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Abstract. The article presents the influence of operating conditions on the design of vehicles, the increase in ambient temperature on changes in the performance properties of lubricants. Methodology for conducting experimental studies and evaluation parameters for determining the base number of motor oils is proposed. Test results of Agrimot 15W-40 engine oil for base number on tractors Claas are obtained.

1. Introduction

The article presents the influence of operating conditions on the design of vehicles, the increase in ambient temperature on changes in the performance properties of lubricants.

The increase in oil prices at the world level with the simultaneous expansion of the fleet of tractors, machines and mechanisms leads to the need for an economical and rational use of fuel and energy resources, in particular lubricants. Saving lubricants in tractor equipment is achieved by their correct selection for specific operating conditions and justification of the timing of their replacement.

The operating conditions of the Republic of Uzbekistan are characterized by high temperature, dustiness, high salt content. The influence of these factors on the change in the quality of tractor motor oils for the operating conditions of the republic has not been sufficiently studied. In addition, the frequency of replacement of engine oils in these tractors, taking into account the operating conditions, the heat stress of the engines and the above factors, is not scientifically substantiated. The recommended periods for replacing engine oils by manufacturers are set for a temperate climate, etc.

The operating conditions of tractors affect the operating modes of units and parts, accelerating or slowing down the change in the parameters of their technical condition. The influence of operating conditions on the design of vehicles and the reliability of their operation are divided into groups: transport conditions, field conditions, natural and climatic conditions, traffic conditions.

Transport operating conditions provide for the type, conditions of maintenance, repair and storage of rolling stock and predetermine the choice of the type and design of tractors. Tractors are mainly used in dusty fields. The rolling stock is stored in an open area of the enterprise, maintenance and repair are carried out in the production room.

Field conditions are one of the most important factors that directly affect the technical and economic performance, technical characteristics and design of tractors. In terms of operational indicators, the fields are characterized by the estimated speed and degree of safety of the tractor, the load allowed on the hook, the maximum throughput, and the grip of the wheels with the road and field conditions.

During the operation of the fields, a significant change in the degree of evenness of the road and field occurs, which significantly affects the technical and economic indicators of tractors, their wear and service life. Conditions are characterized by ambient air temperature, barometric pressure, relative air humidity, wind speed, precipitation, solar radiation and air dustiness.

The territory of the Republic of Uzbekistan is part of the Central Asian region, belongs to the hot climatic zone and is located in a hot desert area.

The environmental factors of a hot dry climate have a significant impact on the reliability of tractor operation. A very large additional impact on the reliability of vehicles is exerted by dust and sand storms that occur in areas of deserts and semi-deserts of a hot dry climate. High ambient temperature and intense solar radiation impair heat dissipation from parts and oil, contributing to their temperature increase. This leads to a decrease in the viscosity of the oil, a drop in the bearing capacity of the lubricant layer in the crankshaft bearings and between the rubbing surfaces of other units. The air temperature in summer reaches + 55 °C, the daily difference is 25 °C, air humidity is within 20 ... 30% in summer, 45-75% in winter. Barometric pressure - the average annual atmospheric pressure up to 10 GPa.

The increase in external temperature accelerates the oxidation processes in the oil, contributing to its aging and the operation of additives. Oil evaporation and waste losses are also intensified. Sharp daily fluctuations in air temperature increase the water content in the oil as a result of condensation of atmospheric moisture on the crankcase walls and parts, which, in combination with oxidative phenomena, causes an increase in the aggressiveness of the oil and accelerates the fall in the base number. One of the main operational features of the Central Asian region that have a negative impact on the operation of the lubrication system and the engine as a whole is the high dustiness of the roadside air layer and the high abrasive properties of the dust. At a height of 0.65 m above the ground, the dust consists of 66% of fine particles up to 10 microns in size. It easily penetrates into the engine crankcase through oil fillers, oil gauge holes, the slightest leaks in the joints of external parts. The finest dust (up to 3 microns), passing through oil filters, being enveloped by the products of oil oxidation and polymerization, forms a thin colloidal suspension that does not increase friction and has almost no negative effect on the operation of the units.

Particles with a size of 5-10 microns remain in an active state, quickly clog fine filters, increase their internal resistance and disrupt oil filtration. Getting into the gaps between the rubbing parts, they cause intense wear of the surfaces.

The studies were carried out on specially allocated Claas controlled vehicles using standard and private methods, using specialized control and measuring equipment in accordance with regulatory documents for conducting experimental studies.

