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# THE PROPENSITY OF AUTOMOBILE FUELS TO FORM RESINOUS DEPOSITS.

**Alimova Zebo Hamidullayevna** *(professor) ,*
**Ahmatjanov Ravshanjon Nematjonovich** *(associate professor),*
**Abdurazakov Abduaziz Abdujabarovich** *(associate professor)*

**Annotation.** *The purpose of this work is to study the formation of car fuels of resinous deposits and their effect on engine operation. One of the main factors determining the propensity of gasoline to form resinous deposits in the engine is the hydrocarbon composition, and first of all, the content of unsaturated hydrocarbons. To remove deposits in the power system, detergent additives are used, which are various surfactants.*

**Keywords:** *resinous deposits, temperature, wear of parts, starting qualities, engine, fuel stability,hydrocarbons.*

The use of automobile gasoline is accompanied by deposits in the fuel supply system, the intake pipeline and on the walls of the combustion chamber, therefore, to ensure the reliability and durability of automobile engines, gasoline should have the least tendency to form deposits. Deposits disrupt the normal operation of the engine and can lead to its failure and accident.

One of the main factors determining the propensity of gasoline to carbon formation in the engine is the hydrocarbon composition, and first of all, the content of unsaturated and aromatic hydrocarbons. At the same time, high-boiling aromatic hydrocarbons have a greater influence on carbon formation than low-boiling ones. Thus, along with resin-forming compounds, aromatic hydrocarbons cause carbon formation in engines.

The conducted studies of the influence of the entire variety of properties of fuels on the power and economic indicators of various internal combustion engines have shown that the combustion efficiency of the fuel-air mixture is largely due to the physico-chemical properties of the fuel itself.

Fuel stability is understood as its ability to maintain properties within acceptable limits for specific operating conditions. Conditionally distinguish between the physical and chemical stability of the fuel. Physical stability is the ability of a fuel to maintain its fractional composition and uniformity.

Chemical stability is the ability of a fuel to maintain its chemical composition. As a result of the oxidation of gasoline during storage, soluble organic acids and resinous substances are formed. The content of the actual resins - products of oxidation, polymerization and condensation reactions determine the degree of tarring of gasoline. When the actual resin content is within the limits allowed by the standards

(7-15 mg / 100ml), the engines work for a long time without increased tar and carbon formation.

The propensity of gasoline to deposits is estimated by:

– the content of resins;

– the content of unsaturated hydrocarbons (olefins);

– the induction period;

– a period of stability.

Resins are products of oxidative polymerization and condensation of hydrocarbons. As the composition becomes more complex and the molecular weight and concentration increase, the solubility of resinous substances in gasoline decreases and they precipitate in the form of dark brown sticky deposits.

The substances forming resinous compounds also include unsaturated hydrocarbons. They eventually turn into resins under the influence of high temperatures, oxygen in the air and other factors (they are often called potential resins). The resin contained in the fuel settles in the fuel tanks and the walls of the exhaust pipes, blocking the exhaust gases of gasoline engines. Resinous compounds also accumulate in the hot walls of the exhaust manifolds of the engine, in the nozzles of diesel injectors and valves, in the combustion chamber, in piston ditches and other places.

The ability of gasoline to keep its composition unchanged under the conditions of transportation, storage and use (stability) is evaluated by an induction period. The most reliable result of the propensity of gasoline to tar formation is given by the definition of the induction period. To determine their amount in the fuel, a certain amount of fuel is heated with hot air to a high temperature (gasoline at 150oC, diesel fuel at 250oC), as a result of which the fuel evaporates and tar remains. They are measured in milligrams per 100 ml of fuel.

The induction period is the time during which gasoline is resistant to oxidation in a laboratory bomb, at elevated temperature, in an oxygen atmosphere. This indicator is estimated by the time in minutes from the beginning of gasoline oxidation to the active absorption of oxygen by it in a laboratory installation during artificial oxidation of gasoline (t = 100 0C, in an atmosphere of dry pure oxygen at a pressure of 0.7 MPa). This time for gasoline is in the range from 600 to 900 minutes. To increase chemical stability, gasoline hydrotreating is used and special multifunctional antioxidant additives are introduced into their composition.

The propensity of gasoline to deposits increases with a decrease in chemical stability, which is determined mainly by the content of unsaturated hydrocarbons (olefins). The content of olefins in gasoline is estimated by the iodine number, i.e. the amount of iodine reacting under certain conditions with the test fuel.

Resins cause clogging of the fuel system, are deposited on the walls of fuel tanks, cover the mesh fuel filters with a film, reduce the cross-section of fuel lines. A layer of resinous deposits on the diffuser, sprayers and other parts of the carburetor can lead

to engine outages. Dangerous are not only the already formed resins, but also the so-called potential resins formed during the preparation of a combustible mixture under conditions of fine gasoline spraying, high turbulence of the air flow and elevated temperatures in the intake system.

To increase the chemical stability of gasoline, antioxidant additives are used that inhibit the development of oxidative reactions. As such additives are used: wood–resin oxidizer (up to 0.15%); antioxidant FCH - 16 (up to 10%) and paraoxydiphenylamine (up to 0.01%). To remove deposits in the power system, detergent additives are used, which are various surfactants. For this purpose, a multifunctional additive "Afen" has been developed, which has, in addition to detergent and anti-icing properties. Their use is carried out in two ways:

– with an increased concentration of up to 0.1%, but for a short time, for one–time removal of deposits; - with a small concentration of up to 0.05% regularly, for constant “washing out” of deposits.

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