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Biological Degradability of Motor Oils Significant Damage to the Environment

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ABSTRACT: The biological degradability of motor oils into non-toxic water-soluble compounds is considered. An analysis was made that petroleum products are susceptible to slow biodegradation, and waste oils are especially resistant to this. Waste oil products evaporate very slowly under normal conditions, and high adhesive properties contribute to their retention in the soil.

KEYWORDS: Adhesion properties of oils, used motor oil, environmental properties, regeneration, processing, additive for oils.

I.INTRODUCTION

It is advisable to compare the environmental properties of automotive operating materials with the environmental consequences of smoking tobacco products, the health risks of which were seriously discussed only at the end of the last century [1]. The situation is similar with automotive operating materials, whose environmental and, in particular, toxic properties are discussed in passing as a side effect on the environment [2]. However, most of the components that make up fuels, lubricants and special liquids, some of which are basic substances in the manufacture of products, have been fully investigated, and a specific assessment of their toxic and sanitary-hygienic properties has been given [3].

Ecologists around the world are sounding the alarm about the environmental problems of road transport [4]. To date, there is no comprehensive approach to solving this problem, which considers environmental issues in all areas, starting with the processes of manufacturing vehicles, obtaining operational materials necessary for the normal operation of vehicles, transportation, storage, as well as the results of their application [5].

Separately, the biodegradability of motor oils should be considered.

Biodegradability is the ability of a substance to be broken down by microorganisms into non-toxic, water-soluble compounds. The biodegradability of oils as a property is becoming increasingly important. Conventional mineral oils and other petroleum products, as well as some synthetic oils, do not biodegrade and cause significant damage to the environment over a long period of time.

Vegetable oils and animal fats have excellent biodegradability, paraffin oils are difficult to decompose, and naphthenic compounds do not decompose at all. Compounds having ester groups are easily decomposed, and some synthetic ester and polyglycol oils are relatively easy to decompose [6].

To improve biodegradability, mineral oils are chemically modified.

Recently, in some countries (Germany, Switzerland, Scandinavian countries), laws have been adopted that regulate the use of non-biodegradable substances in many industries [7]. First of all, attention is drawn to oils for two-stroke engines that enter the environment with exhaust gases, as well as oils used in tractors, agricultural machinery, oils for lubricating chains of chainsaws and greases. As a result, oil product manufacturers in Germany, Austria, Switzerland, France, and other European countries have a fairly large number of biodegradable oils, hydraulic fluids, and greases in their product range [8].

Since the use of lubricating oils is only about 1% of the total use of petroleum products, it would seem that the issue of their operation from an environmental point of view does not deserve much attention [9]. However, due to the fact that a significant part of used oils end up in the environment, it is the environmental interests in the regeneration and processing of used oils that are provided in the first place. As is known [10], petroleum products are susceptible to slow biodegradation, and used oils are especially resistant to this. Waste oil products evaporate very slowly under normal conditions, and high adhesive properties contribute to their retention in the soil.

In reservoirs, waste oils spill over the surface of the water and interfere with its contact with air, and a significant part of them settle to the bottom, forming precipitation that kills the flora and fauna of reservoirs. Researchers have found that used oils account for at least 50% of the total oil pollution.

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A qualified oil change reduces its release into the environment, but the part of unqualified service is 10-15%. Many consumers do not hand over used oil for recycling, but throw it into city dumps or drain it into the sewer. At the moment, there are no reliable data on the disposal of used oils. It is assumed that no more than 20% of used oils are subject to recycling, which leads to a negative impact on the environment.

More than 140 types of concentrated polycyclic carbons have been identified in used oils, the number of which increases with the use of oils. These carcinogenic compounds are formed as a result of the combustion of oil and their ingress into the oil from the fuel. According to calculations by Western experts, if 1 liter of oil enters water bodies, it causes poisoning of up to 1 million liters of water, and pollution is long-term.

One of the most promising ways of dealing with used oils is their regeneration and reuse. Oil regeneration is an economically viable technology that reduces the environmental burden on the environment by reducing the amount of oil that must be disposed of.

Depending on the regeneration process, 2-3 fractions of base oils are obtained, from which commercial oils (motor, transmission, hydraulic, plastic lubricants) can be prepared by compounding and introducing additives.

One of the problems that sharply reduces the economic efficiency of the disposal of used motor oils is the high costs associated with their collection, storage and transportation to the place of processing. To restore used oils, a variety of technological operations are used, based on physical, physico-chemical and chemical processes and consisting in processing the oil in order to remove aging products and pollution from it. As technological processes, the following sequence of methods is usually observed: mechanical (to remove free water and solid contaminants from the oil); thermophysical (evaporation, vacuum distillation); physical and chemical (coagulation, adsorption).

II.CONCLUSION

If they are not enough, chemical methods of oil regeneration are used, which are associated with the use of more complex equipment and high costs:

- methods of regeneration (purification) of used oils by treating them with strong mineral acids, in particular sulfuric acid, followed by treatment with bleaching clays. At the same time, a significant part of the oils, up to 50%, is lost, turning into acid tar. Such processing of oil leads to problems of disposal of waste clays and acid sludge, which also pollutes the environment;

- the following method, including a number of successive stages: removal of mechanical impurities, removal of water and light hydrocarbons, treatment with saturated hydrocarbon solvents, followed by vacuum distillation and catalytic hydrogenation.

- the next method, the essence of which is heating, distillation of water and light hydrocarbon fractions, processing with polymethylsiloxane solvents, followed by vacuum distillation in a thin-film evaporator. The disadvantage of the process is the high cost of the solvent and the difficulty of removing it from the oil mixture. The quality of the oil after the extraction stage does not allow it to be used for the production of motor oils and requires an additional stage of vacuum distillation.

- the following method of regeneration (purification) of used oils, including the following stages: heating the oil to remove light fractions and water, extracting the oil with saturated hydrocarbon solvents (for example: propane), vacuum distillation with fractionation and hydrotreating, with the heavy fraction being subjected to heat treatment and re-extracted solvent. When using this technology, gas oil fractions are removed at the fractionation stage after extraction, which worsens the quality of the oil, and additional processing stages are required - heat treatment, additional extraction. This significantly complicates and increases the cost of the technological process.

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