

LUBRICANT COMPOSITIONS BASED ON WASTE PRODUCTS

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The article presents the pilot study results on lubricant compositions based on waste oil refining and petrochemistry. Dropping point, penetration test, copper strip corrosion test and other metrics were performed. The results reveal that the lubricating grease from waste oil refining and petrochemistry can be used for general machines where extreme pressure is not required. The application of wastes in industries is a wise way to decrease pollution from industries as well as to preserve the environment.

Introduction. Grease is a semi-solid lubricant. Lubricating grease consists of base oil, thickener agents and additives and its main application is to reduce friction and wear between moving parts of machineries that results in improvement in efficiency and saving of energy.

Greases are semi-solid lubricants used to reduce friction between two solid surfaces. Lubricating grease is defined by American Society of Testing and Materials as semi fluid to solid product of a dispersion of a thickener in a liquid lubricant. Greases are made by dispersing thickening agent into carrying lubricant (oil) in a controlled mixing temperature [1–3].

Lubricating grease has been used for plenty of application, involving machinery and moving part for efficiency and to prolong the life-time of the machinery [4]. Grease can perform additionally, more than lubricant oil does for the reason that grease can act as a seal, provide protection against corrosion and at the same time reduce noise and shock.

The grease formulation, which is currently used, is made from petroleum and its derivatives.

There is a great need for the reutilization of waste oil refining and petrochemistry into useful recycled products. Recycling is considered to be beneficial to environment and to economic development since it mitigates resource scarcity, decreases demand for landfill space and generally involves savings in energy.

The objective of this research is to produce lubricating grease from waste oil refining and petrochemistry.

Methodology. Grease was prepared by mixing the low molecular weight polyethylene (thickener) and different dispersion media: dewaxed oil (DM-1), residual solvent refined extract (DM-2), waste petroleum oil (DM-3) and waste synthetic oil (DM-4). Different ratios of thickener and dispersion media were used. Dropping point, penetration test and copper strip corrosion test were performed. The copper strip corrosion test indicates that corrosive nature of the grease samples was low under specific condition. The colour of the lubricating oil was brown and black is shown in Figure 1.



Fig. 1. The colour of prepared the lubricating oils

Results, discussion and conclusion. A number of samples of lubricant compositions have been obtained in the laboratory. The lubricant compositions are on the basis of high-density polyethylene (HDPE) that is the waste production of The Low Density Polyethylene Plant “Polymir” OJSC “Naftan”. The melting temperature of selected HDPE, that has low mass fraction of volatiles, is over 95°C. HDPE consists of a mixture of saturated hydrocarbons, predominantly with a normal structure, therefore is resistant to corrosion and chemically aggressive environments, has a high flash point (over 250 °C), and low ash content (less than 0.1%), is thermally reversible (it restores the structure and its properties after remelting) and a hydrophobic substance, has a high adhesion to various materials, i.e. it has properties of greases.

It was found that the synthetic lubricant compositions based on HDPE bear analogy to the existing industrially produced hydrocarbon greases as CPG (corrosion protection grease), CIAFAO-205 (Central Institute

of Aviation Fuels and Oils) according to their physico-chemical and service properties. However the source components for their production are cheaper than the ones for commercially produced lubricants. The formulation of lubricant compositions based on HDPE comprising dispersion media was developed: DM-1 – 27 ... 30% wt.; DM-2 – 27% wt.; DM-3 – 26 ... 27% wt.; DM-4 – 26 ... 27% wt.. They have the service properties that are similar to the CPG lubricant type.

On the basis of research results (Table 1), it was concluded that IV dewaxed oil vacuum distillate, waste petroleum oil and waste of synthetic oil can be used as dispersion media for production of lubricants based on HDPE. However it is recommended to use petroleum and synthetic oils after special refining.

Table 1 – Properties of synthesized lubricant compositions based on HDPE

Indicators	Lubricant compositions based on High Density Polyethylene having different dispersion medium			
	DM-1	DM-2	DM-3	DM-4
Appearance	smooth homogeneous ointment			
Colour	light brown	dark brown	black	dark brown
Dropping Point, ° C	60	57	57	56
Penetration at 25 ° C, 0.1 mm for 5 sec	102	106	142	153
Sliding temperature, °C	54...55	52...53	50...51	52...53
Acid value mg KOH/g	absence	absence	0,303	0,408
Volatility, for 1 hour at 100 °C; 150 °C	0,704 1,562	0,235 1,510	0,371 1,582	0,289 0,289
Colloid stability,% wt.	0,307	2,925	3,372	3,095
Oxidation at 120 ° C for 10 h, mg KOH / g	0,022	0,136	0,077	0,093

The results reveal that the lubricating grease from waste oil refining and petrochemistry have soft appearance and can be used for general machines where extreme pressure is not required. This shows that waste oil refining and petrochemistry have better potential in the lubricating market and also helpful in reducing the pollution problem as well as to preserve the environment and cost of the grease produced. Also this will helpful in further utilization of wastes into useful products and reduce the burden on the conventional sources. So this novel idea can bring the most effective solution to convert the industrial wastage to the usable form.

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