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EFFECT OF İNORGANİC COMPLEXES OF İMİDAZOLİNE BASED ON SYNTHETİC PETROLEUM ACİDS AND TRİETHYLENTETRAMİN AGAİNST CARBON DIOXIDE CORROSİON

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Imidazoline derivatives have been synthesized on the basis of synthetic petroleum acids and triethylentetramine. Complexes were prepared from the above-stated compounds and HCl in the ratio 1:2, 1:3. Note that 20% solutions of the complexes were prepared in aqueous isopropyl alcohol. The kinetic effect of steel corrosion in CO_2 -saturated 1% NaCl solution has been examined by ACM Gill AC potentiometer. It revealed that imidazoline derivative complexes based on the SPA and TETA with HCl in the molar ratio 1:2 at concentration of 25 mg/l had corrosion protection 87.0%, at concentration of 50 mg/l - 96.4% and at concentration 100 mg/l - 97.1%; however, in the mole ratio of 1:3 the complex reveals its best results – 93.8, 97.8 and 98.4%.
Keywords: *corrosion inhibitor, synthetic petroleum acids, oxidation, triethylentetramin, imidazoline*

İNTRODUCTİON

Corrosion of metal constructions, specifically oil and gas industry equipment, incurs great losses to all spheres of national economy. This is due to highly aggressive components of the said equipment and its operation. On the other hand, corrosion consequences in all spheres of industry lead to unscheduled shutdowns. As a result, it negatively affects economic indices of oil and gas industry.

Manufacture of equipment from anticorrosion materials does not always secure its reliability and durability. That's why other methods have to be used in corrosion protection matters.

A widely used method to reduce aggressiveness of corrosion components is the use of inhibitors [1-3].

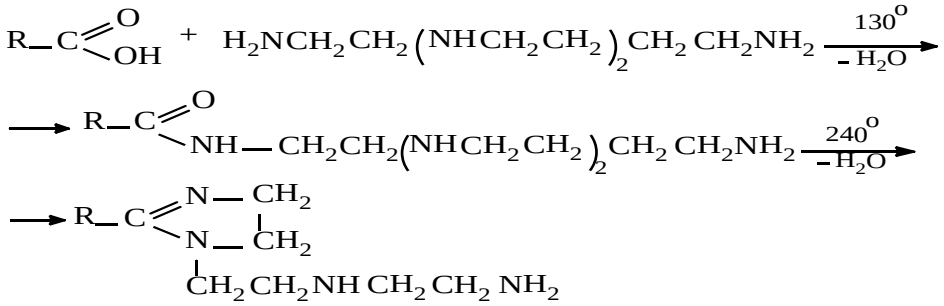
Key requirements include as follows: inhibitors are to be obtained through the use of available raw material, have multifunction effect and be cheap. Worthy of note among inhibitors which comply with current requirements are nitrogen-containing organic compounds obtained on the basis of synthetic (SPA) and natural petroleum acids of major importance. In this respect, it is very important to use SPA which is obtained from catalytic oxidation of naphthenic-paraffinic hydrocarbons and new hydrocarbons in liquid-phase obtained from Azerbaijani oil [4-7]. Thus, for SPA synthesis there were used fractional reserves that are available in our country. On the other hand, unlike derivatives of oil acids, derivatives of these acids their freezing temperatures are much lower.

The article deals with the production of new inhibitors which are highly effective in CO_2 mediums to comply with the above-mentioned requirements.

EXPERİMENTAL PART

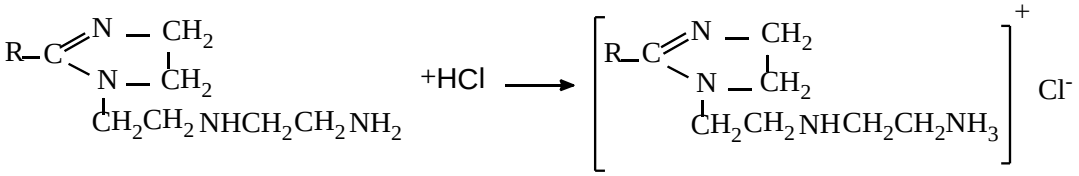
Note that SPA has been used for synthesis of highly effective corrosion inhibitors. To obtain SPA, Azerbaijani oil of de-aromatized boiling fraction with boiling interval of 250-350^{0}C has been used. The process of dearomatization was carried out through the use of sulfurization. Naphthenic-paraffinic hydrocarbons were oxidized in liquid-phase with oxygen of air in the presence of catalyst of salts of natural oil acids. The process has been carried out within 6 hours at a temperature of 135 ^{0}C in a special reactor.

Synthesis of SPA derivatives and tiethylentetramine (TETA) gets through two stages. In the first stage, there was obtained an amid compound on the basis of SPA and TETA, in the second stage - imidazoline derivatives:



The structure of the synthesized imidazoline was explored through IR and NMR spectroscopy.

