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IMPROVEMENT OF UREA-ASSISTED CLEANING OF RESINS AND COMPOUNDS IN DIESEL OR OIL

Khaidarov Bobomurod M. [1]***, Sodikov Usman Kh.*** [1]***, Rakhmanov Ortik K.*** [1]

[1] Fergana Polytechnic Institute

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Abstract

Diesel fuel is one of the most popular petroleum products used in agricultural machinery. The composition, properties and quality of diesel fuels used in tractor and automobile engines largely determine the service life and reliability of fuel equipment and components and parts of the cylinder-piston group. The chemical stability of diesel fuel is its ability to resist oxidation processes that occur during storage. This problem arose with the deepening of oil refining by introducing middle distillate fractions of secondary oil processing, for example, gas oils obtained from catalytic cracking and coking, into the composition of commercial diesel fuel. The latter is enriched in unsaturated hydrocarbons, and also contains a large amount of sulfur and tar compounds. The presence of these compounds together with unsaturated hydrocarbons contributes to their oxidative polymerization, thereby affecting the formation of resins and deposits.

Keywords: *Diesel fuel, water, oil, coagulant*

Introduction

Currently, diesel engines are widely used in various areas of motor transport and are being developed as fuel for cars. Diesel engines are more economical than gasoline engines, have a lower risk of fire, are more reliable and have a longer service life, and are widely used due to their wide distribution. Diesel-fueled vehicles are 25–30% more fuel-efficient than gasoline-fueled vehicles. Diesel fuel has the property of operating more efficiently because it burns at a higher temperature than gasoline. The main reason for this is that diesel fuel has a higher cetane number (Mitusova T.N., Polina E.V., Kalinina M.V., 2002).

Diesel fuel has a standard of no more than 0.05% sulfur dioxide, other European and Eastern countries recommend that diesel fuel be produced according to the EN-590 standard (S $<$ 0.005%) (Elvers B., 2012).

The production of diesel fuel with a low gold content of 0.035–0.001% is still it is also brewing at a low rate, but at a fast rate (Danilov A.M., 1998).

The composition, properties and quality of diesel fuels used in tractor and car engines largely determine the service life and reliability of the fuel equipment and components of the cylinder-piston group and the engine (Ostrikov V.V., Nagornov S.A. Gafurov I.D., 2006).

The ability to achieve a high compression ratio in diesel engines allows for a 25–30% reduction in specific fuel consumption compared to carburetor engines. The most important performance parameters of diesel fuel are the cetane number, fractional composition, low-temperature and lubricating properties, degree of purity, viscosity, presence of sulfur compounds, hydrocarbons and metals, as well as the flash point, which determines safety (Ostrikov V. V., Nagornov S. A. Gafurov I. D., 2006).

The cetane number determines the severity of the operating process, fuel consumption, and exhaust gas pollution. The higher the cetane number, the harder the engine will work. The higher the cetane number of diesel fuel, the faster the mixture will burn and the vehicle will start. However, as the cetane number increases, engine efficiency decreases and exhaust gas smog increases (Skarlykin A. N., 2003).

Research methods and objects G

As shown in Figure 1, the simulation of fuel cleaning processes to remove contaminants and water was carried out using a laboratory centrifuge.

The results were analyzed at centrifuge rotor operating or rotation speeds ranging from 2 to 10,000 rpm

Figure 1. *In the laboratory modeling centrifuge*

Cleaning for intended fuel from 20 to 30 °C was temperature between is heated. From this then 1% quartz powder to the fuel entered and harvest was mixed one trick to the state brought and later centrifuge with the help of again worked.

Experience from the beginning before, permanent dispersion provision for in fuel additional particles of the spread one variety microscopic in a way was evaluated.

Fuel cleaning process from 20 to 90 minutes changed standing time between to do increased.

Cleaning processes since it ended then, again worked in fuel exists of mechanical compounds The composition is regulated by GOST 6370–83 to the standard suitable was evaluated. The rest particle a pollutant substances microscopic analysis with the help of checked and described.

