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RESEARCH OF THE CAUSE OF CONTAMINATION OF LUBRICANTS USED IN VEHICLES

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Annotation

Studies of the contamination of lubricating oils during operation in hot climates and high air dust content show that lubricants are intensively contaminated with mechanical impurities, water, fuel and organic products, which leads to premature aging of the oil.

During operation, engine components and parts are contaminated with various deposits. The process of formation of deposits is associated with thermo-oxidative transformations of products of incomplete combustion of fuel and oil components. These transformations take place both in the volume of the oil and in its thin layer on a heated metal surface. The resistance of the oil against oxidation by atmospheric oxygen is one of the most important factors that determine the behavior of the oil in the friction units during operation.

We analyzed M-10V$_2$ motor oils and calcium alkyl salicinate additives. After the introduction of such a concentration of the additive into the oil, we observed its dissolution. Studies show that the addition of a 9% additive reduces the process of piston ring wear by 3-4%, as well as an increase in efficiency by 1%, which leads to an increase in engine power by about 4%.

Keywords: *contamination of lubricating oils, the process of formation of deposits, oxidative processes, varnish deposits, dustiness in the air.*

When operating in engines, units and friction units, lubricating oil is oxidized by atmospheric oxygen, as a result of which its composition changes, new substances appear in it. Studies of the contamination of lubricating oils during operation in hot climates and high air dust content show that lubricants are intensively contaminated with mechanical impurities, water, fuel and organic products, which leads to premature aging of the oil.

During operation, engine components and parts are contaminated with various deposits. The process of formation of deposits is associated with thermo-oxidative transformations of products of incomplete combustion of fuel and oil components. These transformations take place both in the volume of the oil and in its thin layer on a heated metal surface. The main reason leading to the formation of high-temperature deposits in engines is oxidation processes occurring in the volume of the oil and on the metal surface. Such deposits negatively affect the reliability, efficiency and durability of the engine.

The resistance of the oil against oxidation by atmospheric oxygen is one of the most important factors that determine the behavior of the oil in the friction units during operation.

Oxidation leads to the formation of varnish and carbonaceous deposits (especially on hot surfaces such as pistons and piston rings), low-temperature deposits - sludge, corrosion and destruction of metals, for example, bearing shells, resulting from acidic products. And although the oil at rest on the heated parts is much less time than in the flow, the oxidation of the oil under static conditions in some cases has a significant effect on varnish formation in the engine.

Varnish deposits cause the piston rings to burn and overheat the parts on which the deposits have formed. All this leads to a decrease in engine power, its quickest wear and an increase in oil consumption.

The results of spectral analysis (elemental composition) of active elements and contaminants are presented in the table.