Complexes based on the obtained imidazolines with HCl were synthesized under normal conditions:



Complexes were prepared from the said compounds and HCl in the ratio 1:2 (sample 1), 1:3 (sample 2). Note that 20% solution of the complexes came as a result of the use of aqueous isopropyl alcohol. The kinetic effect on steel corrosion in CO_2-saturated 1% NaCl solution was analyzed by ACM Gill AC potentiometer.

RESULTS

One of the effective methods of struggle against carbon-dioxide corrosion is the use of inhibitors. Types of corrosion inhibitors are not a lot of. Amines, amides, imidazolines and salts of quaternary ammonium are used most frequently [9-11].

Note that the concentration 25, 50 and 100 mq/l of complexes have been analyzed within 20 hours. At the same time, corrosion of steel samples was explored in the absence of corrosion inhibitor.

Fig.1 shows that in the absence of inhibitor the corrosion rates become faster as time goes by. At concentration of 100 mg/l after 5 hours the protection effect increases from 93.8% to 98% after 20 hours of research:

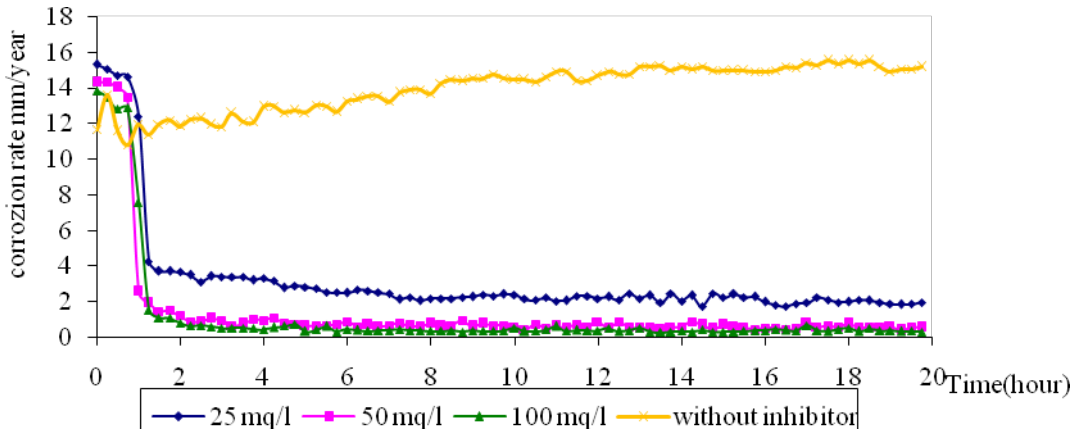


Fig. 1. Dependence of corrosion rate upon time for steel in CO_2-saturated 1% NaCl solution containing various and sample 1 at 50 ^{0}C.

Fig. 1 shows the effect of sample 1 on the corrosion rate of carbon steel in CO_2 saturated 1% NaCl solution at a temperature of 50^{0}C.

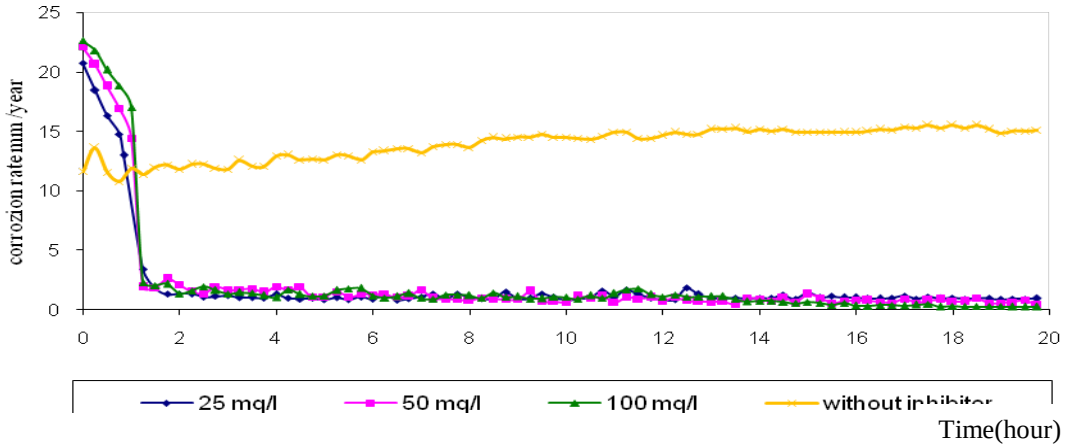


Fig 2. Dependence of corrosion rate upon time for mild steel in CO_2-saturated 1% NaCl solution at various concentrations of sample 2 at a temperature of 50 ^{0}C.

