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METHODS OF ANALYSIS OF THE PHYSICO-CHEMICAL PROPERTIES OF LIQUID COMPOSITION USING A SECONDARY TIRE SCREEN

***Abstract**: In this article obtained that the method of determining the freezing temperature of the composition is the freezing temperature of the oil, which does not change when the surface of the oil is bent at an angle of 45° in one minute. Composite road pavements based on used tire slag and interpolymer phosphogypsum were introduced in the district road. A scientifically based technology of obtaining a liquid composition and processing them with the help of secondary tire sawdust was recommended.The physico-chemical properties and field of use of the products obtained in the process of liquid composition using the secondary tire sawdust and interpolymer phosphogypsum ingredients were recommended.*

***Key words**: road, freezing temperature, oil, liquid composition, properties, tire, sawdust, viscosity.*

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Introduction

The method of determining the density of a liquid composition is determined by a hydrometer. Determination of density in a hydrometer is based on Archimedes' law. In this case, the difference between parallel measurements should not exceed 0.001-0.002. Before testing the sample, it is dissolved in kerosene of specific volume and density. The density of the tested sample is calculated by the following formula (1):

$$\rho = 2p_1 - p_2 \qquad (1)$$

G1-is the weight of the liquid composition of the cup together with the soaked filter paper before analysis, g.

G2-is the weight after analysis of the liquid composition of the cup with the soaked filter paper, g.

The weight of the liquid composition obtained for G-testing, g

The arithmetic mean value of 2 parallel analyzes is taken for the result of the analysis.

The needle immersion depth of the liquid composition is determined according to the method of determination (GOST 5346-50). As a measurement result, the arithmetic mean value of 5 measurements are obtained. The result of each measurement did not differ by more than ±3% from the arithmetic mean value of the measurement. On the contrary, when the arithmetic mean value of 10 measurements is taken, the value of the measurement results does not differ from the arithmetic mean values by more than ±6%. Measurement results that differ by more than ±6% are not taken into account.

Determined according to the consistency limit of the liquid composition (GOST 7143-54). Strength limit of liquid composition kg. force/cm^2 is calculated according to the following formula (3).

$$\tau = \frac{P * r}{2l} * 1000 \qquad (3)$$

P-is the highest pressure, kg/cm^2

r - capillary radius, cm

l-is the length of the capillary.

The results of calculations are rounded up and written down to the second digit. The arithmetic average value of errors should not exceed ± 10%.

The amount of free alkalinity of the liquid composition is based on the method of determination (GOST 6707-57). The amount of dissolved alkalis in the composition is calculated by the following formula (4) in relation to NaOH (X.%):

$$X_1 = \frac{V * 0{,}0040}{G} * 100 = \frac{0{,}4 * V}{G} \qquad (4)$$

V, - volume of KOH used for titration, ml.

Amount of NaOH in 0.0040-1 ml of 0.1N solution, g.

G - the amount of oil taken for inspection, g.

If the amount of alkali in the tested oil is less than 0.02%, it is considered to be alkali-free.

The method of determining the amount of dissolved acids in the composition is calculated according to the formula (5) by expressing the number of acids in tire sawdust in percentages:

$$K = \frac{V_2 * 0{,}005611000}{G} = \frac{5{,}61 * V_2}{G} \qquad (5)$$

The volume of 0.1N KOH alcohol solution used for V_2-titration, ml.

The amount of KOH in 0.00561-1 ml of 0.1N KOH solution.

G- the amount of oil taken for inspection.

Oleic acid (X2) is determined by the following formula (6) with the amount of free organic acids in the tire sawdust composition:

$$X_2 = \frac{V_2 * 0{,}02825}{G} * 100 = \frac{2{,}825 * V_2}{G} \qquad (6)$$

V_2- amount of 0.1 n KOH used for titration, g/ml.

The amount of oleic acid equivalent to 0.02825-1 ml KOH is g.

G- the amount of the tested oil, g.