Elemental composition of contamination of lubricants when the engine is running

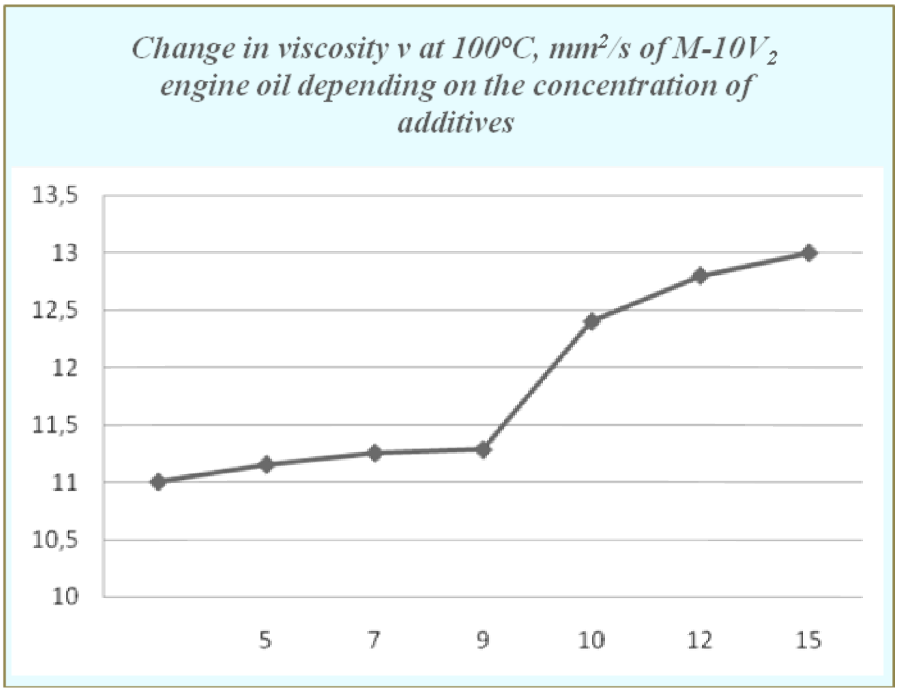
Element name	In waste oil,%	In refined oil,%
Iron (Fe)	0,07	0,0006
Lead (Pb)	0,077	0,00021
Chromium (Cr)	0,001	0,00001
Copper (Cu)	0,002	0,00019
Magnesium (Mg)	0,0025	0,0003
Aluminum (Al)	0,022	0,0001
Silicon (Si)	0,06	0,0004

Analyzes show that used oil mainly contains wear products, atmospheric dust and products of spent additives in the form of iron (Fe), zinc (Zn), lead (Pb), chromium (Cr), magnesium (Mg), copper (Cu) , calcium (Ca) and barium (Ba). The table shows that the active elements in the waste oil are almost 40 - 45% less than the norm.

To ensure minimum wear on parts, it is better to use oils with a higher viscosity. However, such an increase in viscosity, especially for engines not warmed up to operating temperature, causes starting wear and deterioration of fuel and economic performance.

The transition to the use of low-viscosity oils is primarily due to the fact that nanotechnology is used in the manufacture of modern engines, the deviation of the dimensions of the parts is insignificant and, accordingly, the gaps between the rubbing parts are minimal. More viscous, including medium-viscosity oils during the start-up period cannot penetrate all the gaps and as a result, dry friction and maximum wear occur within a few seconds.

We analyzed M-10V_2 motor oils and calcium alkyl salicinate additives. After the introduction of such a concentration of the additive into the oil, we observed its dissolution. Having determined the dissolution of the additives in the engine oil and the calcium alkyl salicinate additive, we determined the physicochemical parameters of the engine oil for various concentrations of additives. We suggest adding 9% of additives, since further increase in oil viscosity sharply increases, which leads to increased wear of parts (Fig. 1).



