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Corrosion Inhibitors Based on Imidozoline

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Abstract: In the article, it is proved that the C=H bond intensive absorption characteristic for the imidozoline family is more in the sample obtained by acid catalysis. In this, C= H - and C=O- we see that the absorption intensities for the bonds are interrelated, as the intensity of one bond increases, that of the other decreases. It is possible to prove the existence of imidazaline derivatives as a result of comparison of C=H bond intensities in the IR spectra of the studied samples under different conditions.

Keywords: general, imidazoline , catalysis , acidic , double bond, intensity .

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One of the important problems of today's petrochemical industry is to create new corrosion inhibitors for construction materials and increase the efficiency of their use. The weight of metal losses due to corrosion is large, and the amount of expenses due to accidents in pipelines, industrial chemical-technological equipment, etc. is increasing. It is important to obtain polyfunctional heterocyclic compounds based on multi-ton olefins, glycols, amines, which have the activity of preventing the decomposition of materials in an aggressive environment.

During the period of rapid development of the chemical and oil and gas processing industry in the world, scientific research is being conducted on the methods and structure of the main classes of organic inhibitors, the nature of corrosion processes, and the protection of construction materials in the processes of hydrocarbon production and processing. In this regard, certain results have been achieved in the direction of production of new generation organic corrosion inhibitors, including the provision of chemical products that substitute imports.

Obtaining imidoziline derivatives based on ethylenediamine, diethylenetriamine, polyethylene polyamine, secondary products of the oil-oil industry containing fatty acids and gossypol resin, preparation of various compositions based on them, systematic research of their physico-chemical and technological properties, production of synergetic effective corrosion inhibitors soluble in highly effective hydrocarbons development of low-level, energy-saving technologies of production is of scientific importance.

The purpose of the study is to create a technology for the development of effective hydrocarbon-soluble corrosion inhibitors based on local raw materials and secondary products of industry.

Tasks Of The Research

Study of condensation processes of fatty acids and ethyleneamines in the solvent environment in the presence of acid catalysts;

determination of optimal conditions for obtaining corrosion inhibitors based on a mixture of fatty acids;

obtaining new solvents for the synthesis of corrosion inhibitors based on a mixture of fatty acids;

One of the important tasks of the modern chemical industry is to create new corrosion inhibitors for construction materials and evaluate their effectiveness. Below are considered the methods and structure of the main classes of organic inhibitors, the nature of corrosion processes and methods of protection of construction materials in the production and processing of hydrocarbons

Experience Part

Diethylenediamine, polyethylene polyamine, oleic acid, a mixture of fatty acids, gossypol tar, solvents pure benzene, a mixture of aromatic hydrocarbons (benzene, toluene and xylenes), chloroform, acetone, distilled water were used to study the reactions of obtaining corrosion inhibitors based on imidozoline . Below are some physicochemical properties of the starting materials used. [1-3]

Physico-chemical characteristics of the finished product and initial reagents

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Corrosion inhibitor of the "IIK-D1" series is a dark brown liquid, its physical and chemical parameters are given in Table 1.1.

Table 1.1
Physico-chemical parameters of "IIK-D1" series corrosion inhibitor

No	Name of pointers	Indicators
1	Amen number , per 1 g of inhibitor NSl mg, not less than the indicator	45.0
2	Hydrogen sulfide keeper Hydrocarbon in the environment to protect level , less than % it's not	90.0
3	Solubility : in hydrocarbons in the water	 it dissolves dispersed _
4	Hardening temperature does not exceed °C	minus - 35
5	20 °S in mm ^{2} /s kinematic viscosity , a lot it's not	25
6	Dry residue, less than % it's not	67
7	20 °C of the inhibitor density , g/cm ^{3} ,	1.05 – 1.1

Imidozolin is a heterocyclic compound with the gross formula C 3 H 6 N $_2$, with five atoms , three carbon atoms and two nitrogen heteroatoms (nitrogens are located in the 1 and 3 positions and are bonded to each other). Imidazoline exists in three isomeric states depending on the position of the double bonds. [3-5]

Ethylenediamine (1,2-diaminoethane) H $_2$ NCH $_2$ CH $_2$ NH $_2$ is an organic compound belonging to the class of amines. A widely used substance in many chemical syntheses, it is a colorless, weak ammoniacal liquid that reacts with air of high humidity. t $_{liquid}$ 116.5 °C, t $_{liquid}$ 8.5 °C, density 0.899 g/cm³ (20 °C); ethylenediamine is good in water, ethanol and sparingly soluble in ether, insoluble in benzene and other nonpolar hydrocarbon solvents. It has a strong base characteristic.

Polyethylene polyamine (PEPA), [– C $_2$ H $_4$ NH –] is a mixture of compounds with $_n$ fragments, if n = 2-6 it is low molecular polyethylene polyamine, if n = 250-1500 it is considered high molecular polyethylene polyamine. Low molecular polyethylene polyamines are pale yellow to dark brown liquids with a density of 1.05.

Oleic acid (cis-9-octadecene acid, C $_{18}$ H $_{34}$ O $_2$) is a monounsaturated fatty acid belonging to the omega-9 (ω-9) family, with a double bond in the 9th position of its chain; molecular mass: *282.46 ; t $_{liquid}$ =16.3 °C; t $_{boil}$ = 360 °C,* $d_4^{20} = 0.896$; $n_D^{20} = 1.45482$; insoluble in water, soluble in benzene, chloroform, diethyl ether.

Coapctok is a refined (refined) product, produced as a result of alkaline treatment of vegetable oils and fats in the oil processing industry. It has a variable complex composition and depends on the nature of oils and fats, the methods of their extraction and purification, and the conditions of the technological process of processing. [4,5]

KU 2-8 cationite synthetic of materials prepared , the diameters are 0.3-1.35 mm granules . Strong acidic ionites to the line enters _ High efficiency storage for hydrogen in the form of pH 2 - 14 used , technological characteristics are given in table 1.2 .

