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Issue Article

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THE INVESTIGATION OF Na^+, K^+ SALTS OF AMIDES, OBTAINED BY INTERACTION OF MONO- AND DIETANOLAMINE WITH ETHYLENEDIAMINTETRAACETIC ACID AS CORROSION INHIBITOR IN H_2S CONDITION

Abstract: *Amides of ethylendiaminetetraacetic acid synthesized by interaction it with monoethanolamine (MEA) and diethanolamine (DEA) in various mol ratio (1:1-3). Obtained amides were investigated and confirmed by IR, and 10% solutions of their Na^+, K^+ salts prepared for establishing their anticorrosion activity.*

10% solutions of synthesized salts were prepared for study as corrosion inhibitors in H_2S condition on the steel plate. It was determined that Na^+, K^+ salts of amides obtained by interaction of EDTA with MEA in 1:2 mol ratio and Na^+, K^+ salts of amides obtained by interaction of EDTA with DEA in 1:1 molar ratio shows the best anticorrosion activity at concentation 200 mg/l and protection effect was 97% and 97,6%.

Key words: *ethylendiaminetetraacetic acid, monoethanolamine, diethanolamine, H_2S corrosion, protection effect.*

Language: *English*

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Introduction

In modern time, the problem of corrosion of equipment of oil industry in our republic is still actual. The main goal of researchers is to solve problems bonded with corrosion. The reason of corrosion of equipment as a resupt of expluatation is H_2S and carbon dioxide corrosion. The adsorbtion of hydrogen increases in the metal surface under H_2S and metal exposes corrosion, that results metal destroy[1]. So, the corrosion effects are global problems [2]. H_2S-corrosion activates and increases under oxygen, CO_2 action on metal surface. By the synergetical effect of factors shown above, the iron atoms ionizes that results to cross-destruction of metal equipment [3].

Presence of H_2S in oil and undeground water is the reason of corrosion intensification in equipmemt that used in oil industry. Problems released to H_2S corrosion is actualized, corrosion control increases and quantity of corrosion inhibitors increases day by day. Before 1980 about 5 thousands inhibitors were known. Today researchers study not only way of synthesis the new inhibitors but also the propeties known ones and ways to evaluate their inhibitor properties. The relation between structure of compound and it's inhibitor properties also is area of interest of scientists. The investigation of structor-inhibitor properties of compounds forms the condition of obtaining new effective compounds. [4-7].

Group of researchers by the tutoring of academician V.M.Abbasov carried out the wided range of experiments initiated preparation of corrosion inhibitors Kaspi-2, Kaspi-4 and Araz-1. Inhibitors Kaspi-2 and Kaspi-4 that characterized with high provided by H_2S corrosion inhibitory activity were tested in Kazakhstan Tengiz field and has shown best results in comparative studies.

Academician V.M.Abbasov and colleagues prepared inhibitor VFİKS-82 that tested and applyed in various objects in the period of USSR [8-11]. Same authors prepared and applyed inhibitor Azeri [12].

N.İ.Mursalov [13-16] and collegues synthesized complexes of imidazole derivatives, obtained on the base of triethanolamin and technical oil acids, with formic and acetic acids in 1:1 and 1:2 mol ratio and investigated their anticorrosion activity of Ct3 brended steel in the water-kerocine two-phased condition with dissolved hidogen-sulfide. It was determined that studied complexes are 90% effective in H_2S condition from minimal concentration 10 mg/l.

For decreasing corrosion in inner part of gas pipes E.F.Sultanov [17] synthesized and studied effectivity of multifunctional bacterial inhibitor Neftqaz-2016 NİM consist naften and oil acid in the appropriate ratio and poliaminenand copper salts. It was established that by use the inhibitor in corrosion proseses in gas pipes the effectivity against H_2S corrosion is 98.4% applying reagnet in concentration 100 mg/l.

As shown above, the applying of inhibitores for corrosion protection of equipment is the most simple and effective and is suitable economically [18-23].

So, the problem of preparation of inhibitors thar are effective against H_2S corrosion is still actual problem for oil industry [24-27].

İn our scietific laboratory we carry out the studies in this direction. Amides of ethylendiaminetetraacetic acid obtained by interaction it with monoethanolamine (MEA) and diethanolamine (DEA) in various mol proportions (1:1-3) [25] and 10% solutions of their Na^+ and K^+ salts and prepared solutions for establishing their H_2S-corrosion actiivity [29].

