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Environmental Interests in Used Oil Recycling

Aliyev Abror Akbarovich , Bakhtiyorov Jaloliddin Sharafiddinovich

Institute of General and Inorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan;
Tashkent State Technical University named after I. Karimov.

ABSTRACT: This article assesses the toxicity of exhaust gases and is largely characterized by the content of sulfur and phosphorus in the oil. Modern technology makes it possible to create completely biodegradable oils based on esters, since esters are environmentally friendly products and are easily disposed of.

KEYWORDS: Waste engine oil, regeneration, toxicity, hydrosynthetic oils, exhaust gases, additives, esters, dioxins.

I. INTRODUCTION

Toxicity is the property of substances to cause poisoning (intoxication) of the body [1]. It is characterized by a dose of a substance that causes one or another degree of poisoning. In case of inhalation poisoning, the dose is estimated by the product Ct, where C is the concentration of vapors or aerosol (mg / m3), t is the inhalation time (min). In case of damage in other ways (intravenously, intramuscularly, through the gastrointestinal tract, skin, etc.) - the amount of the substance in mg per 1 kg of live weight. Toxicity is determined in animal experiments using statistical methods [2].

The toxicity of exhaust gases is largely characterized by the content of sulfur and phosphorus in the oil. On the one hand, there is a direct indicator - the content of toxic components measured in the cycle of motor tests. On the other hand, there are also “deferred fines” - after all, the aggressive components of sulfur and phosphorus contained in the oil do not directly affect the readings of the gas analyzer, but, nevertheless, are quite harmful. And what is especially important, their compounds, getting into the exhaust gas converter, significantly reduce its resource [3].

In this regard, leading automakers require that the sulfur content in the oil does not exceed 0.2%, and phosphorus - 0.08%. These figures, depending on the tolerance of the car manufacturer, may vary slightly [4].

Hydrosynthetic oils (hydrocracking) are especially rich in sulfur, which is explained by the imperfection of the technology for the production of such oils. The used engine oil (Fig. 1) has an insignificant effect on the content of carbon oxides CO and nitrogen NOx, which cannot be said about the composition of the air-fuel mixture and the features of the combustion process [5].

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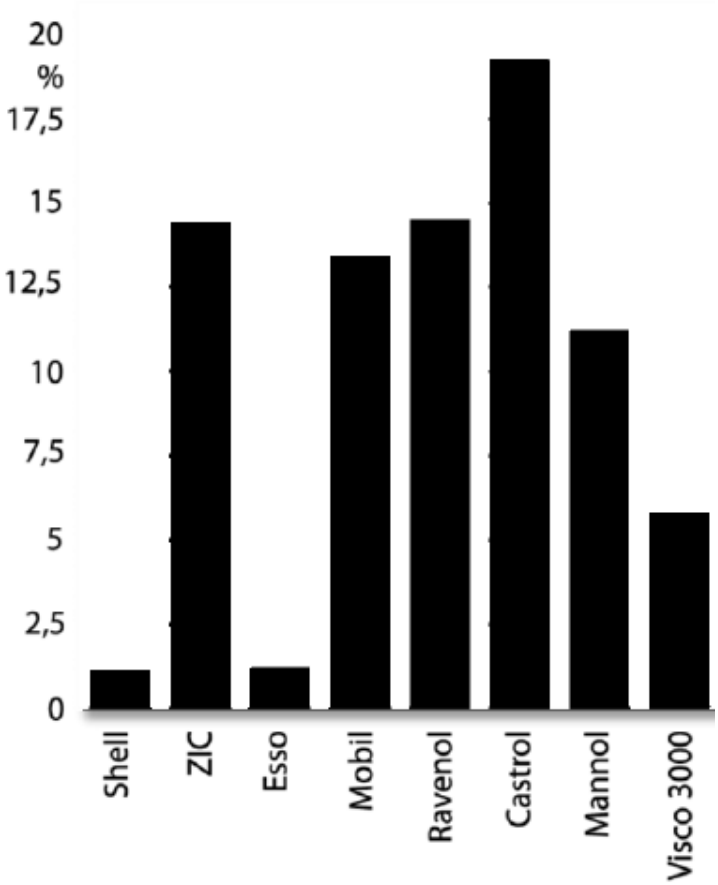

Figure 1. NOx content in relation to reference oil

But part of the CH in the composition of the exhaust gases depends precisely on the oil burning in the cylinder - this indicator is affected by the degree of volatility of the oil itself and the thickness of the oil film left in the cylinder by the piston rings when the piston goes down on the expansion stroke. An indirect indicator of volatility is the flash point: the higher it is, the less volatile components in the oil, and it burns out more slowly. And the thickness of the film under the rings, other things being equal, determines the viscosity at high temperature.

