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Issue Article

Teyyub A. Ismailov
Institute of Oil Chemistry Processes after Y.H.Mammadaliyev of Science and Education Ministry
researcher

Nurana M. Musayeva
Institute of Oil Chemistry Processes after Y.H.Mammadaliyev of Science and Education Ministry
researcher

Sevda B. Asadova
Institute of Oil Chemistry Processes after Y.H.Mammadaliyev of Science and Education Ministry
researcher

Ismail T. Ismailov
Institute of Oil Chemistry Processes after Y.H.Mammadaliyev of Science and Education Ministry
researcher

Khalida R. Ismailova
Institute of Oil Chemistry Processes after Y.H.Mammadaliyev of Science and Education Ministry
researcher

Sabahat I. Aslanova
Institute of Oil Chemistry Processes after Y.H.Mammadaliyev of Science and Education Ministry
researcher
Az 1025, Baku, Khojaly str., 30

SYNTHESIS AND STUDY OF BAKTERICIDE PROPERTIES OF COMPLEXES OF NATURAL NAPHTHENE ACIDS WITH HEXAMETHYLENDIAMINE

Abstract: *Complex compounds were synthesized at room temperature at 1:1 and 2:1 mol ratio, structures confirmed by IR, physical-chemical characteristics and bactericide properties were investigated by preparing their solutions. In the experiment, the SRB's Desulfovibrio desulfuricanes and 1143 stamp were used. Sulphates of SRBs are anaerobic bacteria that reduce to hydrogen sulfur. The nutrient environment that is more suitable for SRB development is postgate B environment. The PH must be in 7.0-7.5 interval. The experiment was conducted in a well-known way in sterilized 10 ml test tubes. In an effort to determine the number of bacteria in an inhibitorless environment, bacteria are first stabilized and stored in the thermostat at 30-32°C with an incubation period of 14 days, and it was established that number of bacteria in an inhibitorless environment was* 10^8 *. After that, synthesized complexes were added to environment in concentration 250, 500 and 1000 mg/l and again stayed at thermostat at 30-32°C and after 48 hours of experimental complexes effected on bacteria growth. Bactericide effect of complexes synthesized from natural naphthene acids and hexamethylenediamine in concentration 250 mq/l is 95%, but in 500 mg/l and 1000 mg/l is 100%.*

The results suggest that complexes synthesized from natural naphthene acids and hexamethylenediamine can be used to prevent bacteria growth.

Key words: *natural naphthene acid, hexamethylendiamine, sulfuric acid, complex compounds.*

Language: *English*

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Introduction

In recent years, corrosion of metal and non-metal materials has become a research object for microbiologists. The role of a biological factor in metal corrosion and damage of various non-metal materials should be emphasized. More than 50% of destruction resulted from corrosion of pipeline can be attributed to action of microorganisms [1-3].

80% of the damage caused by corrosion in the oil industry, is related to sulfuric acid. Depending on the environment various microorganisms can be involved in the corrosion process. The most active abrasive substances are tion and nutrification-producing bacteria that create an acidic aggressive environment, sulphate-reductive bacteria, and heterotrophic microorganisms that produce abrasive metabolites (NH_3, CO 2, H $_2$S, organic acids) [4].

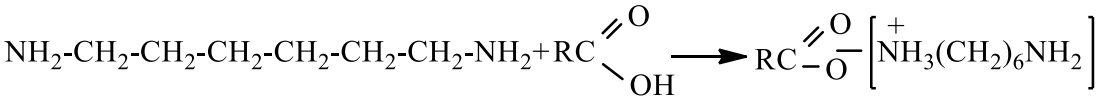
One of the most important factors determining the growth of microorganisms in the oil field is the organic matter of oil itself. It is known that all organic matter is destroyed by microorganisms less or faster in favorable conditions. Crude oil is made up of oxygen, sulfur, nitrogen, microelements, carbohydrates and heterocyclic compounds. Oil also contains hydrogen sulfide and elementary sulfur. The source of sulfur is probably hydrogen sulfide, which is caused by the activity of activity of sulphate-reducing bacteria in crude oil [5-8]. These types of corrosion occur in anaerobic neutral conditions. Anaerobic corrosion is often local in practice. Corrosion