Synthesized Na^+, K salts of amides of EDTA with MEA in various mol ratio is effective against H_2S corrossion in concentration 50, 100, 150, 200 mg/l for 6 hours. Study results presented in table 1.

Table 1. Results of study of Na^+, K^+ salts of amides, obtained by interaction of monoetanolamine with ethylenediamintetraacetic acid as corrosion inhibitor in H_2S condition

Compound	Concentaration C, mg/l	Corrosion rate P, g/m²hour		Protection effect, Z%	Delay constant, γ
		With inhibitor	Without inhibitor		
1	2	3	4	5	6
Synthesis Na salt of EDTA with MEA in 1:1 mol ratio	50	0,126	0,031	75	4,06
	100	0,126	0,020	84,1	6,3
	150	0,126	0,012	90,4	10,5

	200	0,126	0,004	96,8	31,5
Synthesis K salt of EDTA with MEA in 1:1 mol ratio	50	0,634	0,240	62,1	2,64
	100	0,634	0,190	70,03	3,33
	150	0,634	0,110	82,6	5,76
	200	0,634	0,08	87,38	7,92
Synthesis Na salt of EDTA with MEA in 1:2 mol ratio	50	0,793	0,317	60	2,5
	100	0,793	0,205	74,1	3,86
	150	0,793	0,075	90,5	10,5
	200	0,793	0,023	97,0	34,4
Synthesis K salt of EDTA with MEA in 1:2 mol ratio	50	0,793	0,425	46,4	1,86
	100	0,793	0,316	60,15	2,5
	150	0,793	0,204	74,2	3,8
	200	0,793	0,112	85,8	7,0
Synthesis Na salt of EDTA with MEA in 1:3 mol ratio	50	0,476	0,275	42,2	1,73
	100	0,476	0,124	73,9	3,83
	150	0,476	0,056	88,2	8,5
	200	0,476	0,024	94,9	19,8
Synthesis K salt of EDTA with MEA in 1:3 mol ratio	50	0,952	0,476	50	2,0
	100	0,952	0,374	60,7	2,54
	150	0,952	0,225	76,3	4,23
	200	0,952	0,126	86,7	7,55

Initially syntesized in 1:1 mol ratio Na^+, K^+ salts of amides of EDTA are studied as protective agent against H_2S-corrosion and established that 10% solutions of synthesized compounds in concentration 50 mg/l shows 75% protection effect, but increasing the concentration up to 100, 150, 200 mg/l increases protective effect to 84,1; 90,4; 96,8%. 10% solution of 1:1 mol ratio syntesized K^+ salt of amide of EDTA shows protective effect in concentration 50 mg/l about 62,1% 1and in concentration 100, 150, 200 mg/l is effective about 70,03; 82,6 və 87,38%

10% solutions of Na^+, K^+ salts of amides synthesized in 1:2 mol ratio were studied against metal plates H_2S corrosion in various concentration. It was established, that Na^+ salt in concentration 50 mg/l shows 60% effect, in concentration 100, 150, 200 mg/l shows effect 70,1; 90,5 and 97% approximately. 10% solution of K^+ salt in concentration 50 mg/l shows 46,4%, anticorrosion effect and in concentration 100, 150, 200 mg/l shows 60,15; 74,2; 85,8% effect approximately.

10% solutions of Na^+, K^+ salts of amides synthesized in 1:3 mol ratio were studied against metal plates H_2S corrosion in various concentration. It was established, that Na^+ salt in concentration 50 mg/l shows 42,2% effect, in concentration 100, 150, 200 mg/l shows effect, 73,9; 88,2; 94,9% approximately. 10% solution of K^+ salt in concentration 50 mg/l shows 50% anticorrosion effect and in concentration 100, 150, 200 mg/l shows 60,7; 76,3; 86,7% anticorrosion effect approximately.

As can be seen from the table, the best result was shown by the 10% solution of Na^+ salt of amide synthesized in 1:2 mol ratio at a concentration of 200 mg/l.

İn this case the protection effect is 97%, delay constant is 34,4.

By the same way, 10% solutions of Na^+, K^+ salts of amides obtained by interaction of EDTA with DEA in various mol ratio were synthesized and their effectivity against H_2S corrosion of metal plates was investigated. The results of study is presented in table 2.

