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IBI (India) = 4.260
OAJI (USA) = 0.350

SOI: [1.1/TAS](#) DOI: [10.15863/TAS](#)

International Scientific Journal
Theoretical & Applied Science

p-ISSN: 2308-4944 (print) e-ISSN: 2409-0085 (online)

Year: 2021 Issue: 05 Volume: 97

Published: 27.05.2021 <http://T-Science.org>

QR – Issue



QR – Article

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NEW BIOSTABLE LUBRICATING COMPOSITION FOR LOCOMOTIVE AND INDUSTRIAL DIESEL ENGINES

Abstract: It is important to study and apply new modifications of various additives with functional properties used in the creation of lubricating compositions that meet the requirements of M-14B₂ motor oil used in locomotive, large-capacity, self-discharging and industrial diesels. Changes in the initial properties and unusability of lubricants due to the effect of various external factors, including microorganisms, during long-term use and storage, make studies on increasing the resistance of oils to biodegradation urgent.

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Biostable properties of lubricants against bacteria (Pseudomonas aeruginosa, Mucobacterium lacticum) and mould (Aspergillus niger, Cladosporium chrysogenum, Penicillium cyclopium) have been defined, a new biostable lubricating composition of 14B₂ motor oil has been created with the study of α -phenyl- β -nitroethane and α -furyl- β -nitroethane of special purpose. It was determined that the addition of biocide at the concentration of 0,25% to the composition does not adversely affect other functional properties of the oil.

Key words: motor oil, additive composition, additives, biodegradation, biocides.

Language: English

Citation: Javadova, H. A., et al. (2021). New biostable lubricating composition for locomotive and industrial diesel engines. *ISJ Theoretical & Applied Science*, 05 (97), 428-431.

Soi: <http://s-o-i.org/1.1/TAS-05-97-71> **Doi:**  <https://dx.doi.org/10.15863/TAS.2021.05.97.71>

Scopus ASCC: 1600.

Introduction

M-14B₂ motor oil, M-10B₂C, M-12By, M-14B₂, M-16B₂, M-20B₂ motor oils used in all types of diesel engines of various purposes belongs to B₂ group [1].

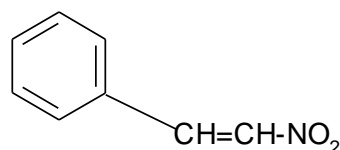
The need for these oils requires the expansion of their production in the XXI century.

It is known that the methods of protecting materials from biodegradation vary depending on the type of oils. The application of biocides is aimed at solving two main issues:- protection of materials from microorganisms; protection of the human body from pathogenic microorganisms [2].

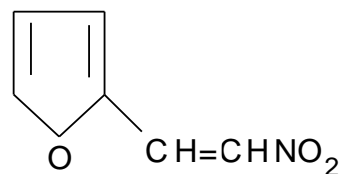
For many years, at the Institute of Chemistry of Additives of ANAS, organic compounds of different composition: heteromethylated oxase- and diazocycloalkanes, adamantane derivatives, heterocyclic amines, N-alkoxymethylpiperidins and N-alkoxymethylperhydropyrimidines have been synthesized, these compounds have been studied as antimicrobial additives and the dependence of their effectiveness on the chemical structure has been determined. The fact that the vast majority of organic compounds known as biocides are insoluble in mineral oils limits their application [1].

It should be noted that the organic compounds in the lubricating compositions, consisting of different functional properties, have oxidation, corrosion, etc. properties, but don't have biostable property. It is known that all types of base oils used in the creation of motor oils are a source of food for microbes and bacteria.

α -Phenyl- β -nitroethane and α -Furyl- β -nitroethane biocides used as the object of the study were tested in accordance with GOST 9.082 and GOST 9.052, together with additives that provide the performance properties of oils of various purposes [3, 4, 5].



α -Phenyl- β -nitroethane



α -Furyl- β -nitroethane

It was determined that additives of different composition and structure do not affect the development of microbes and moulds, so in both cases there is a full development of microorganisms. In this case, the initial indicators of the oil in use change and become unusable. It is possible to prevent the full development of microorganisms in motor oils studied at a concentration of 0,15-0,5% of biocides, the area of destruction of bacteria is 2,5-3,0 cm², in some cases the area of destruction of moulds is 3,0-3,5 cm².

Oil samples of newly created lubricating compositions M-10B₂, M-12By, M-14B₂, M-20B₂ for locomotives, stationary, self-discharging, etc. diesel engines have been studied with biocides, on the basis of IHP-101 (barium salt of di-(oxyalkylphenyl)-methane and its new modifications, providing the detergent-dispersing properties of M-8 and M-15 Baku base distilled oils and motor oils processed at the Oil Refinery of the Republic of Azerbaijan, AKI series additives (alkylphenols, formaldehyde and calcium salts of condensation products with various amines) calcium salts of condensation products with amines), the results are given (Table 1, Figure 1,2)[6].