Sample 2 at various concentrations in the CO_2 medium was studied. At concentrations of 25 mq/l in sample 2 following 5 hours of research the corrosion effect grows from 92,3% to 93,8% after 20 hours of research; at concentration of 100 mq/l 5 hours of research a figures rises from 93,8% to 98,4 %. Fig. 2 shows the effect of sample 2 on the corrosion rate of carbon steel in CO_2 saturated 1% NaCl solution at 50 ^{0}C.

Results of research into inhibitor effectiveness of synthesized complexes at various concentrations are shown at Table 1.

Table 1. Results of inhibitor effectiveness of complexes

Concentration, C, mq/*l*	Time, hour	Sample -1		Sample -2	
		Corrosion rate, ρ, mm/year	Protection effect, Z, %	Corrosion rate, ρ, mm/year	Protection effect, Z, %
Without inhibitor	5	12.611	-	12.611	-
	10	14.48	-	14.48	-
	20	15.148	-	15.148	-
25	5	2.510	80.7	0.974	92.3
	10	2.22	81.7	0.947	91.2
	20	1.962	87.0	0.857	93.8
50	5	0.712	87.2	0.517	95.9
	10	0.518	92.0	0.538	96.3
	20	0.55164	96.4	0.588	97.8
100	5	1.065	91.6	0.318	93.8
	10	0.617	95.7	0.423	95.0
	20	0.440	98.1	0.295	98.4

Thus, protection complex in the various mole ratio at low concentrations grows with the rise ion mole share. Thus, sample 1 at concentration of 50 mq/l following 20 hours of research masde up 96,4%, for sample 2 it reached 97,8%. However, corrosion protection effect of samples at concentration of 100 mq/l following 20 hours of research changed insignificantly.

It should be noted that the kinetic effect of steel corrosion on the basis of imidazoline obtained from SPA and TETA and SPA in 1% NaCl sdaturated with CO_2 on the steel corrosion yields higher effect. Complexes based on imidazoline and HCl in the molar ratio 1:3 as compared with 1:2 molar ration are more exposed to chemisorption on the metal surface than in the ration 1:2, that's why protective films on the surface are more stable. For this reason, the complex is notable for higher corrosion protection effect than previous ones.

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ВЛИЯНИЕ НЕОРГАНИЧЕСКИХ КОМПЛЕКСОВ ИМИДАЗОЛИНА, ПОЛУЧЕННЫХ НА ОСНОВЕ СИНТЕТИЧЕСКИХ НЕФТЯНЫХ КИСЛОТ И ТРИЭТИЛЕНТЕТРАМИНА, НА УГЛЕВОДОРОДНУЮ КОРРОЗИЮ

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Синтезированы производные имидазолина на основе синтетических нефтяных кислот и триэтилентетрамина. На основе этих соединений и HCl получены комплексы в соотношении 1:2 и 1:3. 20%-ный раствор комплексов приготовлен в водном изопропиловом спирте. Исследован кинетический эффект коррозии стали в 1% -ном растворе NaCl, насыщенном CO_2, с помощью потенциометра ACM Gill AC. Было обнаружено, что комплексы имидазолиновых производных на основе СНК и ТЭТА с HCl в молярном отношении 1: 2 при концентрации 25 мг/л проявляют защитный эффект от коррозии 87.0%, при концентрации 50 мг/л – 96.4% и 100 мг/л – 98.1%, а в случае комплекса при мольном соотношении 1: 3 наблюдаются лучшие результаты – 93.8, 97.8 и 98.4% соответственно.

***Ключевые слова**: коррозия, ингибитор, синтетические нефтяные кислоты, окисление, триэтилентетрамин, имидазолин.*

SİNTETİK NEFT TURŞULARI VƏ TRİETİLENTETRAMİN ƏSASINDA SİNTEZ OLUNMUŞ İMİDAZOLİNİN QEYRİ-ÜZVİ KOMPLEKSLƏRİNİN CO_2 KORROZİYASINA TƏSİRİ

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Sintetik neft turşuları və trietilentetramin əsasında imidazolin törəməsi sintez edilmişdir. Sintez olunmuş imidazolin və HCl əsasında 1:2 və 1:3 nisbətlərində komplekslər alınmışdır. Komplekslərin 20 %-li məhlulu sulu izopropil spirtində hazırlanmışdır. CO_2 ilə doymuş 1%-li NaCl məhlulunda poladın korroziyanın kinetik effekti ACM Gill AC markalı potensiometrin vasitəsilə tədqiq olunmuşdur. Məlum olmuşdur ki, 1:2 nisbətində sintez olunmuş imidazolinin kompleksi 25 mq/l konsentrasiyada korroziyaya qarışı 87.0 % inhibitor effektinə malikdir, 50 mq/l -96.4% və 100 mq /l - 98.1%, lakin 1: 3 nisbətində daha yaxşı nəticələr müşahidə olunur – müvafiq olaraq inhibitor effekti 93.8, 97.8 və 98.4% olmuşdur.

Açar sözlər: *korroziya, inhibitor, sintetik neft turşusu, oksidləşmə, trietilentetramin, imidazolin.*

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