If the content of free organic acids in the tire crumb composition is less than 0.02 mg KOH/g oil, the oil is considered free organic acids. As a result of the analysis, the arithmetic mean value of 2 parallel analyzes is taken. That is, the difference between the parallel sizes did not exceed 0.02%, and the difference in the parallel sizes when determining the acid number is between 0.02% and 0.1.

The difference in parallel determination of free organic acids should not exceed 0.2% when calculated in relation to oleic acid.

The kinematic viscosity of tire crumb composition is determined by viscometry using the Pinkevich VPJG-4 viscometer using the method of determining kinematic and dynamic viscosity (GOST 33-82). For this, a clean and dry viscometer is filled with petroleum oil. A rubber tube is inserted into the tube of the viscometer, and by closing the eye with a finger, turning it over, the eye is lowered into the oil, and the oil is sucked up to the M2 mark using a rubber grommet.

Care is taken to avoid the formation of air bubbles, and the viscometer is removed from the oil container and quickly returned to the normal environment. The viscometer is placed in the thermostat (bath) below the oil mark. After standing in the thermostat for 15 minutes, the time when the oil was pushed to 1/3 height and flowed from M1 to M2 mark was determined. After the results of three consecutive measurements do not differ by more than 0.2%, the average kinematic viscosity mm2/s is calculated using the arithmetic formula (7):

$$V = c * \tau \qquad (7)$$

where, c-viscometer constant, mm^2/s,

τ -oil average flow time in a viscometer, s.

The dynamic viscosity of the tested oil, mPa*s, was calculated by the following formula (8):

$$\eta = v * \rho \qquad (8)$$

where v is the kinematic viscosity of the oil, mm^2/s

The density of r-oil at the temperature at which the viscosity is determined, g/cm^3.

The permissible difference in the determination of kinematic viscosity average arithmetic indicators must not exceed:

Measuring temperature, °C: -60 : -30 -30 : -15 15 : 150

Permissible deviation, %: ±2.5 ±1.5 ±1.2

The method of determining the viscosity index (QI) of the tire crumb composition is calculated using the following (9,10) formulas in accordance with State Standards.

$$КИ = \frac{V - V_1}{V_3} * 100 \qquad (9)$$

$$V_3 = V - V_2 \qquad (10)$$

where, the kinematic viscosity of the sample at a temperature of 150 °C, mm^2/s (sSt), with a viscosity index of V- equal to 0 and the viscosity of which is the same as the kinematic viscosity of the tested composition at a temperature of 100 °C;

v_1 - kinematic viscosity of the tested composition at 150°C, mm^2/s (sSt);

Kinematic viscosity at 150°C of the composition with viscosity index v_2 equal to 100 and the viscosity at 150°C is the same as the kinematic viscosity of the tested oil at 150°C, mm^2/s (sSt).

The value of v_3 is the result of the difference between v and v_2, mm^2/s (sSt).

By measuring the value of the viscosity index of the composition made of tire sawdust at 150°C, the values of v, v_2, v_3 were taken from the special table and calculated according to the State Standards (GOST 8581-57).

The method of determining the freezing temperature of the composition is the freezing temperature of the oil, which does not change when the surface of the oil is bent at an angle of 45°C in one minute. A device consisting of two test tubes is used to determine the freezing temperature of the composition (GOST 20287-74). The first of them (height 160±10mm, diameter 20±1mm) at a distance of 30mm from the bottom of the test tube; and the second one, i.e. outside (height 130±10mm, diameter 40±2mm) serves as a coupling for the inner test tube. It was checked that the freezing temperature of the composition did not exceed -50°C on average when it was determined twice.

The method of determining the flash and ignition temperature of the composition is determined in open and closed crucibles (GOST 4333-48):

a) The apparatus used to determine the flash and ignition temperature of compositions in an open crucible (Brenken method) consists of: 1) a metal or porcelain crucible with a height of 46 mm and a diameter of 58 mm; 2) sand bath; 3) 250-360°C thermometer divided into 1°C degrees; 4) fire extinguisher. Oil to be tested is placed in the crucible 12 mm (if the flash temperature is below 210 °C) or 18 mm (if it is above 210 °C) from the bottom edge of the crucible. The crucible was heated on an electric plate, connected to a rheostat.

