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The Effect Of Physico-Chemical Composition Of Micro-Particles Contamination Of Diesel Fuel On The Technical Condition Of The Power Supply System Of Diesel Engines.

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ABSTRACT

The article provides information about the features of pollution of diesel fuel equipment, as well as the magnitude of these contaminants in the tanks and tanks of the fuel supply system in operating conditions. The technique and equipment of the study on the effect of water and abrasive impurities contained in the fuel on the performance of injection pump plunger pairs are described. In the course of the research it was found that the content of 1% water in the fuel increases the wear of the plunger pairs by 2.2 times, which corresponds to the presence of abrasive in the fuel in the amount of 0.00002%. The combined effect of water and mechanical impurities increases the wear by 4.6 times.
Keywords: diesel fuel, water, physico-chemical pollution, fuel system, temperature conditions

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INTRODUCTION

The presence of various types of contaminants in diesel fuel leads to deterioration of the power supply system and increased wear of precision parts.

When vehicles are operated under normal conditions, the fuel in the power system is contaminated to its maximum concentration after 2...3 refills after washing the tank. Thus, flushing the fuel tanks does not particularly reduce the contamination of fuel in them.

The amount of pollution in automotive fuel tanks depends on the area and season in which the equipment is operated, and is from 2...9 g to 200...400 g per 1 ton of fuel. For dump trucks that operate in particularly dusty conditions, contaminants in the fuel are increased by accumulating about 1.5 times more than for on-Board vehicles. The saturation of the contamination of fuel from tractors, about 2 times more than that of cars [1,2].

The qualitative composition of mechanical impurities is the same as the composition of the dust. The sizes of micro particles in motor fuel, as a rule, do not exceed 50 microns, and the greater number of these particles meets the sizes, approximately, 5 microns.

The dust composition is also determined by the specific surface area S, which varies in a significant interval (90...700 m^2/kg). Most often in dust there is quartz, containing from 50 to 90%. Its hardness is usually higher than the hardness of rubbing machine parts, which leads to their abrasive wear [2,3].

MATERIALS AND METHODS

To identify the effect of water and abrasive contaminants present in the fuel on the change in the technical condition of the injection pump plunger pairs, we have implemented experimental studies.

The experiment involved 48 new plunger pairs UTN-5-1111410-A5.

Technical characteristics of the plunger pairs were determined by the hydraulic density, which was estimated by the device KI-1640A (KI-759).

In the course of studies, plunger pairs were mounted in four pump sections of the pump, so that the difference in hydraulic density between them was no more than ± 5 seconds.

As a result of the operation of the standard filtration system and the presence of mechanical impurities in the fuel up to 200 g/t, up to 32 g/t enters the pump, which corresponds to 0.003% by weight. In the mathematical processing of the experiment, such an amount of abrasive impurities in the fuel was taken as the upper level of the variation factor, and their absence – as the lower one.

To identify the effect of the presence of water in the fuel on the amount of wear of precision parts, 5% of the emulsion water concentration in the fuel was taken for the upper level of the factor, and its absence for the lower [2,4,5].

Uninterrupted operation of the fuel pump with an increase in the concentration of emulsion water in the fuel more than 3% leads to a noticeable deterioration in the efficiency of plunger pairs. As a result of the cyclic operation – the water concentration of more than 0.5% already significantly impairs the operation of the injection pump. This is due to the formation of corrosion wear during breaks in operation, together with the deterioration of the lubricating properties of the fuel.

Measurement of the hydraulic density of the plunger pairs in the first and second experiment (on pure and watered fuel) was carried out after 120 hours of operating time, and in the third and fourth experiment (in the presence of abrasive and abrasive with water in the fuel)-after 40 hours. Such a difference in the intervals is justified by a large difference in the intensity of changes in their densities.

As a result of the experiment processing, the number of experiments (N) was 4 (on clean, watered, contaminated with abrasive and contaminated with abrasive and simultaneously watered fuel). The number of repetitions of the experiments (n) - 12 (number of plunger pairs involved in one experiment).

The initial processing of the results shows that the dynamics of the change in the hydraulic density of precision parts of the injection pump, ΔP/Δt (where ΔP is the change in the hydraulic density of the plunger pairs for the period of Δt) is not subject to the normal distribution law. Thus, it would be advisable to replace it with the relative intensity of hydraulic density change [6]:

$$W = \frac{\Delta P}{P_H \Delta t},$$

where W – is the relative intensity of the change in the hydraulic density of the pair, s^{-1};
P_H – the initial value of the hydraulic density of the pair, s.