Results and Discussion

In addition to free water, which can be easily removed by physical treatment methods, diesel fuel also contains contaminants such as resins, asphaltenes, oxidation products, and sulfur compounds, which are almost impossible to completely remove.

The main difficulty in the removal process is the lack of effective fuel cleaning agents capable of removing additives in the dispersed phase smaller than 0.1 to 0.5 microns.

The presence of tars and sulfur in diesel fuel does not necessarily have a negative impact on its quality, since these substances can act as «lubricating agents» that help the combustion process to a certain extent. However, the accumulation of tars, sulfur, and heavy fractions in the fuel during combustion can lead to the formation of carbon deposits in the cylinder-piston complex. In addition, these components in diesel fuel can negatively affect engine efficiency and contribute to high levels of exhaust emissions, which worsens environmental pollution.

Dissolved components in fuel can only be removed by increasing the volume of dispersed particles using filters, centrifuges, and separators combined with physical and chemical cleaning methods.

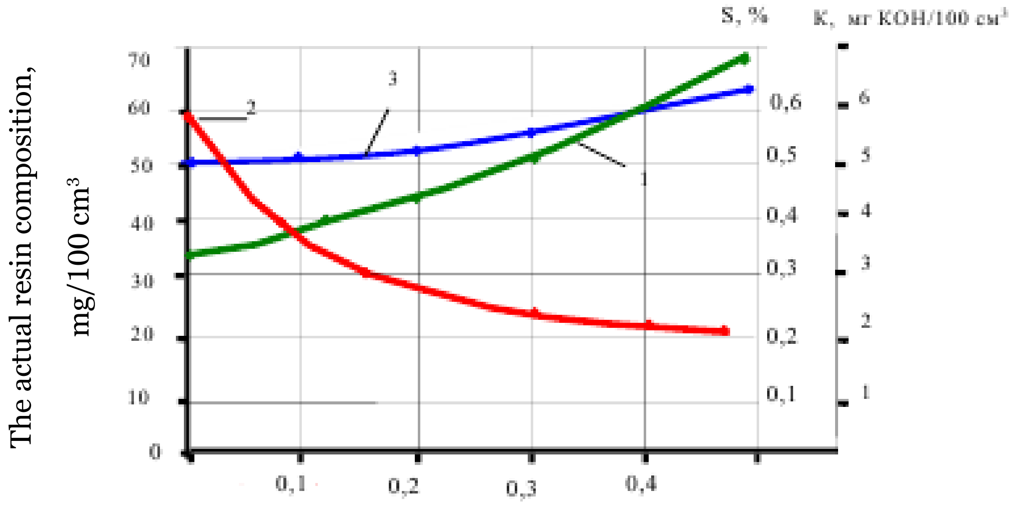
The removal of fuel components can only be achieved by increasing the volume of dispersed particles using filters, centrifuges, and separators combined with physical and chemical cleaning methods.

Microscopic analysis with a magnification factor of Kuv = 110 shows that the tar content in the fuel is 60 mg/100 cm^3, the mass fraction of sulfur is 0.5% or more, and no additives beyond this concentration were detected in the fuel.

Figure 2 shows the relationship between different concentrations of added acid and the resulting changes in fuel characteristics.

The use of sulfuric acid has been shown to help remove tars from diesel fuel (shown by curve 2 in Figure 2); however, this process simultaneously increases the sulfur concentration (S) and the acidity level (K) of the fuel, both of which are considered to be input effects.