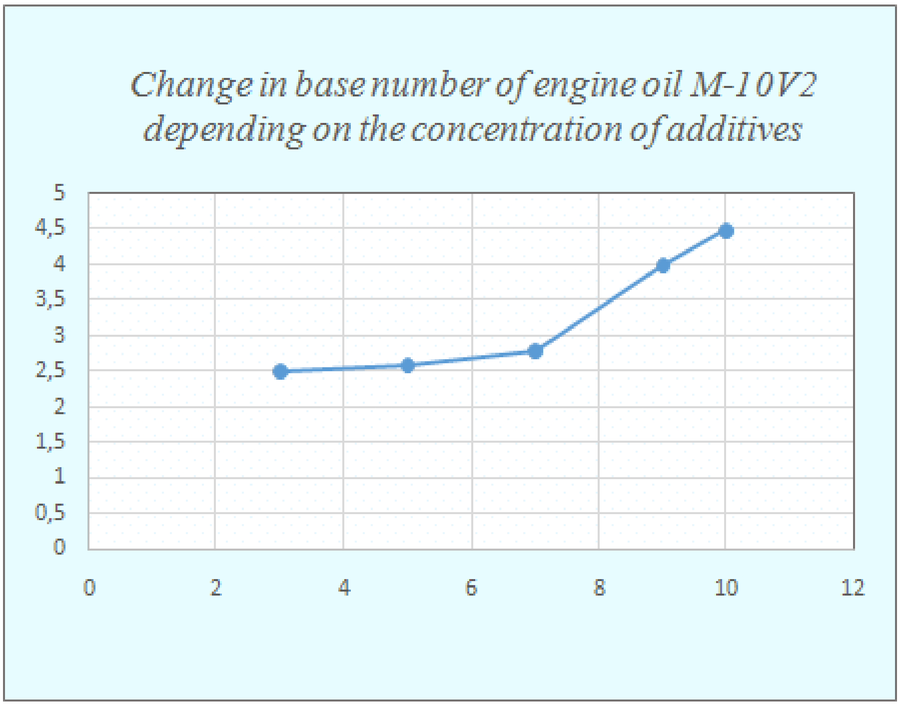


Fig 1. Physicochemical indicators of engine oil for various concentrations of additives

Studies show that the addition of a 9% additive reduces the process of piston ring wear by 3-4%, as well as an increase in efficiency by 1%, which leads to an increase in engine power by about 4%.

In the future, these oils can be admitted to the next stage - to performance tests on special equipment.

References

1. Dzherikhov VB Automotive operational materials: textbook. St. Petersburg: SPGASU, 2009. –256 p.
2. Ostrikov V.V. O. A. Kleimenov, V. M. Bautin. Lubricants and their quality control in the agro-industrial complex - M .: Rosinformatekh, 2008. - 172 p.
3. Smirnov A. V. Automobile operational materials: a tutorial. - Veliky Novgorod: NovGU, 2004 .- 176 p.
4. Kirichenko N.B. Automotive maintenance materials Textbook for secondary vocational education - M .: Iz.Tsentr "Academy", 2012.
5. Danilov V.F. and others. Oils, lubricants and special fluids. Study guide-Elabuga: publishing house of the K (P) FU branch. 2013. - 216 p.
6. Alimova Z.Kh. Ways to improve the properties of lubricants used in vehicles - T.: "VNESHINVESTROM", - 2019.
7. Alimova, Z. X., Kholikova, N. A., Kholova, S. O., & Karimova, K. G. (2021, October). Influence of the antioxidant properties of lubricants on the wear of agricultural machinery parts. In IOP Conference Series: Earth and Environmental Science (Vol. 868, No. 1, p. 012037). IOP Publishing.
8. Alimova, Z. Kh. Influence of the chemical composition of motor oils on viscosity indicators / Z. Kh. Alimova, A. A. Ismadierov, F. O. Tozhibaev // Economy and society. - 2021. - No. 4-1 (83). - S. 595-598.
9. Alimova, Z. Kh., Sidikov, F. Sh., & Usmanov, I. I. (2021). Improving the stability of lubricants against oxidation. Science and Education Today, (2 (61)), 23-25.
10. Alimova, Z. Kh., & Karimova, K.G. (2021). The effect of changing the performance properties of engine oils on engine wear. In Science Forum: Engineering and Physics and Mathematics (pp. 11-14).
11. Alimova, Z. Kh., Sidikov, F. Sh., & Alimov, Sh. I. (2020). Reducing wear of engine parts by improving the antioxidant properties of engine oils.
12. Alimova, Z., Akhmatjanov, R., Kholikova, N., & Karimova, K. (2021). Ways to improve the anticorrosive properties of motor oils used in vehicles. In *E3S Web of Conferences* (Vol. 264, p. 05004). EDP Sciences.
13. Alimova, Z., Ismoilov, S., & Akhmadjanov, R. (2020). Improving the Performance of Transmission Oils.
14. Alimova, Z., Kholikova, N., & Karimova, K. (2021). Influence of the antioxidant properties of lubricants on the wear of agricultural machinery parts. *Web of Conferences* IOP Conf. Ser.: Earth Environ. Sci. 868 012037