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RESEARCH OF MOTOR OILS FOR MINING AND TRANSPORTATION EQUIPMENT

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Annotation: *The purpose of this work is to study the performance characteristics of motor oils operating in engines of heavy-duty mining equipment. The physico-chemical parameters of the working oil can serve as a diagnostic parameter, according to which, without disassembling the unit, it is possible to assess not only the serviceability of the object at the time of diagnosis, but also the possibility of further trouble-free use for a certain period. Studies of the performance characteristics of SAE15W-40 engine oil, API CI-4 used in diesel engines and mining equipment have been carried out.*

Keywords: *engine oil, oxidation, pollution, deposits, oxidation, durability, dustiness of the air.*

In recent years, the concept of lubricating oils as an engine design element has become increasingly recognized. By knowing the patterns of behavior and changes in the operational properties of engine oil, it is possible to use it more effectively in engines and scientifically justify the timing of its change. Of particular importance in this case are the operating conditions of motor oils operating in mining and transport equipment engines in high air dustiness. It is known that determining the optimal timing of oil change in engines is an important and difficult task of chemmotology, solved only on the basis of in-depth research in actual operating conditions.

The purpose of this work is to study the performance characteristics of SAE15W-40 engine oil, API CI-4 used in diesel engines operating heavy-duty mining equipment.

Studies have shown that dump truck downtime due to engine failures accounts for 29% of the total downtime balance, which directly leads to increased operating costs and reduced productivity. The power units of dump trucks do not have backup, and, as a result, the failure of one or more nodes will lead to the failure of the car as a whole.

The use of oil at elevated ambient temperatures (more than +40 °C) there are specific failures caused by deterioration of physical and mechanical properties due to an increase in oil temperature in the crankcase of the engine. When the oil

temperature in the crankcase rises above 120 ° C, the oil loses its viscosity and is unable to form a reliable film on the rubbing parts, as well as provide liquid friction in the bearings, which also leads to increased wear. In addition, a further increase in oil temperature by 10°C increases the rate of oil oxidation by 2 times, significantly increases the consumption of oil for carbon monoxide. An increase in the oil temperature above 190-200 ° C can provoke its flash and gorenje.

Analyzing the causes of changes in individual physico-chemical indicators of the quality of the working oil, it can be noted that each indicator adequately reacts to the manifestation of external disturbances in the operation of engine components and systems.

At the same time, many indicators are interconnected. For example, an increase in the content of insoluble precipitate causes an increase in the viscosity of the oil, a low flash point indicates that the oil is liquefied by fuel, which leads to a decrease in viscosity; an increase in the content of iron and other metals in the oil causes an increase in acidity and the content of mechanical impurities and, as a result, viscosity, etc.

For engine diagnostics, it is usually recommended to determine the kinematic viscosity, flash point, alkaline and acid numbers, water and pollution content, density, oil color, etc. in oils. A comprehensive analysis of the results of these indicators allows you to diagnose the condition of the engine with low labor costs and a certain reliability. During the operation of controlled vehicles, samples of fresh oil, working and spent, with mileage recording, were examined.

To diagnose the condition of individual components and assemblies, an oil sample was taken in an amount of 0.3–0.5 liters. The main physico-chemical parameters of properties (kinematic viscosity, alkaline number, moisture content, flash point in an open crucible) affecting the performance of the oil have been studied.

Experimental data on the quality indicators of the employee

engine oil SAE15W-40, API CI-4

Table 3

Oil running time m/h	Flash point, ^{0}C	Kinematic viscosity at 100 ^{0}C, cSt	General base number, mg KOH/g
0	224	15.30	9.30
50	215	14.32	9.21
100	210	13.93	9.05
150	204	13.88	8.01
200	202	13.50	7.63
250	195	13.04	6.95
300	189	12.95	5.73

As follows from the deviation table, the qualitative indicators (viscosity, alkaline number and flash point) became noticeable when the dump truck ran 200 m/h or more. During operation, the viscosity of the oil decreased to 12.95. This is due to changes in the structural and group composition and the ingress of fuel. The limit of the performance of oils is very often considered to be the equality of the total alkaline number to the total acid number. The permissible value of the alkaline number is limited to 1.5...2.0 mg KOH/g, or 50% of the alkaline number of fresh oil. The operation of the engine on oil with an alkaline number below the limit leads to accelerated wear of piston rings and cylinders, sometimes there is an intensification of varnish and carbon formation. The table shows that the alkaline number decreased from 9.31 to 5.73 during operation.

The service life of the oil is mainly due to its detergent properties, therefore, in almost all motor tests, great attention is paid to detergent properties. The engine is polluted due to the intense oxidation of the oil in contact with the hot surfaces of the parts. When the diesel engine is running at a constant rate, the rate of depletion of the alkalinity of the oil is proportional to fuel consumption.

Taking into account all the experimental data we have obtained on changes in quality indicators (base number and flash point), we recommend additionally introducing additives into the engine oil.

Currently, research is continuing on the effectiveness of the influence of nature and the concentration of additives on the performance of engine oils operating in heavy-duty mining equipment engines in high air dustiness.

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