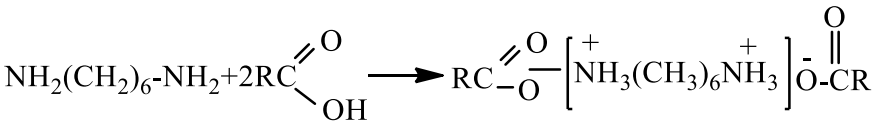
Dutch researchers first noted the presence of enough amount of sulfate-reducing bacteria from the Desulfovibrio genus in an environment where anaerobic corrosion of iron and steel occurs. The conditions for these increases are fully in line with the conditions needed for a particular bacterial group to grow. It is noteworthy that bacteria use hydrogen that is polished from the metal surface for dissimilar processes. In anaerobiosis, sulfate-reducing bacteria allow corrosion to continue in depolarization reactions, replacing oxygen. These observations mostly suggest that the extraction of hydrogen from the cathode zone of the metal surface stimulates corrosion; Hydrogen is used by bacteria to convert sulfates into sulfides, and when there are no active sulfate-reducing bacteria, the cathode polarized and corrosion [11,12].

One of the most effective way to combat microbial pollution is the use of bactericide inhibitors to protect oil deposits and soil equipment from internal corrosion.

Experimental

In the study, the obtaining of bactericide inhibitors is carried out in the following order. A certain amount of natural naphthene acids (NNA) are filled in three-neck flask equipped with thermometer and stirrer. After the mixture is processed, hexamethylendiamine in appropriate mole ratio is added to the reactor flask and mixed for an hour. Reaction carried out at room temperature and 1:1 and 2:1 mol ratio. The acquisition of complexes follows the reaction:





The structures of synthesized compounds confirmed by IR.

Figure 1 provides the IR spectrum of a complex compound derived from the interaction of a molecule NNA and a molecule hexamethylendiamine.

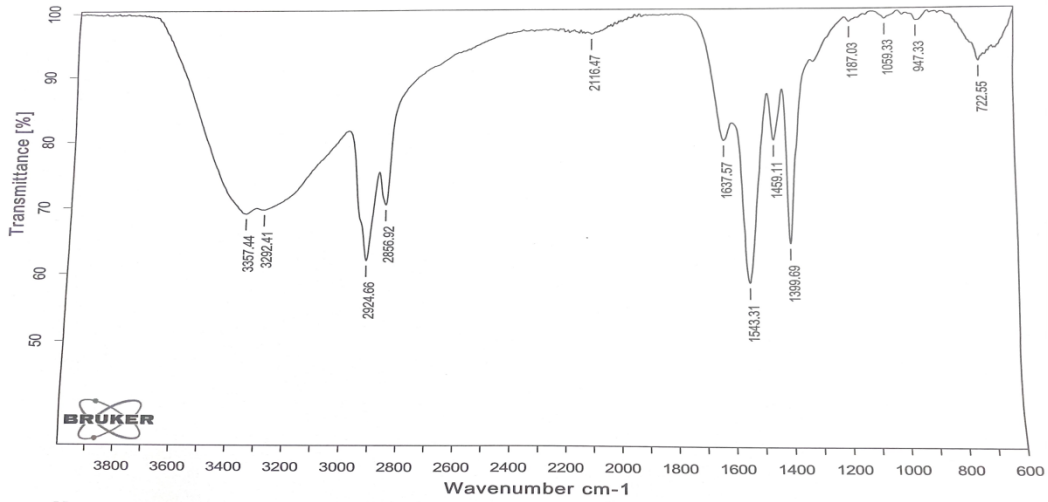


Figure 1. IQ spectrum of complex compounds derived from interaction of NNA and hexamethylenediamine at 1:1 mol ratio

The IQ spectrum contains the following swallowing bars:

Mathematical fluctuations of C-H bond of $_{722}$ $^{cm-1}$ -CH 2 groups;

1399, 1543 $^{cm-1}$ - C-O bond of the COO group;

1637 $^{cm-1}$ - Dance of deformation of N-H communications;

2116 $^{cm-1}$ - $-NH_3^+$ group; (Amen salt)

1459, 3292, 3357 $^{cm-1}$ - $CH_2$and CH_3 groups' CH bond deformation and valence fluctuation;

3292, 3357 $^{cm-1}$- N-H and O-H bonds are compatible.

The physical indicators of the synthesized complex identified by studying of it's 14.3% solution and the results have been showed in Table 1.