Table 1. Biostability properties of different types of lubricants

Lubricants for locomotive, ship and stationary diesels	Without biocides	Biocides	Concentration, %	Destruction of development area of microorganism, cm ²	
				bacteria	mould

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M-10B ₂	+	α -phenyl- β -nitroethane	0,15 0,25 0,5	1,7 2,0 2,5	1,3 1,6 2,0
	+	α -furyl- β -nitroethane	0,15 0,25 0,5	1,2 1,5 2,0	1,5 2,5 3,0
M-12B _y	+	α -phenyl- β -nitroethane	0,15 0,25 0,5	1,1 1,3 2,5	2,0 – –
	+	α -furyl- β -nitroethane	0,15 0,25 0,5	1,0 1,2 2,0	2,5 – –
M-14B ₂	+	α -phenyl- β -nitroethane	0,15 0,25 0,5	1,5 3,0 4,0	1,2 1,5 2,0
	+	α -furyl- β -nitroethane	0,15 0,25 0,5	1,2 2,0 2,5	1,5 2,0 3,0

“–” complete destruction of microorganisms;
 “+” complete development of microorganisms

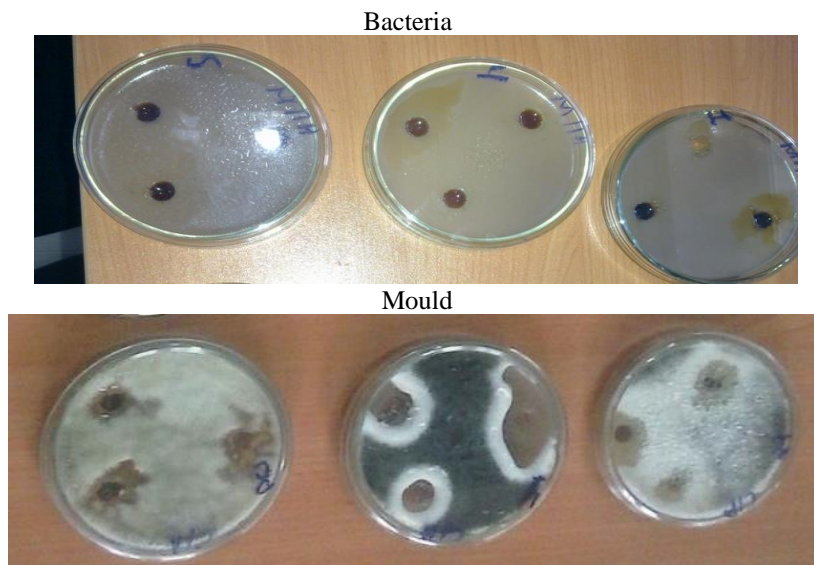


Fig 1. Test results of M-10B₂, M-14B₂, M-12B_y lubricating compositions with α -furyl- β -nitroethane biocide

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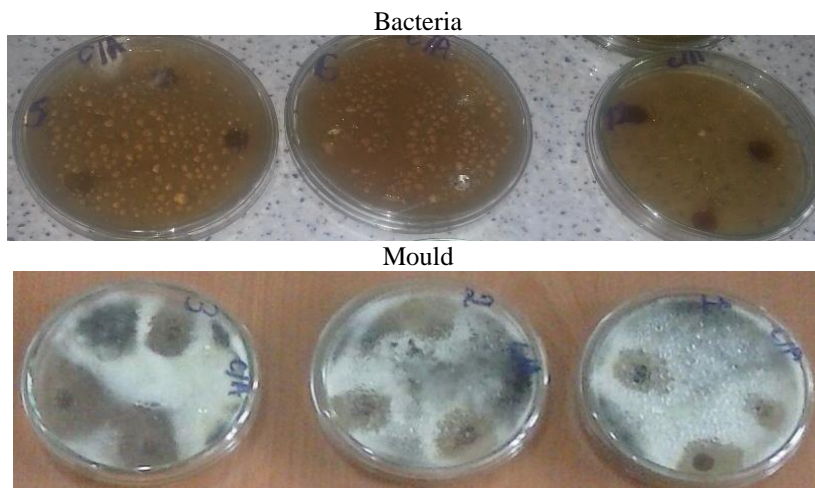


Fig. 2. Test results of M-10B₂, M-14B₂, M-12BE lubricating compositions with α -phenyl- β -nitroethane biocide

The positive results of the tests create basis for the use of low-concentration of biocides in lubricants in production process, increasing the service life of the oil by ensuring its biostable property.

The addition of biocide to the composition makes it necessary to determine its effect on the change of important indicators of M-14B₂ oil defined in accordance with GOST 12337. Therefore, oxidation (GOST 11063), corrosion (GOST 20502), lubricating properties (GOST 9490) have been determined [7,8,9,10].

Oxidizing properties resist to oxidation at 200°C for 50 hours, the amount of sediment was 0,5-0,6%,

corrosion loss in lead plate at 140°C for 25 hours in the presence of copper naphthenate catalyst was 3,5-3,6 g/m², lubricating properties: abrasion index I_s 36 mm, ultimate load 548 Pk, N, welding load 1960 Pc, N, diameter of the abrasion trace D_s 0,48, mm 196, N.

Thus, the new biostable lubricating composition of M-14B₂ motor oil created with Viscoplex-2-670, AKI-150; C-150 (C-250, C-400), DF-11, α -phenyl- β -nitroethane, Viscoplex-5-309, PMS-200A additives meets all the requirements of M-14B₂ oil in accordance with GOST 12337.

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