To ensure the reliability of engines, engine oil must have a certain set of properties, depending on their models and operating conditions. The complex of properties of oils is created on a mineral or synthetic basis and a package of additives. Engine oil performs several functions in the engine at the same time: it reduces wear, friction forces between engine parts, protects them from corrosion, washes, retains mechanical impurities, seals the gap between parts, removes wear products from the friction zone, removes heat from contacting surfaces. The properties of the oil during engine operation change due to physical and chemical processes. Oil aging occurs as a result of the oxidation of its hydrocarbon base, the operation of additives, the accumulation of products of incomplete combustion of fuel, wear particles, dust and water. The studies were carried out on engines of Claas tractors running on Agrimot 15W40 oil. The correlation method revealed a change in the content of chemical additives in engine oil during technological engine running-in. The dependence of the base number on the content of the antioxidant barium additive in the oil is presented. Numbers from the content of the barium antioxidant additive in the oil.

2. Materials and methods

For the study, the workplace was equipped with the necessary instruments and materials. These include, a laboratory potentiometer (pH-meter) with a scale division value of 5 mV; indicator (glass) and reference (silver chloride or calomel) electrodes; titration stand; laboratory glassware; 0.1 N

hydrochloric acid solution; acidic buffer solution (alcohol solution of gamma collidine and hydrochloric acid) with pH -4; alkaline buffer solution (alcohol solution of methanitrophenol and potassium hydroxide) with pH-11; solvent (30% ethanol and 70% toluene or 50% isopropyl alcohol, 49% toluene and 1% water).

3. Results

Total alkaline A_2 in milligrams of potassium hydroxide per 1 g of product, determined by direct titration, is calculated by the formula

$$A_2 = \frac{(V_5 - V_2) * c_4 * 56.1}{m^2}$$

where: V_5 is the volume of 0.1 mol/dm^3 hydrochloric acid solution used to titrate the sample to the EMF value in the acidic buffer solution or to the potential jump in this area, cm^3.

V_2 is the volume of 0.1 or 0.05 mol/dm^3 hydrochloric acid solution used to titrate the control experiment to the EMF value in an acidic non-aqueous buffer solution or to the potential jump in this region, cm^3;

c_4 is the concentration of the hydrochloric acid solution, determined according to 5.7.2, in mol/dm^3;

m^2 is the mass of the analyzed product, g.

The test result is taken as the arithmetic mean of two consecutive determinations. The result is rounded up to 0.01. The obtained data are compared with the requirements of GOST.

Table 1. Base number test results for Agrimot 15W-40 engine oil.

No	Claas Com 1	Claas Com 2	Claas Com 3	Test result A2		
				Claas Com 1	Claas Com 2	Claas Com 3
1	0 m/h	0 m/h	0 m/h	12.23	12.23	12.23
2	20 m/h	19 m/h	23 m/h	11.07	11.09	11.01
3	50 m/h	54 m/h	55 m/h	10.49	10.24	10.30
4	74 m/h	70 m/h	73 m/h	9.35	9.41	9.37
5	93 m/h	92 m/h	90 m/h	8.14	8.17	8.08
6	105 m/h	101 m/h	103 m/h	7.77	7.79	7.78
7	124 m/h	120 m/h	122 m/h	6.14	6.66	6.34
8	141 m/h	143 m/h	144 m/h	5.23	5.20	5.17
9	162 m/h	164 m/h	165 m/h	4.55	4.49	4.47
10	192 m/h	194 m/h	190 m/h	3.10	3.07	3.14
11	200 m/h	207 m/h	209 m/h	2.28	2.25	2.23
12	225 m/h	219 m/h	221 m/h	1.54	1.87	1.63

Depending on the operating conditions, the fuel used and the quality of the engine oil, its alkaline reserve is consumed with varying intensity during operation (table 1.). The consumption rate and the initial alkalinity value determine the amount of corrosive wear of parts, especially in the upper part of diesel engine cylinders. When engines operate on sour fuel, the oil needs a large reserve of alkaline properties (5.5 mg KOH/g). In oils that have fully worked out their life in the engine, the alkalinity index decreases to 1-0.5. Therefore, the results of studies of Agrimot 15W-40 engine oil on Claas tractors meet the above requirements.

4. Conclusion

During the operation of engines, the properties of oils change as a result of oxidation, the operation of additives, the accumulation of products of incomplete combustion of fuel, wear particles, dust and water. The performance properties of motor oils are affected by the operating conditions of tractors, transport conditions, field conditions, driving conditions.

To assess the quality of motor oils, it is necessary to determine the kinematic viscosity and the total base number and base number of strong bases.

The optimal mileage of motor oils in terms of base number and kinematic viscosity in the conditions of Uzbekistan was determined.

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