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ADDITIVES USED TO IMPROVE THE ANTIOXIDANT PROPERTIES OF MOTOR OILS

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Abstract
Antioxidant additives are part of additive compositions that can simultaneously improve several properties of the oil. Antioxidant additives should dissolve well in oil and actively show a washing effect for a long time. We have studied additives used to improve the antioxidant properties of motor oils.

Keywords: Antioxidant additives, detergents, dispersants, deposits on parts, oxidation products, washing effect.

Introduction

Modern high-powered engines require high-quality engine oils. The most effective method of improving the performance properties of lubricating oils is by adding special additives to them.

The main means of combating varnish formation in the engine is the addition of antioxidant additives to the oils. When choosing an antioxidant additive, it is assumed that it dissolves well in oil and actively exhibits an antioxidant effect for a long time.

Antioxidant additives are part of additive compositions that can simultaneously improve several properties of the oil. The addition of antioxidant additives of various compositions reduces the formation of varnish deposits on the piston. Antioxidant additives prevent agglomeration (sticking together) of insoluble oxidation products and their deposits on parts.

When choosing antioxidant additives, they proceed from the fact that it dissolves well in oil and actively shows a washing effect for a long time. According to the mechanism of action, they are divided into detergents and dispersants. Detergents are surfactants (oil–soluble alkyl benzene sulfonates, phosphates, etc.) that protect the surface of engine parts from sticking and accumulation of oxidation products on them. Some sulfonates have alkaline properties and neutralize acidic oxidation products. The

composition of alkaline additives may include dispersed oxides, hydroxides and metal carbonates.

Dispersants suppress agglomeration and adhesion of oxidation products, and deposition of resinous substances on the surfaces of parts. The main task of these additives is to maintain impurities in the oil in a dissolved state, prevent their deposition on engine parts, oil channels, etc., dispersion (dissolution) of large contaminants. Polymers with polar groups are used as dispersants, which support colloidal particles of oxidation and contamination products in a suspended state (Fig.1).

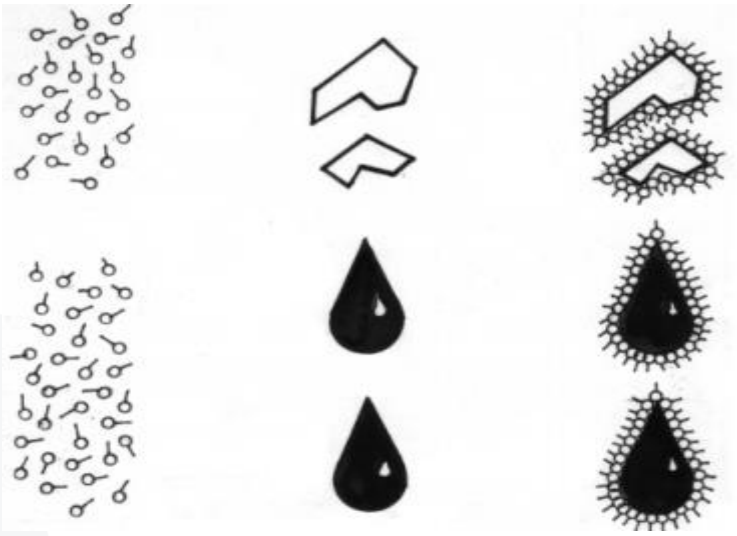

Fig.1 The scheme of action of dispersants: formation of suspension and emulsion

Emulsifiers lower the surface energy of liquids, as a result of which the water in the oil forms a stable emulsion and is released into a separate layer. Detergents serve as emulsifiers.

When using oil with good cleaning properties, the engine parts look as if washed, hence the appearance of the term "detergents".

In addition, detergent additives keep the oil oxidation products suspended, preventing them from sticking to the surfaces of heated parts and splicing particles together, which would disrupt the flow of oil to the rubbing parts (Fig. 2.).

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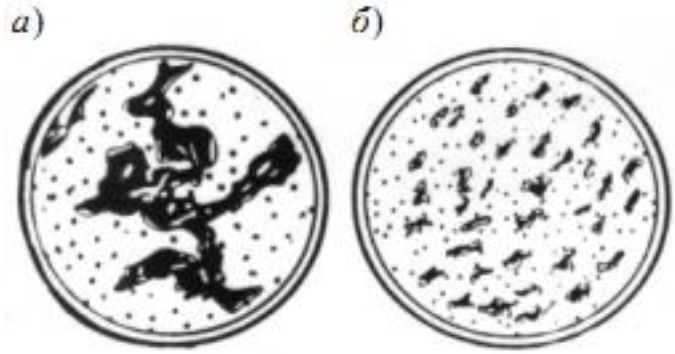

Fig.2. Scheme of carbon dispersion in oil, observed using an electron microscope:
a – without an anti–oxidizing additive;
b - with an anti-oxidizing additive

The antioxidant property is the ability of the oil to resist varnish formation on hot surfaces as a result of inhibition of oxidation and coagulation processes.
Antioxidant additives:
- they keep the oxidation products of the oil in suspension, i.e. they have a stabilizing effect, which is achieved by the ability of the additive to form adsorption shells on the surface of the particles;
- transfer oil-insoluble oxidation products into a colloidal solution using micelle additives, i.e. they have a solubilizing ability;
- prevent the adhesion of oil oxidation products to the surface of heated parts, due to the formation of a surface-active additive layer on it, i.e. they exhibit a shielding effect.
Thus, the antioxidant potential of engine oil is the percentage of the reference substance in the oil, at which it is able to maintain high aggregate stability, that is, liquid state without precipitation of products of oxidative polycondensation, which should usually be at least 70-80%. Thanks to this, additives help to reduce varnish deposits on metal parts of the engine.

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