Figure 2. *Dependence of changes in fuel properties on the concentration of introduced sulfuric acid*

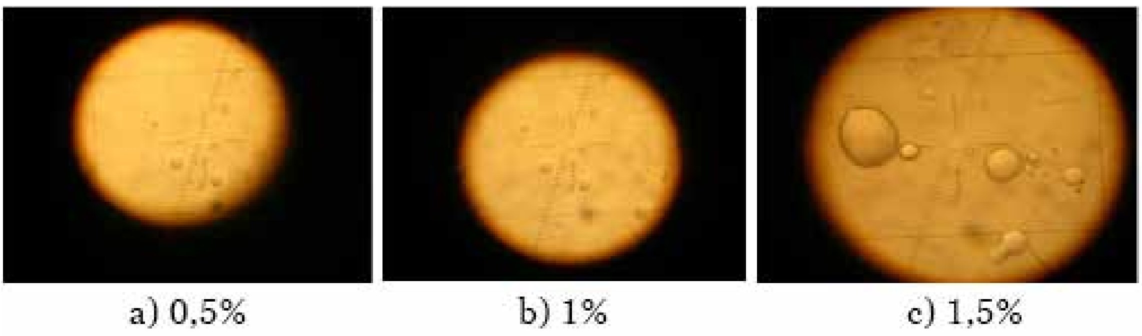


Concentration of H_2SO_4 in fuel

According to row 2 of Figure 2, the actual tar concentration in the fuel composition shows the most pronounced decrease in sulfuric acid concentration from 0.1% to 0.2%. Increasing the acid concentration to 0.5% does not lead to a significant additional decrease in tar content.

To evaluate the effectiveness of alkaline coagulants, a soda solution prepared with water was used. Various sodawater ratios - 5:1, 3:1 and 1:1 – were checked. 5:1 and 3:1 ratio yours truly complete to the end not achieved was determined. On the contrary, the ratio is 1:1 satisfactory solubility showed that more than 80% of soda dissolves As a result, next experimental processes 1:1 aqueous solution with the help of held, his in fuel concentration is kept at 1.5%.

Figure 3. *Water hydroxide solution since joining later diesel fuel samples photomicrographs*



Aqueous hydroxide solution with mixed fuel up to 100 ° C heated , then permanent mixing from 0.5 to 1 hour under continue which permanent thermal impact under take will go the coagulation process efficiency microscopic in the method with the help of taken results analysis done.

Various in concentrations watery hydroxide solutions with processing given fuel samples photomicrographs are different in Fig. 3.

Is presented in Figure 3 experimental results analysis that shows that at concentrations of (a) 0.5%, (b) 1% and (c) 1.5% for fuel watery alkaline solution addition fuel in the composition melted to mixtures almost coagulant impact does not show.

If diesel fuel melted heavy hydrocarbon fractions, to sulfur based oil compounds and other substances included ultra-disperse system as if you look at it , its stability small in quantity electrolytes introduction noticeable to the extent impact to do can In lyophobic colloidal systems electrolytes the presence of the coagulation process noticeable to the extent accelerates . Coagulation installed theoretical principles and anointing in the oils disperse systems destabilization according to previous to research based on urea - wide widespread village farm mineral fertilizers fuel inside melted of mixtures coagulation in motion its potential effectiveness assessment for selected.

Given an optimized cleaning capacity of 100 liters per hour, the process operates in a continuous cycle, with 100 liters of diesel fuel being pumped from the primary storage tank over an hour, through a centrifugal separator, and back into the tank. This configuration allows for the simultaneous execution of key operations, including the addition of a coagulant, mixing, and homogenization of additives during a 60-minute cleaning period. From a mechanical perspective, the improvements in low-temperature fuel performance observed during this process can be attributed primarily to the uniform distribution of dissolved additive particles throughout the fuel matrix. This uniformity is facilitated by the hydrodynamic forces generated by the flow pressure as the fuel moves through the centrifuge rotor and then impacts the inner surface of the centrifuge housing, which also helps to remove residual water from the system.

Conclusion

Optimization studies using reactive centrifugation have shown that effective separation of resins and oxidation products can be achieved by collecting them. Optimal centrifugation performance was observed at a rotation speed of 7000 to 8000 rpm and a preheating temperature of 80 ° C. The required processing time, depending on the initial degree of contamination, was 45 to 60 minutes.

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Contact: eldor8501@gmail.com