Since the value of W characterizes the relative intensity of the change in the hydraulic density of pairs in dimensionless fractions, it will express the relative intensity of the change in its technical state or the relative value of its wear for a given period.

EXPERIMENTAL PART

Table: Results of the experiment

Experience number	1	2	3	4
Water content in the top lion, % by weight (X1)	0	5	0	5
The content of the abrasive material in the fuel, % by mass (X2)	0	0	0,003	0,003
Arithmetic mean value of relative wear intensity, s^{-1} (W)	0,0001	0,0007	0,0166	0,0236

It can be seen from the table that in the absence of free water and abrasive in the fuel (X1 = 0 and X2 = 0), there is still a slight wear of the plunger pairs, even with the operating time for such a short time. This can be explained by the fact that in the first hours of operation of the plunger pairs in the "plunger-sleeve" coupling redistribution of micro-deformations is observed as a result of their tightening and there is a so-called accelerated operating wear.

According to the results of studies, it can be said that in the above intervals of variation, the effect of abrasive in the fuel on the wear of plunger pairs is 5.2 times greater than the effect of water. But the presence of such an amount of abrasive in the fuel (from 0 to 0.003%) is almost always observed in dusty operating conditions, despite even the system of its filtration.

CONCLUSION

The water present in the fuel, taking into account the effect of its interaction, significantly increases the wear properties of this amount of abrasive: at its content in the fuel about 2.5...3% by 30...40%. The results obtained by us confirm quantitatively that the water content in the fuel over 3% leads to a significant deterioration of the lubricating properties of the fuel.

Thus, the presence of 1% water in the fuel increases the wear of the plunger pairs by about 2.2 times, which is equivalent to the presence of abrasive in the fuel in an amount of about 0.00002%. If they are present together, the wear increases by about 4.6 times.

REFERENCES

[1] Anoshkin P.I., Zhidkov A.A., Rylyakin E.G. Some problems of maintenance of vehicles. Transport. Economy. Social sphere. (Current problems and their solutions): a collection of articles of International scientific-practical conference, Penza, 2014, 160 p.

[2] Vlasov P.A., Novichkov A.V. Contaminated fuel is the cause of the wear. Rural machine operator, 2007, no.5, 40.

[3] Novichkov A.V., Novikov, E.V., Rylyakin, E. G., etc. Study of wear of precision parts of diesel fuel equipment. International scientific journal, 2014, no 3, 108-111.

[4] Novichkov A.V. Dehydrate of the fuel – increase resource. Rural machine operator, 2007, no.11, 46.

[5] Skarlykin A.N. Improving the performance of agricultural tractors by reducing the water content of the fuel in the tanks: abstract of candidate of tech. sciences dissertation, Penza, 2003, 18 p.

[6] Rylyakin E.G., Zakharov Yu.A., Anoshkin P.I. Improving fuel economy of the engine of thermal controlling the working fluid in the hydraulic actuator. Transport. Economy. Social sphere. (Current problems and their solutions): collection of articles of International scientific-practical conference, Penza, 2014, 160 p.

[7] Rylyakin E.G. Influence of water on the properties of hydraulic fluids. Models, systems, networks in the economy, technology, nature and society, 2014, no. 2(10), 195-198.

[8] Rylyakin E.G. Definition of Engine Capacity Losses on Resistance Overcoming in Transmission and a Hydraulic Actuator. Contemporary Engineering Sciences, Vol. 10, 2017, no. 8, 353-357.

[9] Rylyakin E.G. Theoretical Foundation of Thermal Regulation of Working Liquid in the Hydraulic System. Contemporary Engineering Sciences, Vol. 10, 2017, no. 8, 359-366

[10] Vlasov P.A., Rylyakin E.G. The temperature control fluid of the hydraulic system of the Rural mechanic, 2007, №6, 36.

[11] Rylyakin E.G., Kostina V.I. The study of hydraulic units parts durability. Contemporary Engineering Sciences, Vol. 8, 2015, no. 11, 477-480.

[12] Punin A.V., Rylyakin E.G. Bench researches of the hydrodynamic dispergator. «The priorities of the world science: experiments and scientific debate»: Proceedings of the II International scientific conference 24-25 December 2013, Saint Petersburg. – North Charleston, SC, USA: CreateSpace, 2014. – pp. 71-75.