

**CONSERVATIVE LIQUIDS ON THE BASES OF METAL SALTS AND
AMIDOAMINES OF NATURAL PETROLEUM ACIDS**Ulviyya B. Abbasova¹

¹Department of chemical reagents for oil and gas extraction and processing industries, Institute of Petrochemical Processes named after Yu. H. Mammadaliev, National Academy of Sciences of Azerbaijan

Corresponding Author: ulviyya.abbasova30@gmail.com

Abstract: The compositions on the bases of ferric, nickel, zinc and manganese salts and amidoamines with ethylenediamine of natural petroleum acids separated from T-46 oil distillate and kerosene fractions obtained on the bases of Azerbaijani oils (petroleums) have been prepared and checked their protective ability as conservative liquids. Amidoamines and metal salts added to T-46 oil distillate have been taken in equal amounts. The total amount of amidoamines and metal salts in conservative liquids have been taken as 10% and 20%. It has been determined that higher protective ability in the presence of nickel salts of natural petroleum acids in composition is assigned. Thus, conservative liquid prepared by adding T-46 oil distillate, amidoamine with ethylenediamine of natural petroleum acids of 10% and nickel salt of these acids of 10%, provides corrosion protection for more than 263 days in the hydrochamber. Protection period in sea water and 0,001% H₂SO₄ solution are 160 and 162 days, respectively. It also defined that protection period for atmospheric corrosion constitutes, respectively, 225, 240, 194 days, if conservative liquid is prepared on the bases of manganese, ferric and zinc salts of natural petroleum acids. The protection periods of those compositions in sea water are 125, 140 and 125 days, respectively.

Key words: atmospheric corrosion, conservative liquids, natural petroleum acids, amidoamines, metal salts

Paper received: 24/11/2022 **Paper Accepted:** 30/11/2022 **Paper Published:** 10/12/2022

I. INTRODUCTION

At present atmospheric air is intensively polluted with aggressive components (H₂S, CO₂, nitrogen and sulfur oxides, etc.) [1-3]. Because of this reason, atmospheric corrosion of metal equipments and their spare parts intensifies [4-6]. There are different methods for preventing atmospheric corrosion [7,8], more convenient of these methods is the use of conservative liquids [9,10]. In many scientific centers, as well as in Y.H.Mammadaliyev Institute of Petrochemical Processes such extensive researches are conducted in this field [11-13]. Unfortunately, neither Azerbaijan nor other Caspian littoral countries have the production of conservative liquids, which are the most convenient means of protection from atmospheric corrosion (this problem has been partially solved in the Russian Federation). Therefore, extensive research should be conducted in this area, new and more efficient conservative liquids should be created and their production should be organized.

II. MATERIAL AND METHODS

Amidoamines were synthesized on the bases of ethylenediamine and petroleum acids separated from the kerosene fraction obtained from the Baku oils mixture. Physico-chemical properties of synthesized amidoamines are given in Table 1.

Table 1. Physico-chemical indicators of amidoamine with ethylenediamine of petroleum acids separated from distillates of Baku oil mixtures

Indicators	Method	Amidoamines with ethylenediamine of natural petroleum acid
Kinematic Viscosity, mm ² /sec, 20 °C	ASTMD 445	163,08

Density, g/cm ³ 20 °C	ASTMD 5002	0,9771
Refractive coefficient, 20 °C	ASTMD 5006-96	1,4902
Freezing point, °C	GOST 20287-91	-20

Manganese (Mn), ferric (Fe), nickel (Ni), zinc (Zn) salts of natural petroleum acids (NPA) have been obtained by a method of double-replacement reaction. The reaction was carried out in hexane medium. The purpose of conducting the reaction in an organic environment is to ensure that there is no crystallization water in the composition of obtained salts. After the reaction is complete, the solvent is expelled from the reaction and the pure salt is obtained. Physico-chemical properties of salts are given in Table 2.

Table 2. Physico-chemical indicators of amidoamine with ethylenediamine of petroleum acids separated from distillates of Baku oil mixtures

Indicators	Method	Title of samples			
		Mn salt of NPA	Fe salt of NPA	Ni salt of NPA	Zn salt of NPA
Kinematic Viscosity, mm ² /sec, 20°C	ASTMD 445	-	-	-	-
Density, g/cm ³ 20°C	ASTMD 5002	1,011	1,019	1,010	1,031
Refractive coefficient, 20 °C	ASTMD 5006-96	1,4861	1,4881	1,4835	1,4840
Freezing point, °C	GOST 20287-91	-15	-15	-10	-15

The molecular structure of the Ni salt of natural petroleum acid was studied by the IR spectrum and has been given in Figure 1.

