusions and points about the advantages and disadvantages of the mass.

Keywords: direct methods, indirect methods, Dean-Stark method, conductometric method, mass fraction of moisture.

Water in oil can be in three forms: dissolved, dispersed and free. The content of dissolved water mainly depends on the chemical composition of oil, oil products and temperature. With increasing temperature, the solubility of water increases in all hydrocarbons. Methods for determining water in oil and petroleum products can be divided into two groups: qualitative and quantitative.

Method for determination of water content (Dean-Stark method)

The essence of the method is to distill the mixture of the test sample of oil and solvent, which is not miscible with water, and measure the volume of water condensed in a Dean-Stark trap. [1]

The conductometric method is based on the dependence of the conductivity of the material on its moisture content.

Pure water has a relatively low electrical conductivity (electrical resistivity at (20 ° C, 22 · 106 Ohm · cm). But due to the dissociation of electrolytes when they dissolve in water, the conductivity of the solution increases by several orders of magnitude. Thus, the conductivity of a wet

material is determined primarily electrolytes contained in the material itself.

Moisture-containing materials that, when dry, are dielectrics with electrical resistivity 10-15 ÷ 10-10 Ohm · cm and more, when moistened, they become semiconductors. The electrical resistivity is reduced to 10-3 ÷ 10-2 Ohm · cm.

Humidity measurement is reduced to measuring the electrical resistance of the primary transducer. The nature of the dependence of the electrical resistance of the primary converter on the humidity of the solid organic material has the form shown in Fig. 3.

In this regard, the conductometric method is used for measurements of low and medium humidity. The lower limit of measurement is limited by the difficulties of measuring very large resistances. For most materials, this corresponds to a moisture content of about 5 ... 8%.

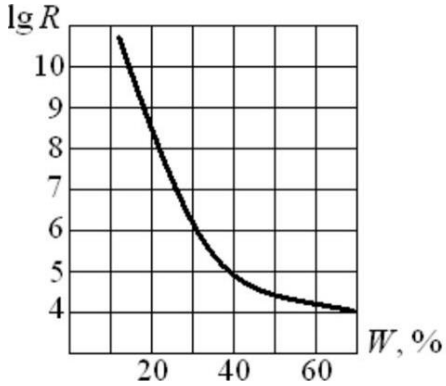

Fig. 1. The nature of the dependence of the electrical resistance of a solid material on moisture: W is the mass fraction of moisture; lgR - electrical resistance of the primary converter, Ohm

At low and medium humidity, a sharp dependence of resistance on humidity appears, which ensures high sensitivity of the moisture meter in this humidity range. With high humidity, sensitivity decreases. Therefore, factors not related to the moisture content of the analyte (chemical composition, structure, etc.) influence the measurement result.

In non-aqueous liquids, the dependence of the electrical conductivity in a narrow range can be almost linear.

The electrical conductivity of wet materials, as mentioned above, is determined by the content of electrolytes in them, which, when dissolved in water, decay into ions. Electrolytes are conductors of an electric current of the second kind. The passage of electric current is determined by the movement of ions and is accompanied by chemical reactions - electrolysis. In this case, a change in the potential of the electrodes occurs - polarization. To eliminate the effect of polarization on the measurement result, in most cases, the resistance measurement is carried out on alternating current.

The conductivity of materials is greatly influenced by temperature. Therefore, in the means of measuring the humidity of materials should be provided for temperature compensation or stabilization of the temperature of the analyzed materials [2].

The dielcometric (capacitive) method is based on the special electrical properties of water. Water has a number of structural features and properties that distinguish it from other substances. One of the abnormal properties of water is a very high dielectric constant. The dielectric constant of free water is ~ 80. For most solids ε <10, for liquids ε <10 ÷ 20. The dielectric constant of water depends on its state. When bonded, water loses its mobility in an electric field, and its dielectric constant decreases. For chemically bound water, ε = 4.5 ÷ 4.9.

Wet material can conditionally be represented as a two-component mixture with a dielectric constant ε_cm, which is determined by the expression

$$\varepsilon_{\text{см}} = \rho_{\text{в}}\varepsilon_{\text{в}} + \rho_{\text{с}}\varepsilon_{\text{с}}$$

where ε_vi ε_c is the dielectric constant of water and dry material;

ρ_в and ρ_c — volumetric concentration of water and dry material.

The dependence of the dielectric constant of some solid materials on moisture is shown in Fig. 4.

The primary transducer of the dielcometric moisture meter is a capacitor. The capacity of the capacitor C depends on the dielectric constant of the substance located between the electrodes of the capacitor:

$$\text{C} = k\varepsilon$$

where ε is the dielectric constant of the analyte; k is a constant coefficient, which is determined by the size of the capacitor and its design.

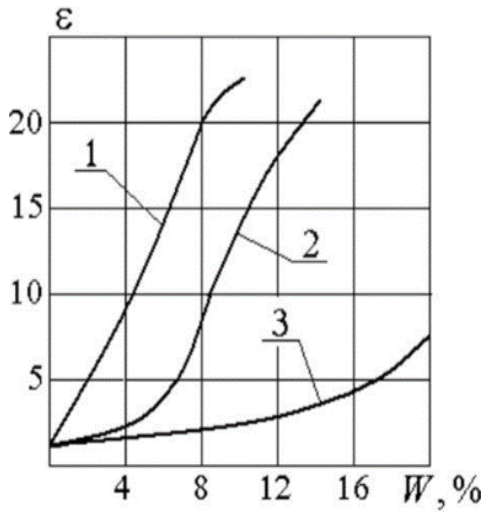

Fig. 2. The dependence of the dielectric constant of the material ε on its moisture content:

1 - sand; 2 - coal; 3 - grain; W - mass fraction of moisture.