Polyalphaolefins (PAO), esters, or a mixture of them usually act as synthetic base oils. PAOs are hydrocarbons with a chain length of about 10–12 atoms. It is obtained by polymerization of short hydrocarbon chains - monomers of 3-5 atoms. The raw materials for this are usually petroleum gases: butylene and ethylene. Esters are esters - products of neutralization of carboxylic acids with alcohols. Raw materials for production are vegetable oils, such as rapeseed or even coconut. Esters have a number of advantages over all other known bases. Firstly, ester molecules are polar, that is, the electric charge is distributed in them in such a way that the molecule itself "sticks" to the metal. Secondly, the viscosity of esters can be set at the base production stage: the heavier alcohols are used, the greater the viscosity. You can do without thickening additives, which "burn out" during operation in the engine and lead to "aging" of the oil [6].

Modern technology makes it possible to create completely biodegradable oils based on esters, since esters are environmentally friendly products and are easily disposed of. However, all these benefits come at a high price. An ester base costs 5-10 times more than a mineral base, so their content in motor oils is usually limited to 3-5%, and they are used only in the most advanced products, usually at the top of the product line of oil companies.

Environmental problems in the use of motor oils are closely correlated with the tribological parameters of oils. Higher tribological parameters lead to a deterioration in environmental properties, because sulfur and phosphorus are natural anti-seize additives: the more of them, the better the friction unit is protected. Thus, there is a contradiction between the requirements for the intended purpose and environmental requirements for motor oils.

It should also be taken into account that during use, oils are contaminated with water, dust, metal corrosion products, oxidation products formed upon contact with air and under the influence of elevated temperatures, are diluted

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by fuel entering them, and deteriorate their characteristics under the influence of other factors; their functional properties change significantly. Used oil must be recycled. Disposal methods depend on the composition of the original oil (the amount and type of additives, the component composition of hydrocarbons) and the degree of impact on the environment and humans, the accumulated harmful substances in them. So, oils from gasoline engines become carcinogenic after a run of more than 5 thousand km, in oils from diesel engines, the accumulation of biologically active polycyclic arenes (products of incomplete combustion of fuels and thermal decomposition of oils) occurs to a much lesser extent.

The content of polycyclic arenes in used oils can be 10–100 times higher than their content in fresh products. The toxicity and carcinogenicity of used lubricating oils significantly complicate the possibility of their rational disposal.

The greatest danger in used motor oils is halogen-containing compounds, primarily chlorine, which can cause cancer, immune system disorders, etc. Their source is chlorine-containing additives to oils and fuels, chlorides that enter the oil from fuels, etc.

The main source of oil pollution is polychlorinated biphenyls (polychlorinated biphenyls), as well as their derivatives, the content of which in mixtures of used oils can exceed 240 ppm. During thermal decomposition, which occurs when used oils are burned, polychlorinated biphenyls (PCBs) form even more toxic substances, polychlorodibenzodioxins (PCDDs).

Polychlorinated biphenyls (polychlorinated biphenyls) is a group of organic compounds that includes all chlorine-substituted derivatives of diphenyl (1–10 chlorine atoms connected to any carbon atom of diphenyl, the molecule of which is composed of two benzene rings), corresponding to the general formula C12H10-nCln. PCBs are quite toxic.

The multifaceted damaging effect of these substances on a number of organs and systems, together with the ability for long-term accumulation in adipose tissue, has been proven.

In Uzbekistan, MPC values apply only to industrial mixtures of PCBs. Arochlor was taken as the standard mixture, according to which the MPC was calculated. MACs for PCBs have the following values:

- atmospheric air - 1 µg/m3;
- air of the working area - 1 mg/m3;
- water (water objects of economic and cultural and household wateruse) - 1 µg/l;
- soil - 0.1 mg/kg.

The more toxic polychlorodibenzodioxins (PCDDs) are members of a large group of extremely dangerous xenobiotics from among polychlorinated polycyclic compounds with concentrated cycles.

II.CONCLUSION

The real impact of dioxins on humans and nature, however, is not adequate to their acute toxicity. The data of recent years have shown that the main danger of dioxins lies not so much in their acute toxicity, but in the cumulative effect and long-term consequences of chronic poisoning in extremely small doses.

The most serious factor in the impact of dioxins on human health is their effect on the immune system. Even at negligible concentrations, they cause suppression of the immune system and disrupt the body's ability to adapt to changing environmental conditions.

This leads to a sharp suppression of mental and physical performance.

At slightly higher concentrations, dioxins cause carcinogenic, mutagenic, teratogenic and embryotoxic effects, disruption of the vital functions of the nervous system, damage to the liver, alimentary tract, etc.

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