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The Development of Environmentally Safe Lubricants with High Biodegradability from Local Raw Materials

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III. ENGINEERING SCIENCE

THE DEVELOPMENT OF ENVIRONMENTALLY SAFE LUBRICANTS WITH HIGH BIODEGRADABILITY FROM LOCAL RAW MATERIALS

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Abstract

The article presents the results of studies to obtain a composition of biodegradable engine oil based on rapeseed oil using additives. The comparative physical and chemical characteristics of the composition of biodegradable engine oil with mineral petroleum oil are determined.

Key words: biodegradability, ecology, environmentally safe lubricant, flotation agent, graphite, rapeseed oil.

One of the ways to solve the environmental problems of today requires the search for alternative safe sources of raw materials and energy. This is due not only to the need to reduce pollution of the environment, but also the importance of the transition from exhaustible raw materials to the expanded use of renewable resources. This is essential when using lubricants in the technosphere and biosphere [1].

Work in this direction has been going on all over the world for a long time. In the area of using renewable raw materials, the leading role belongs to bioresources - first of all, oilseeds, since vegetable oils are a quite acceptable alternative to oil feedstock for the production of fuels and lubricants.

Renewability of biodegradable, environmentally-safe raw materials and relative cheapness compared to synthetic and mineral products currently determine the feasibility of expanding work on the use of vegetable oils in technology. The high cost and scarcity of synthetic ester oils with a biodegradability close to vegetable oils (85-90%) significantly limits their use. It is very important that the use of vegetable oils, as well as waste from their processing, is possible not only in the production of almost all types of lubricants, but also fuels. In this regard, from the point of view of environmental safety, in modern technology, vegetable oils are used as lubricants - primarily as technological lubricants, based on rapeseed and castor oil, as a dispersion medium, motor oils [2].

Thus, from a technical, economic and ecological point of view, rapeseed oil and its transesterification products are most suitable for these purposes [3].

Studies of rapeseed oil were carried out, which showed that rapeseed oil is not inferior to petroleum oils in its physical and chemical characteristics, it corresponds to petroleum oils in certain physicochemical characteristics, and its viscosity index and flash and solidification temperatures are much higher than them.

The above studies suggest that at present the use of vegetable oil in its natural state as a dispersion medium should be limited to their function instead of petroleum or some synthetic, and the main role obviously belongs to vegetable oils as cheaper, affordable, made from easily renewable raw materials with high biodegradability and which, apparently, will be a nutrient medium in the soil for microorganisms.

In accordance with the developed methodology, we obtained a composition of biodegradable motor oil based on rapeseed oil using finely dispersed graphite from the second flotation purification of graphite ore with a carbon content of 31% as an additive.

As the results show, the obtained composition of motor oil based on rapeseed (sample No. 1) surpasses mineral oil M-14B_2, M-14G_{2k} in many ways, such as viscosity index - 187, base number - 0.05 KOH/gram, ash content 0.064 % , the pour point is 25 °C, etc., but it has a reduced viscosity at 100 °C - 5.89 mm^2/s.

Thus, it can be considered that using rapeseed oil, a flotator and a graphite additive, it is possible to obtain motor

oil of higher quality than mineral oil, but with enhanced biodegradability. It is necessary to increase the viscosity at 100 °C using a viscous additive and investigate changes in the wear-resistance characteristics.

It can be considered that using rapeseed oil, a flotation cell and a graphite additive, it is possible to obtain engine oil of higher quality than mineral oil, but with enhanced biodegradability.

Thus, in the development of motor oil with enhanced biodegradability, we followed the following concepts based on the analysis of scientific, technical and patent-licensing literature and experimental studies conducted:

1. The increase in the biodegradability of lubricating oils is determined by the presence in the composition of vegetable raw materials, and, the greater the component of vegetable raw materials, the higher the biodegradability of the resulting lubricant;

2. Upon receipt of a lubricant with enhanced biodegradability, it is necessary to select such a component of plant raw materials as the dispersion medium that most suits the developed lubricating engine oil with the necessary physicochemical and performance characteristics.

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