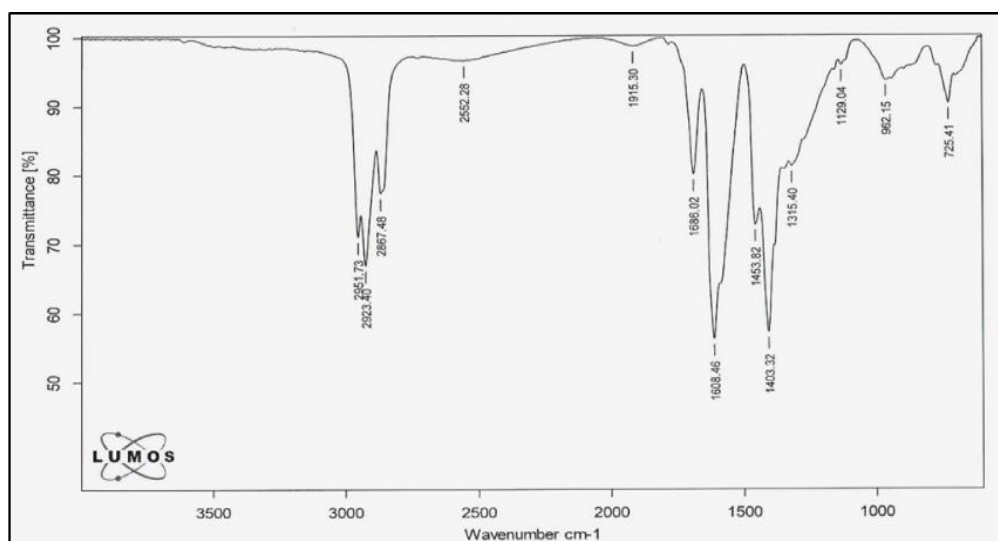


Fig 1. IR spectrum of Ni salt of natural petroleum acid

Deformation (1453 cm⁻¹) oscillations and valence (2867, 2923, 2951 cm⁻¹) vibrations of C–H bond in -CH₃ and -CH₂- groups; 1686.02 cm⁻¹ - in carbonic acid of –C=O group (associated) 1608.46 cm⁻¹ - in the aliphatic

chain for the unsaturated $-C=C-$ group; 1403.32 cm^{-1} - deformation oscillations of the $C-H$ bond in the $=C-H$ group; 1315.40 cm^{-1} plane oscillations of the $-NiO-$ bond; 962 cm^{-1} non-plane oscillations of $-NiO-$ bond; mathematical oscillations with deformation 725.41 cm^{-1} of $C-H$ bond of $(CH_2)_n$ in naphthene group have been observed.

III. RESULTS AND DISCUSSION

Conservative liquids have been prepared on the bases of T-46 oil distillate, amidoamine with ethylenediamine of natural petroleum acids and Mn, Fe, Zn, Ni salts of those acids. During the preparation of conservative liquids, the amidoamine and the salt of the acid were taken in equal amounts. Thus, conservative liquid was prepared (total concentration of inhibitor-10%) by taking T-46 oil distillate of 90%, amidoamine of natural petroleum acids of 5% and the salt of that acid of 5%. In the second case, the conservative liquid was prepared by amidoamine and salt (inhibitor amount - 20%) taking each of them of 10% and T-46 oil distillate of 80%. The prepared conservative liquids were tested in hydrochamber, sea water and 0.001% H_2SO_4 solution. The obtained results are given in Table 3.

Table 3. The corrosion resistance indicators of conservative liquids on the bases of amidoamine with ethylenediamine of natural petroleum acids added to T-46 oil distillate and Mn, Fe, Zn, Ni salts of those acids in hydrochamber, sea water and 0.001% H_2SO_4 solution

Code	Samples	By %	In hydrochamber G-4	In sea water	In H_2SO_4 solution of 0.001%
AU-1	T-46 oil distillate+AAETD+ Mn salt of NPA	10	164	90	90
AU-2	T-46 oil distillate + AAETD + Mn salt of NPA	20	225	125	121
AU-3	T-46 oil distillate + AAETD + Fe salt of NPA	10	190	92	91
AU-4	T-46 oil distillate + AAETD + Fe salt of NPA	20	240	140	139
AU-5	T-46 oil distillate + AAETD + Zn salt of NPA	10	182	71	70
AU-6	T-46 oil distillate + AAETD + Zn salt of NPA	20	194	125	122
AU-7	T-46 oil distillate + AAETD + Ni salt of NPA	10	255	155	150
AU-8	T-46 oil distillate + AAETD + Ni salt of NPA	20	277 days continuation	162	160
AU-9	T-46 oil distillate + AAETD + Mn salt of NPA +NPA	10	172	87	86
AU-10	T-46 oil distillate + AAETD + Mn salt of NPA +NPA	20	230	124	119
AU-11	T-46 oil distillate + AAETD + Fe salt of NPA +NPA	10	260	115	112
AU-12	T-46 oil distillate + AAETD + Fe salt of NPA +NPA	20	212 days continuation	137	132
AU-13	T-46 oil distillate + AAETD + Zn salt of NPA +NPA	10	236	85	82
AU-14	T-46 oil distillate + AAETD	20	212 days	100	97

