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IMPROVEMENT OF ENVIRONMENTAL AND PERFORMANCE PROPERTIES OF LOW-OCTANE GASOLINE

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KEYWORDS

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ABSTRACT

In this work given methods are introduced to improve the environmental and operational properties of low-octane gasoline. The work uses a complex of modern and classical research methods that allow determining the physicochemical properties and group hydrocarbon composition of the object of study – low–octane local industrial gasoline, as well as its sample with improved performance characteristics with the introduction of selected promising oxygenates. The research was also carried out with the involvement of methods for the study of petroleum products in accordance with accepted state standards.

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Currently, motor gasolines are the most widely known and widespread petroleum product. One third of the oil produced worldwide is refined into motor gasoline. In the near future, the importance of motor gasoline will continue. One of the main problems of environmental safety of the population is the negative impact of vehicles on the environment and public health. Reducing the negative impact of cars on the environment is achieved primarily by improving engines and tightening standards for emissions from exhaust gases. The concept of “environmentally friendly motor fuels” covers a wide range of fuel characteristics: reduction of sulfur content, introduction of oxygenates, reduction of benzene and other aromatics, as well as olefinic hydrocarbons, increase in octane numbers of gasoline and the use of an additive package. The introduction of normalization of the hydrocarbon composition and the use of oxygenates involve the production of so-called "reformulated" gasolines, which must contain oxygen-containing additives, detergent additives and meet the established standards for the content of sulfur, benzene, olefinic and aromatic hydrocarbons. Their use does not require changes in the design of the engine and helps to reduce the toxicity of exhaust gases, and also does not affect the level of ozone in the atmosphere. The tightening of fuel requirements, the growth of the motor fleet, mainly due to cars consuming high-octane gasoline, the reduction in volumes, production and refining of oil is of great interest to alternative motor fuels and is relevant. Research and application of optimal oxygenate additives to improve the environmental and chemical-technological properties of local low-octane motor gasoline and increase its resource. Lower alcohols of the homologous series, methanol and ethanol, will be used as additives.

The work uses a set of modern and classical research methods to determine the physico-chemical properties and group hydrocarbon composition of the object of study - low-octane local industry gasoline, as well as its sample with improved performance characteristics with the introduction of selected promising oxygenates. Research was also carried out with the involvement of methods for studying oil products in accordance with accepted state standards.

The most important indicator characterizing the quality of motor gasoline is its knock resistance [1, 2]. The higher the knock resistance, the more economical and efficient the operation of the engine. The knock resistance of motor gasolines is expressed in octane numbers, which are determined by the motor method at the IT9-2 M or UIT-85 units, by the research method at the IT9-6 or UIT-85 units, as well as by the detonation test method on automobile engines in bench and road conditions (GOST 10373 - 75).

Classical and modern research methods were used to determine physical, physicochemical characteristics, functional composition, to find chemical compositions, structure, chemical nature and their stability [1-5].

The temperature at which the products obtained from the fuel under standard conditions lose their mobility is called the pour point. Products, due to the multicomponent composition, do not have such a clear pour point as for the crystallization temperature of

individual substances. The pour point varies over a fairly wide range: from -62 to + 35°C. The pour point of the fuel and its products is significantly affected by the content of paraffins capable of structuring and forming associates (supramolecular structures) at appropriate temperatures. With an increase in the molecular weight of hydrocarbons (especially n-alkanes), their associating ability increases, and, accordingly, with the weighting of fractions (gasoline → diesel → oil → residual), its pour point increases. From the standpoint of physical and chemical mechanics of disperse systems, the pour point of a product is defined as the transition from a free-dispersed to a bound-dispersed (solid) state. The formation and stability of supramolecular structures in fuel fractions at low temperatures can be influenced by substances called depressants. Natural depressants include tar-asphaltene substances. In hematology, the temperature at which crystals (solid hydrocarbons) are detected in the fuel with the naked eye is called the crystallization start temperature. The cloud point is the temperature at which the fuel begins to become cloudy under test conditions. The cloud point is determined visually or optically. It should be borne in mind that if the fuel contains water, then when it cools it becomes cloudy due to the precipitation of ice crystals. Indicators of low-temperature properties of commercial fuels are normalized. Thus, the pour point of brand 3 (winter) fuel for high-speed diesel engines should not be higher than - (35-45)°C, and the cloud point - (25-35)°C. Jet fuels have the most stringent restrictions: their crystallization onset temperature should not exceed -55°C. The pour point is recommended to be determined only after heat treatment in order to exclude the “thermal history” of the sample and to reveal its dependence on the chemical composition. When determining the pour point, the preliminary heat treatment of the product is carried out at 50°C. This temperature corresponds, on average, to the melting point of solid hydrocarbons (paraffin) isolated from various initial fuels. Thus, by conducting heat treatment, we bring the initial samples of fuel dispersed systems into an equally stable state. The essence of the method lies in the preliminary heat treatment of the sample of the analyzed fuel, followed by cooling to a temperature at which the sample loses its mobility.

This is the most common and fairly accurate method for determining the quantitative content of water in oils and petroleum products. It is based on the azeotropic distillation of a sample of oil or oil product with solvents and is used in many countries. Preparation for analysis. According to this method, gasoline is used as a solvent - a solvent for the rubber industry of the BR-1 brand, boiling off at 80 - 120°C and containing no more than 3% aromatic hydrocarbons. The sample is thoroughly mixed by shaking in the flask for 5 min. Highly viscous products are preheated to 40-50°C. From the mixed sample, a 100 g sample is taken into a clean, dry, pre-weighed glass flask 1, then 100 ml of the solvent is poured into the flask 1 and the contents are mixed. For uniform boiling, several glass capillaries or several pieces of pumice or porcelain are thrown into the flask.

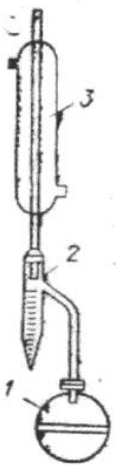

Fig.1. Bottom and Stark device: 1-flask; 2-receiver-trap; 3-refrigerator.

The flask is connected with a thin section to the outlet tube of the receiver - trap 2, and refrigerator 3 is attached to the upper part of the receiver - trap on the thin section. The receiver - trap and refrigerator must be clean and dry. To prevent condensation of water vapor from the air, the upper end of the refrigerator must be covered with cotton wool.

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