

Development of Modern Biostable Lubricating Oils

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ABSTRACT

Today, one of the most important tasks from an economic and ecological point of view is to solve the problem of protecting motor oils from microbiological damage during their long-term storage, transportation, and operation under adverse conditions. In this regard, the study of oils in this aspect is most relevant.

We carried out studies of the biological stability of some analogues of motor oils of groups B₂, Г₂, ДМ, used in diesel engines for various purposes, and also studied the synergism of two- and three-component additives that make up the compositions.

It was determined that the use of multicomponent additives in the tested oils does not ensure their protection against biological damage, and in these systems there is a complete growth and development of microorganisms. Therefore, to protect against bio damage, antimicrobial additives- biocides were added to the additive composition, which dissolve readily in organic solvents and petroleum products.

Keywords: lubricating oils, bio damage, oxidation, microbiological damage, viscosity.

INTRODUCTION

With a broad study of modern lubricating oils, as well as transportation, long-term storage and a number of natural factors - humidity, temperature, etc., the periodically increasing demands placed on performance characteristics to eliminate their influence make the problem topical from the environmental point of view. At present, to achieve stability against various types of microorganisms is an urgent problem.

Economic damage as a result of biological damage to lubricating oils for various purposes, used in large numbers in machines and mechanisms is really huge.

The solution of the task is to increase the biostability of the noted materials is based on research and implementation of ongoing research work using biocides of various composition and structure.

MATERIALS AND METHODS

It is known that motor oils of various origins consist of base oils obtained by modern processing processes and an additive composition. The negative effect of a number of bacteria (*Pseudomonas aeruginosa*, *Mucobacterium lacticum*) and fungi (*Aspergillus niger*,

Cladosporium chrysogenum, *Penicillium cyclopium*) as a part of the oils of groups B₂, G₂, DM of diesel, autotractor, ship, industrial and self-unloading transport diesel engines.

It is established on the basis of experimental data that the process of biological decomposition, regardless of the structure and composition of additives of different functional properties of oils, providing physicochemical and performance characteristics of engine oils - antioxidant, corrosion, anti-wear and other additives, both individually and in two, three - and multi-component systems are fully developed.

To ensure the biostability of lubricating oils, it is necessary to study the effect of biocides of a certain composition and the correct choice. It is known that different classes of hydrocarbons for a number of microorganisms are a nutrient medium. The study of base oils of different origin shows that for the same reason, oils without additives do not possess the properties of biostability.

It is established that synergism of additives occurs in very rare cases. However, the combination of ДФ -11, MX-3103 and MX-3104-zinc salts of dialkyl dithiophosphate with

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detergents СБ -3-barium sulfonate in oil M-11 in a two-component biostability system is to a certain extent enhanced. Thus, the area of

destruction of microorganisms from bacteria and fungi increases from 2.0-2.5 cm to 3.0-3.5 cm.

Table1. Research of biodeterioration of antioxidant, anticorrosive and detergent-dispersant additives

| Sample | The diameter of the zone of destruction of microorganisms, sm | |
|--------------------------|---|---------|
| | Bacteria | Fungi |
| M-8 Baku | | |
| 1,2% ДФ-11 + 3,0% СБ-3 | 1,2-1,8 | 1,7-2,0 |
| 2,0% ДФ-11 + 1,5% С-150 | 1,5-1,9 | 1,3-1,7 |
| 0,8% MX-3103 +1,5% С-150 | 1,8-1,45 | 1,1-1,0 |

“+”full development of the microorganism

Table2. Investigation of bio damage in a three-component system of additives

| Sample | The diameter of the zone of destruction of microorganisms, sm | |
|-----------------------------------|---|-------|
| | Bacteria | Fungi |
| M-8 Baku | | |
| 1,5%С-150+1,2%ДФ-11+4,6%АКІ-150 | 1,6-1,8 | + |
| 0,5%С-400+5,5%АКІ-140+0,8%MX-3103 | 1,7-1,8 | + |
| 0,5% С-400+5,5%АКІ-140+1,2%ДФ-11 | 1,2-1,3 | + |

“+”full development of the microorganism

In the three-component system - antioxidant, anticorrosive and detergent-dispersant additives, a change in the biostability. In the noted additive compositions, if there is a certain protection against bacteria, the fungi develop completely.

In the periodical literature, information on biocides in oils for various purposes is very small

Table3. Resistance against biodamage in oils of various types

| Biostable lubricating oils for autotractor, diesel, marine and stationary diesels | Biocide | Concentration, % | Destruction of the area of development of microorganisms, sm | |
|---|---|------------------|--|-------|
| | | | Bacteria | Fungi |
| 1. M-10B ₂ | α -phenyl- β - nitroethane | 0,15 | 1,7 | 1,3 |
| | "_" " | 0,25 | 2,0 | 1,6 |
| | "_" " | 0,5 | 2,5 | 2,0 |
| | α -furyl- β - nitroethane | 0,15 | 1,2 | 1,5 |
| | "_" " | 0,25 | 1,5 | 2,5 |
| | "_" " | 0,5 | 2,0 | 3,0 |
| 2. M-12BБ | α -phenyl- β - nitroethane | 0,15 | 1,1 | 2,0 |
| | "_" " | 0,25 | 1,3 | – |
| | "_" " | 0,5 | 2,5 | – |
| | α -furyl- β - nitroethane | 0,15 | 1,0 | 2,5 |
| | "_" " | 0,25 | 1,2 | – |
| | "_" " | 0,5 | 2,0 | – |

Investigation of the effect of biocides on the requirements for the physicochemical and operational parameters of lubricating oils having a composition of the additive composition. It has been established that the introduction of additives of α -phenyl- β -nitroethane and α -furyl- β -nitroethane in the composition of the biocide does not adversely affect the main oil parameters.

CONCLUSIONS

It was found that the biocides α -phenyl- β -nitroethane and α -furyl- β -nitroethane in the composition of lubricant compositions exhibit both bactericidal and fungicidal properties,

without degrading the physicochemical and operational properties of the lubricating oils.

As a result of the research, new biostable motor oils of the brands M-10B₂ and M-12BБ for motor-tractor, diesel locomotive, ship and stationary diesel engines were created. Synergism of the functional groups of additives, the incoming lubricant composition and their stability to microbiological damage was studied.

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Citation: *Yulduz B. Ramazanova, Ilaha A. Djafarova, Aida R. Yusifova, "Development of Modern Biostable Lubricating Oils", International Journal of Research Studies in Science, Engineering and Technology, vol. 5, no. 5, pp. 23-25, 2018.*

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