Table 1. Physical indicators of 14.3% solution of synthesized complex.

Name of indicators	Name of device	Method	67.5% solution of complex obtained from interaction of NNA and hexamethylendiamine in 1:1 mol ratio	14.3% solution of complex
Self-indulgation mm^2/s, 20°C	Stabinger SVM	ASTM D445	98.576	2.0983
density, g/sm^3 20°C	DMA 4500M	ASTM D5002	0.9961	1.0013
Freezing temp, C°	Methodology	GOST 20287-91	-40	-8

Structure of complex compound synthesized by interaction of NNA and hexamethylendiamine in 2:1 mole ratio confirmed by IR and presented in fig. 2.

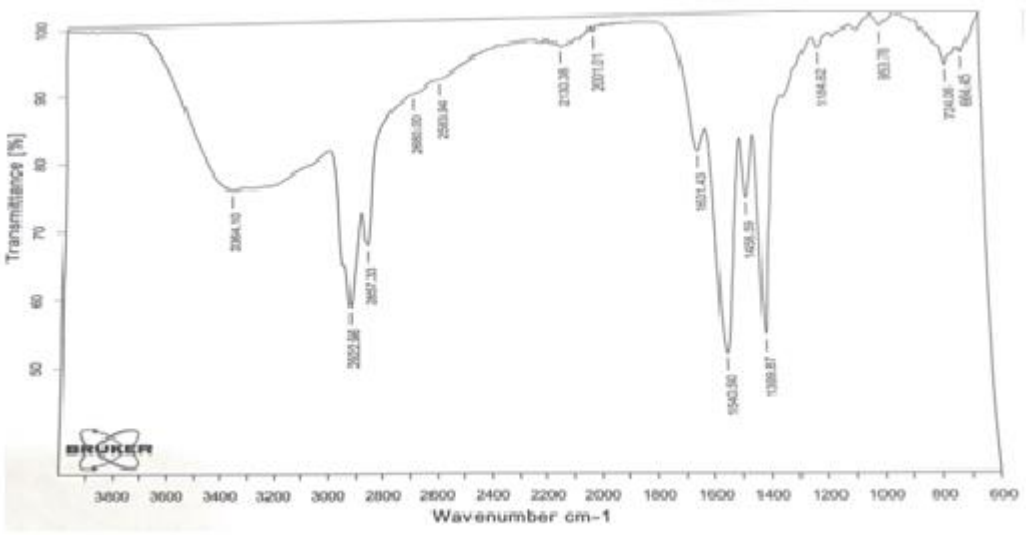


Figure 2. IQ spectrum of complex compounds synthesized from NNA and hexamethylendiamine in 2:1 mole ratio

It has been determined that the spectrum has the following bars.

Mathematical fluctuation of C-H bond of $_{724}$ $^{cm-1}$- ^{CH} 2 groups;

1399, 1540 $^{cm-1-COO}$ group C-O connection;

1458, 2857, 2922 $^{cm-1}$- CH_3, CH_2 group. Deformation and valence fluctuation of C-H bond;

1631 $^{cm-1}$- N-H bond;

2001, 2130, 2583, 2680 $^{cm-1}$ aminoacid salt NH_3^+ group;

3364 $^{cm-1}$ - The strips that are typical of N-H and O-H bond are consistent.

Analyzing IQ spectrum, it was determined that the complex combination had been obtained.

The physical characteristics of synthesized compound and it's 15.2% solution were determined, and the results were shown in Table 2.

Table 2. Physic-chemical characteristics of the complex and its 15.2% solution.

Name of indicators	Name of device	Method	NNA's synthesized complex at 2:1 molecule	
			Complex	15.2% solution
Self-indulgation mm^2/s, 20°C	Stabinger SVM	ASTM D445	347.97	3.9572
Density, g/sm^3 20°C	DMA 4500M	ASTM D5002	0.9997	1.0029
The freezing temp. C°	Methodology	GOST 20287-91	-35	-3

The action of solutions of synthesized complexes on SRB have been studied by well-known methods shown above. In the experimental, the SRB's Desulfovibrio desulfurikans and 1143 stamps were used. SRBs are anaerobic bacteria that reduce sulfates to hydrogen sulfur. The nutrient environment that is more suitable for SRB development is postgate B. The pH should be in interval 7.0-7.5 [13].