	+ Zn salt of NPA +NPA		continuation		
AU-15	T-46 oil distillate + AAETD + Ni salt of NPA +NPA	10	212 days continuation	117	114
AU-16	T-46 oil distillate + AAETD + Ni salt of NPA +NPA	20	212 days continuation	135	122

As it is seen from the table, the highest result was obtained when the composition containing the Ni salt of NPA was used, with a total amount of 20% of the inhibitor. This conservative liquid provides a high level of protection against atmospheric corrosion in both hydrochamber, sea water, and 0.001% H₂SO₄ solution. It should be noted that the conservative liquid containing the Fe salt of NPA also shows sufficiently high protective effect. Thus, the conservative liquid containing T-46 oil distillate of 80%, with a total amount of 20% of the inhibitor, amidoamine with ethylenediamine of natural petroleum acids of 10% and Fe salt of NPA of 10%, provides protection from atmospheric corrosion in the hydrochamber for 255 days, in sea water and 0.001% H₂SO₄ solution for 140 and 139 days, respectively. If we take into consideration that nickel is scarce and more expensive than ferrum. Then the use of the composition based on Fe salt can be more cost-effective.

IV. CONCLUSION

- It has been defined that it is possible to create conservative liquids with high protective ability on the bases of T-46 oil distillate, amidoamines with ethylenediamine of natural petroleum acids and metal salts of those acids.
- As a result of the researches it was determined that the conservative liquid containing Ni salts of natural petroleum acids provides longer protection than Fe, Mn, Zn salts. Thus, the conservative liquid containing T-46 oil distillate of 80%, amidoamine with ethylenediamine of natural petroleum acids of 10% and Ni salt of NPA of 10% provides protection from corrosion in hydrochamber, sea water and 0.001% H₂SO₄ solution during 263, 162 and 160 days.
- The composition with the same concentration, based on the Fe salt of NPA has a sufficiently high defensive ability. Thus, when the total amount of inhibitor is 20% and the amount of ferric salt of NPA is 10%, the protection period against atmospheric corrosion in hydrochamber, sea water and 0.001% H₂SO₄ solution are 240, 140 and 139 days, respectively.
- It is very useful from economic point of view to prepare conservative liquids on the bases of ferric salts as nickel . Since nickel is scarce and expensive, it is economically more convenient to prepare conservative liquids on the bases of ferric salts of natural petroleum acids.

REFERENCES

- [1]. Abbasov V.M., Rzayeva N.Sh., Ahmadova S.Z., et al. Study of opportunities for formation of conservative liquid on the base of sunflower oil, Processes of petrochemistry and oil refining, 2016, Vol.17, No3, pp.262-265
- [2]. Abbasov V.M., Rzayeva N.Sh., Talybov A.H., et al. Inhibitors of hydrogen sulfide corrosion of alkylamines and nitrated sunflower oil, Processes of petrochemistry and oil refining, 2017, Vol.18, No3, pp.229-238
- [3]. Rzayeva N.Sh. The effect of 2-aminopyridine on the kinetics of CO₂ corrosion of acetate and chloride complexes of amidine with natural petroleum acids. Processes of petrochemistry and oil refining, 2018, Vol.19, No. 1, pp.109-115
- [4]. Abdullayeva N.R. Poluchenie konservatsionnoy zhidkosti na osnove turbinnogo masla marki T-30. Neftepererabotka i neftekhimiya, 2018, No. 11, c. 45-48
- [5]. Abdullayeva N.R. Nitrogen-containing organic compounds as inhibitors of corrosion in an aqueous medium. Processes of petrochemistry and oil refining, 2018, No. 3, pp.282-294
- [6]. Abdullayeva N.R., Amiraslanova M.N., Aliyeva L.I. Synthesis and modification of alkyl phenolformaldehyde oligomers with imidazolines on the bases of fatty acids of vegetable origin. Processes of petrochemistry and oil refining, 2019, Vol.20, No. 1, pp.25-32

- [7]. Abbasova V.M., Mammedbeyli E.G., Mamedova H.M., Agamalieva D.B. i dr. Poluchenie kompozichiy na osnove imidazolinovix jirnix kislot rastitelnogo proisxojudeniya i soley metallov i izuchenie ix svoystva. Neftepererabotka i nefteximi 2017, No.10, c.42-46
- [8]. Abbasov V.M., Abbasova U.B., Dadashova N.K., et al. Synthesis of some nitrogen derivatives of natural petroleum acids and their application as a component of conservative liquids. Processes of petrochemistry and oil refining, 2022, Vol.23, No 2, pp. 184-189
- [9]. Abbasova U.B. Application of inorganic and organic complexes of amino derivatives of natural petroleum acids as CO₂ corrosion inhibitor. Processes of petrochemistry and oil refining. Vol. 22, No. 1, 2021, pp. 152-158
- [10]. Abbasova U.B. Synthesis of amides of natural petroleum acids with ethylenediamine and alkylamines and research as a component to conservation liquids. Processes of petrochemistry and oil refining. 2022, Vol 23, No 3, pp. 517-523