Many instruments measure the impedance of a primary transformer with alternating current. Therefore, the method is called dielcometric, and not capacitive.

The design of the primary measuring transducers of electric moisture meters depends on the properties of the analyzed material. The primary transducers for liquids are similar in design to the primary transducers of conductometers. Primary converters are cylindrical, flat and with an external field.

Converters with an external field are made in the form of a vessel or a piece of pipe made of a dielectric, on the outer surface of which electrodes are placed.

When determining the moisture content of oil or oil products for continuous sampling, the flow branch through the samples is branched or the entire stream is passed through a primary transducer installed in a vertical pipeline. To reduce the error caused by the deposition of paraffin and mechanical impurities on the parts of the primary converter, the electrodes should be placed vertically and have a protective coating [3].

Recommended installation schemes for primary converters of dielcometric hydrometers of oil and oil products in accordance with GOST 14203-69 “Oil and oil products. The dielcometric method for determining

moisture ”is shown in Fig. five.

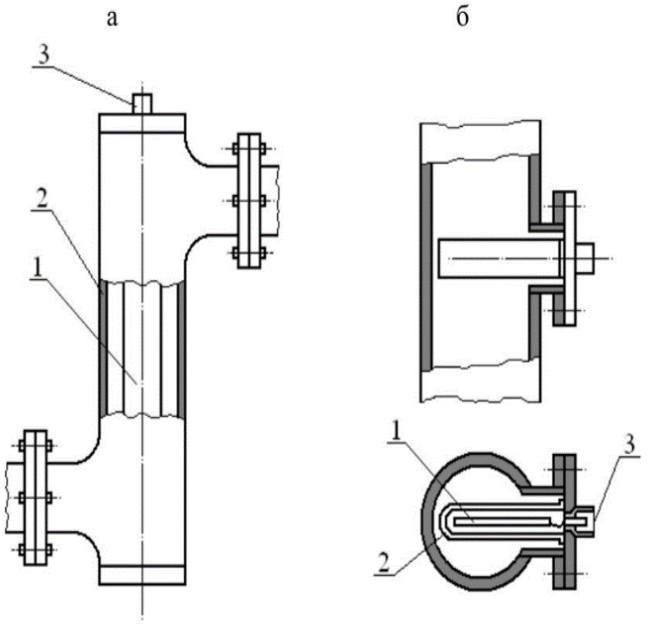

Fig. 3. The location of the primary transducer dielcometric oil moisture meter in the pipeline:
a - with cylindrical electrodes; b - with flat electrodes;
1 - internal electrode; 2 - external electrode; 3 - connector for connection to the measuring unit [4].

Optical methods are based on the ability of water to absorb radiation of specific wavelengths. In hydrometers, the predominantly short-wavelength region of infrared radiation (A = 0.8 ÷ 3 μm) is used.

When measuring the humidity of liquid media, the dependence of optical density on moisture concentration is used. The attenuation of the radiation transmitted through the cell with the analyte is measured. The attenuation of radiation when passing through a cuvette with a liquid containing water mainly obeys the Bouguer-Lambert-Vera law. The method has a high sensitivity; it is used to measure micro-concentrations of moisture (0 ÷ 100rrM). The upper limit of applicability of the method is 10–20%.

Infrared moisture meters for solids work on the principle of absorption or reflection. Absorption moisture meters are used for thin sheet materials that are transparent to infrared rays, such as paper.

Reflection moisture meters are based on the dependence of the energy of reflected radiation of various wavelengths on the moisture content of a substance. Moisture meters are used that use the dependence of the ratio of the intensity of reflected radiation at wavelengths X = 1.96 μm and A = 1.75 μm.

The lack of reflection hydrometers is obvious; only the surface layer of the material is measured as moisture.

Visible optical moisture meters are rarely used. They are based on the ability of some materials to change their color and reflectivity from moisture [5].

Thus, the method of determining the moisture content of oils, based on the principle of the dielectric coefficient, is not inferior in accuracy to the standard method of Dean and Stark and at the same time has a number of significant advantages.

References:

1. Berliner M. A. Measurement of humidity. M.: Energy, 1973 400 p.

2. Oil disperse systems /, - M.: Chemistry, 1990.226 p.

3. Krichevsky E.S., Benzar V.K., Venediktov M.V. and others / Under the general. Ed. E.S. Krichevsky. "Theory and practice of rapid control of humidity of solid and liquid materials." M.: "Energy", 1980, 240 p.

4. GOST 14203-69 “Oil and petroleum products. The dielcometric method for determining moisture. "

5. Mukhitdinov M.M. "Optical methods and humidity control devices." M.: Energoatomizdat, 1986. 96 s

6. GOST 2477-65. “Oil and oil products. Method for determination of water content. "

Turdimukhammad Rakhmonov, Sherzod Kamilov, Shoolim Salimov
Military technical Institute of the National Guard of the Republic of Uzbekistan

ABOUT SOLAR ENERGY CONVERTERS AS ALTERNATIVE SOURCES OF ELECTRICITY

T. Rakhmonov, Sh. Kamilov, Sh. Salimov

Abstract: The article provides an analysis of data on the state of use of solar energy as an energy source in the Republic of Uzbekistan. At the same time, the prospects of using optimal grapheme-based solar energy converters are noted

Keywords: energy, ecology, energy source, converters, hydrocarbon, grapheme, climate, useful work, solar energy.

Introduction. Alternative or non-traditional energy sources are natural resources that can be used to generate electricity.

The use of non-traditional and renewable energy sources (RES) in the fuel and energy industry is an urgent task of the world energy industry. One