The following supplements are added to the Posgate environment for the SRB growth. The additives are:

- iron sulphate $FeSO_4 \cdot 4H_2O$ (5% solution in 2% chloride acid)- 0.5-2 ml,
- sodium hydrocarbonate $NaHCO_3$ (5% aqueous solution) - 1 ml,
- Crystallized natrium sulfide ($Na_2S \cdot 9H_2O$) prepared in 1% of Na_2CO_3 -1 ml.

Daha sonra mühitə 250, 500 və 1000 mq/l qatılıqlarda sintez olunmuş komplekslər əlavə olunaraq yenidən 14 sutka olmaqla 30-32°C temperaturda termostatda saxlanılmışdır və təcrübənin ilkin 48-ci saatında sintez olunmuş maddənin bakteriyaların inkişafına effektiv təsir etməsi müşahidə olunmuşdur.

The experiment was conducted in a well-known way in sterilized 10 ml-test bottles. For determination of the number of bacteria in an inhibitorless medium,

bacteria are first planted by dissolving and stored in the thermostat at 30-32°C with an incubation period of 14 days, and at the end of the experiment it was established that the number of bacteria in an inhibitor less environment taken for surveillance is $n=10^8$. Later, synthesized compounds were added to the medium in densities of 250, 500 and 1000 mg/l and stored again at 30-32°C for 14 days and in the first 48 hours of the experiment, synthesized matter had an effective affect on bacterial growth.

At the end of the experiment, the samples studied were tithed by iodometric method and calculated their bacterial effect based on the amount of received H_2S. fixed iodine solution and fixed sodium sulfate was used during the titration The amount of H_2S is calculated according to the following formula:

$$X \text{ mg/l } H_2S = \frac{N(J)xV(J) - N(Na_2S_2O_3)xV(Na_2S_2O_3)}{VH_2O} \; x \; 17000$$

N(J)= 0.1 n
V(J)=10 ml
N ($Na_2S_2O_3$)= 0.1 n
V ($Na_2S_2O_3$)= 7 ml
V (H_2O) = 20 ml

17000-0.1 n indicates that hyposulfidine is solved at 1000 ml.

According to the amount of received H_2S, the bacterial effect of the inhibitor is calculated according to the following formula.

$$Z = \frac{(C_0 - C_{inh})}{C_0} \cdot 100\%$$

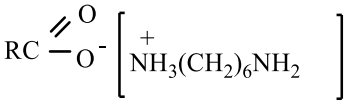
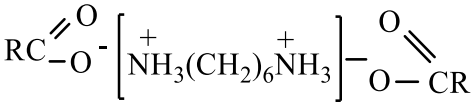
The amount of hydrogen sulfide in the environment taken for C_0 control, mg/l;

The amount of C_{inh}-hydrogen sulfide in a reagent environment, mg/l.

The bacterial effect of the samples was calculated and compared with used in industry inhibitor-bactericides such as INCOR GAZ-11 and TNTOR INCOR GAZ-28 TD.

The results were presented in Table 2. It has been estimated that at a density of 250 mg/l, the bacterial effect of these substances was 95% and 98%, 500 mq/l and 1000 mq/l density 100%.

Table 3. The results of the bacterial effect depending on the density of the compounds synthesized.

Component of the complex	The density of the material, C-mq/l	Number of bacteria (cell number/ml)	H_2S quantity mq/l	The bacterial effect, Z-%
	250	$10^{7/1}$	19	95
	500T	-	-	100
	1000	-	-	100
	250	$10^{7/1}$	7	98
	500	-	-	100
	1000	-	-	100
The amount of H_2 S in the surveillance-I SRB-free environment	24 mq/l			
The amount of H_2 S in the surveillance-II SRB environment	375 mq/l			
Number of bacteria in surveillance-III nutrient environment	10^8 cell numbers/ml			

Synthesized complexes with hexamethylendiamine 1:1 and 2:1 molecules of natural petroleum compounds, confirmed the structures of the IQ spectrum of extracted compounds, studied physical properties, and studied inhibitor bacterial properties. It has been estimated that at a density of 250 mq/l of synthesized compounds at a rate of 1:1 molecules, the bacterial effect is 95%, 500 and 100 mq/l densities 100%; The bacterial effect of 2:1 molecules was 98 percent, 500 and 1,000 mq /l.

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