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LUBRICANTS ON A SYNTHETIC HYDROCARBON BASE

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Petroleum oils, even with highly effective additives, do not satisfy the engineering requirements for viscosity-temperature and other operating properties in many cases. It is more rational to use synthetic hydrocarbon oils for lubrication of heavy equipment operating in extreme conditions [1]. However, the existing methods of producing them based on α-olefins are complicated and involve hydrogenation [2].

We developed a simple method of oligomerization of α-olefins into synthetic oils in the presence of toluene [3]. As indicated in [4], the molecular weight and degree of unsaturation of a polymer can be reduced by adding toluene to the polymerized system. Hydrocarbon oils with a wide molecular weight and consequently

TABLE 1

Indexes	M-16V_2	M-8V_2S	Lubricant	
			sample 1	sample 2
Density at 20°C, kg/m^3	902	862	898	862
Viscosity at 100°C, mm^2/sec	16.2	8.21	7.85	7.84
Viscosity index	94	108	131	110
Temperature, °C				
flash point	214	203	165	190
solid point	–26	–50*	–50*	–50*
Viscosity, Pa·sec				
at –10°C	–	–	–	0.34
at –20°C	1.54	1.23	1.85	0.91
at –30°C	6.08	2.35	6	–
at –40°C	137.6	8.53	18.8	9.25
Base number, mg KOH/g	4.29	4.51	3.78	3.92
Ash content, %	1.16	1.21	0.56	1.04
Antiscuff properties at 20°C				
critical load, N	1120	1480	670	840
welding load, Pa	2.47	2.7	2.08	2.93
Wear spot diameter, mm	0.5	0.5	0.65	0.55
Sludge content after oxidation, %	None		2.6	0.12
Corrosion, g/m^2				
on S-1 lead	21.1	32	3.6	4.1
on M-1 copper	1.1	None		3.2

Note. * Does not solidify.

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wide viscosity range were synthesized with this method with $C_8 - C_{12}$ α-olefins.

The studies showed [5] that the toluene contained in the solvent stops the oligomerization reaction by entering into an alkylation reaction with α-olefins and the products of their oligomerization (oligoalkylation), decreasing the molecular weight and viscosity of the products obtained.

Involving toluene in oligomerization of α-olefins in the presence of $AlCl_3$ complexes decreases the degree of unsaturation, eliminates hydrogenation, and improves the color of the oil.

The results of comprehensive studies of these oils (determination of the composition, thermooxidative stability, carbon formation, and other physicochemical properties) demonstrated the possibility of developing lubricants for different applications with them. Oils with a viscosity of 4 and 7 mm^2/sec at 100°C were used as the base oils.

A lubricant (sample 1) of the M-4z/8V oil type was prepared by thickening oil with a viscosity of 4 mm^2/sec with multifunctional IKhP-234 additive and adding DF-11 and PMS-200A additives. Another lubricant (sample 2) was prepared by adding a package of IKhP-3, DFKu, SB-Zu, IKhP-21, and PMS-200A additives to oil with a viscosity of 7 mm^2/sec. The following goal was set: to obtain the winter analog of standard M-16 IKhP-3 oil (GOST 25770—83), i.e, replacement of M-16V_2 oil — M-8V_2S oil.

The results of testing these compositions in comparison to commercial M-16V_2 and experimental low-viscosity M-8V_2S oils are reported in Table 1.

The compositions developed have functional properties similar to M-8V_2S experimental oil and have better anticorrosive properties. However, they are significantly worse than M-16V_2 and M-8V_2S oils with respect to the antiwear properties, especially in high-temperature conditions (100°C). For this reason, to improve these properties, 1.5% molybdenum disulfide was added to the new compounds, making it possible to approximate the antiwear properties of the lubricants investigated.

Sample 1 was also inferior to the existing oils with respect to oxidation resistance.

After improvement of the antioxidant properties, the synthetic lubricant compounds can be recommended for the next stage of bench tests. Preference should be given to the lubricant of the M-4z/8V oil type which has a high viscosity index and simpler composition.

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