Table 2. Results of study of Na^+, K^+ salts of amides, obtained by interaction of dietanolamine with ethylenediamintetraacetic acid as corrosion inhibitor in H_2S condition

Compound	Concentaration C, mg/l	Corrosion rate P, g/m^{2}hour		Protection effect, Z%	Delay constant, γ
		With inhibitor	Without inhibitor		
Synthesis Na salt of EDTA with DEA in 1:1 mol ratio	50	0,952	0,396	58,4	2,4
	100	0,952	0,125	86,8	7,6
	150	0,952	0,078	91,8	12,2
	200	0,952	0,022	97,6	43,2

Synthesis K salt of EDTA with DEA in 1:1 mol ratio	50	0,534	0,204	44,9	1,8
	100	0,534	0,206	61,4	2,5
	150	0,534	0,146	72,6	3,6
	200	0,534	0,056	89,5	9,5
Synthesis Na salt of EDTA with DEA in 1:2 mol ratio	50	0,793	0,317	60	2,5
	100	0,793	0,223	71,8	3,5
	150	0,793	0,096	87,9	8,26
	200	0,793	0,023	97,09	34,4
Synthesis K salt of EDTA with DEA in 1:2 mol ratio	50	0,793	0,474	40,2	1,67
	100	0,793	0,316	60,15	2,5
	150	0,793	0,187	76,4	4,2
	200	0,793	0,079	90,0	10,03
Synthesis Na salt of EDTA with DEA in 1:3 mol ratio	50	0,952	0,396	58,40	2,4
	100	0,952	0,258	67,4	3,68
	150	0,952	0,143	84,9	6,65
	200	0,952	0,057	94,0	16,7
Synthesis K salt of EDTA with DEA in 1:3 mol ratio	50	0,725	0,376	48,1	1,9
	100	0,725	0,212	70,7	3,4
	150	0,725	0,126	82,6	5,7
	200	0,725	0,078	89,2	9,2

10% solutions of Na^+, K^+ salts of amides synthesized in 1:1 mol ratio were studied against H_2S corrosion of metal plates in various concentration. It was established, that Na^+ salt in concentration 50 mg/l shows 58.4% effect, in concentration 100, 150, 200 mg/l shows effect 86,8%; 91,87%; 97,6% approximately. 10% solution of K^+ salt in concentration 50 mg/l shows 44,9%, anticorrosion effect and in concentration 100, 150, 200 mg/l shows 61,4; 72.6; 89,5% effect approximately.

10% solutions of Na^+, K^+ salts of amides synthesized in 1:2 mol ratio were studied against H_2S corrosion of metal plates in various concentration. It was established, that Na^+ salt in cincentration 50 mg/l shows 60% effect, in concentration 100, 150, 200 mg/l shows effect 71,8; 87,9; 97,9% approximately. 10% solution of K^+ salt in concentration 50 mg/l shows 40,2%, anticorrosion effect and in concentration 100, 150, 200 mg/l shows 60,15; 76,4; 90,0%% effect approximately.

10% solutions of Na^+, K^+ salts of amides synthesized in 1:3 mol ratio were studied ahainst metal plates H_2S corrosion in various concentration. It was established, that Na^+ salt in concentration 50 mg/l shows 58,4% effect, in concentration 100, 150, 200 mg/l shows effect, 67,4; 84,9; 94% approximately. 10% solution of K^+ salt in concentration 50 mg/l shows 48.1% anticorrosion effect and in concentration 100, 150, 200 mg/l shows 70,7; 82,6; 89,2% anticorrosion effect approximately.

As can be seen from the table, the best result was shown by the 10% solution of Na^+ salt of amide synthesized in 1:1 mol ratio at a concentration of 200 mg/l.

İn this case the protection effect is 97,6%, delay constant is 43,2.

Conclusion

10% solutions of Na^+, K^+ salts of amied obtained by interaction EDTA with MEA and DEA in various mol ratio were prepared and their H_2S corrosion of metal plates inhibitor effectivity was studied. It was established that 10% solutions of Na^+ salts of amides in concentration 200 mg/l shows 95-97% effectiveness against H_2S corrosion, but 10% solutions of K^+ salts is 85-90% protective.

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