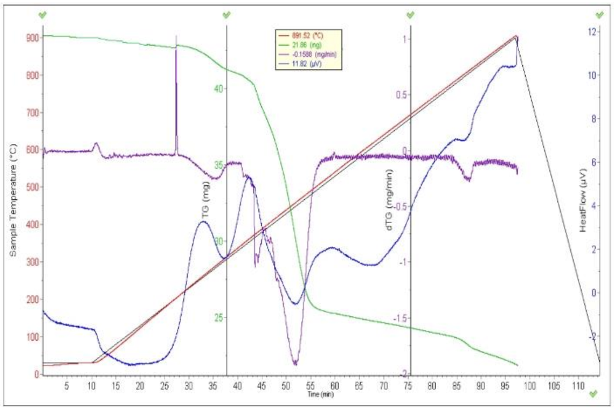
At the beginning, the temperature rate was 10°C in 1 minute, and then, when adding 40°C to the estimated temperature, the heating was reduced and the rate of increase was 4°C in one minute. Using a flamethrower, each 2°C increase in temperature was checked for 5 seconds until a blue flame was formed on the surface of the oil, and the flash temperature was determined from this.

b) The devices used to determine the flash point of compositions in a closed crucible are: a closed metal crucible located in a cast iron bath with a brass jacket. The crucible consists of a two-hole cover, a hole for a thermometer, a burner, a spring-loaded handle and a stirrer.

Pic.1.

According to the research results, the gas phase consists mainly of 45% methane, 14.9% ethane and 17.5% hydrogen. Therefore, this gaseous mixture is used as fuel to burn car tires in a pyrolysis reactor. Among the products of pyrolysis, carbon-containing material has a special place, therefore its properties have been thoroughly studied. Microscopic view of the material after pyrolysis and ground carbon is presented in Picture1.

Carbon-containing material is a brittle, grayish-black substance with an unpleasant odor (if used), and some of the substances also contain metal inclusions. Before use, the carbonaceous material is ground in a VV 600 jaw crusher. The granulometric composition of the ground carbon containing material was studied and its results are presented in Picture 2.



Pic.2.

For this purpose, the oil in the tool was heated at a rate of 5-8°C per minute for oils with a flash temperature of 50-150°C, and 10-12°C per minute for oils with a temperature above 150°C. It is heated at a temperature of 2°C/min when it is 30°C before the ignition temperature, and 1°C/min at 10°C, and turning the knob to 1°C, the sinking flame is observed until the formation of the flame, and the resulting temperature is determined. When the test is carried out at barometric pressure, if it differs from 0.1 MPa (760 mm.s.g.) to 0.01 MPa (15 mm.s.g.), the flash temperature T,°C is calculated using the following formula (16) :

$$T = t + 0{,}25 * (101{,}3 - P) \qquad (16)$$

where, P is the barometric pressure when determining the flash temperature, kPa;

t-is the observed flash temperature at P-pressure, °C

CONCLUSIONS AND RECOMMENDATIONS

The composite road pavements obtained on the basis of used tire slag and interpolymer phosphogypsum were tested at the Jizzakh Regional Road Use Unitary Enterprise (Jizzakh Polytechnic Institute Road Quality Control Accreditation Laboratory, Reference No. 7 dated May 20, 2022). As a result, economic efficiency increased by 40% as a result of the development of new composite road pavements based on modified secondary products.

Composite road pavements based on used tire slag and interpolymer phosphogypsum were introduced in the district road use departments under the Jizzakh Regional Transport Department of the Ministry of Transport of the Republic of Uzbekistan (reference No. 231-N of June 21, 2022 of the Jizzakh Regional Transport Department). As a result, it was possible to reduce the imported composite materials by 40%.

A scientifically based technology of obtaining a liquid composition and processing them with the help of secondary tire sawdust was recommended.The physico-chemical properties and field of use of the products obtained in the process of liquid composition using the secondary tire sawdust and interpolymer phosphogypsum ingredients were recommended. The composition of composite materials based on high molecular compounds was recommended to obtain road pavements used in various conditions by adding the created talc-like carbon organic material.

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