Table 1.2
of sulfocationites acidity characteristics

Sample	Acidic centers concentration ×10 ^{7} , mol/m ^{2}							
	N0 1.7 _	2.6	2.8	3.8	4.8	5.7	6.3	∑
KU-2-10	0.59	0.75	7.81	0.2	0.14	3.38	1.24	13.11
KU-23-10/60	1.22	6.32	15.4	2.76	0.6	0.94	3	30.24
KU-23-10/100	0.93	5.4	25	0.53	0.37	3.6	0.67	36.53
KU-23-30/100	0.11	0.35	0.93	0.07	0.06	0.01	0.12	1.65
KU-23-16/60	0.61	3.2	7.7	1.4	3	4.7	1.5	22.11
KU-23-16/80	0.1	0.45	2.2	0.07	0.02	0.01	0.34	3.19

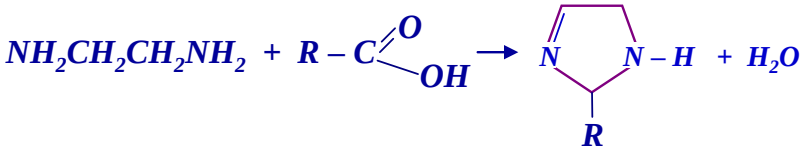
Benzene - C $_6$ H $_6$ is a colorless, clear liquid with an unpleasant odor, which is removed before use. T $_{brother-in-}$

ISSN NO: 2770-4491
Date of Publication:11-07-2023

law. = 80.1 °C, $d_4^{20} = 0.8798 \frac{g}{cm^3}$; $n_D^{20} = 1.5021$; specific gravity 0.879. Insoluble in water; mixed with organic solvents such as alcohol, ether, chloroform.

Optimal conditions for the synthesis of imidozoline derivatives

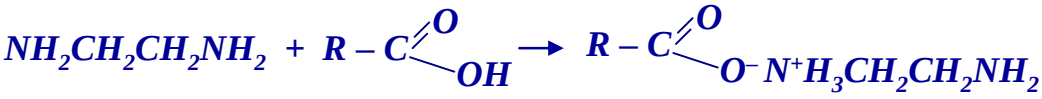
The synthesis of imidozoline derivatives is carried out in different proportions of fatty acids and ethylenediamine.



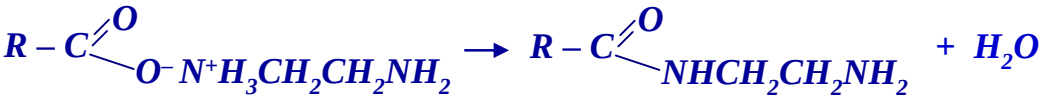
Imidazoline synthesis linear amides harvest to be stage through done increase proved . Reaction from the conditions come out , first stage Imidazoline people harvest to be provider of fatty acids monoamide and diamides harvest will be

As mentioned above, the synthesis of imidozoline derivatives is multi-step and takes place with the formation of many intermediate products. The sequence of the process can be shown by the following chemical reaction schemes:

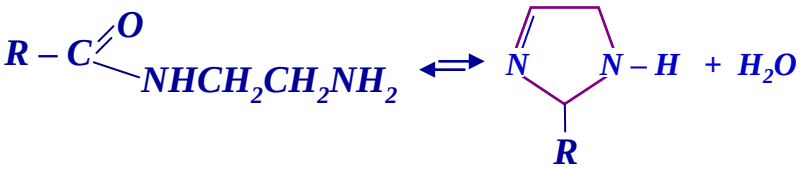
Stage 1. Formation of ammonium salts of fatty acids with ethylenediamine:



Stage 2. Separation of water from ammonium salts of carbonic acid and formation of amides:



Stage 3. Cyclization of carboxylic acid amides and formation of imidozoline derivatives :



fatty acids and ethylenediamine based on Imidazoline derivatives synthesis of doing acceptable conditions determination in order to , of temperature the effect is within 180 - 250 °C studied , studies two in stages observed . Initial reagents tube - to the reactor from loaded after temperature 160 °C, 3 hours of reaction in duration reaction in Dina-Stark nozzles of water meeting with done increased

Then reaction at a temperature of 190 °C for 8 hours continue will be delivered . The adduct formed at this stage of the synthesis is a brown liquid with a white precipitate consisting of up to 50% acid linear amides. Dewatering is also °carried out at a temperature of 230 C, a homogeneous liquid of brown color is formed, and no sediment remains.

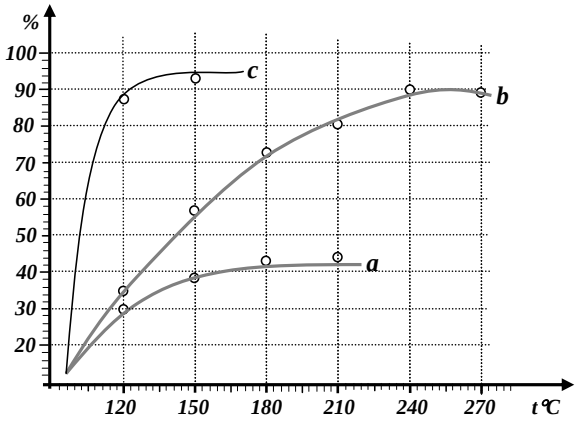


Figure 1.1. Dependence of the yield of imidozoline formation on temperature:
a) after the first stage of two-stage heat treatment; b) after the second stage of two-stage heat treatment; c) in the presence of an acidic catalyst

In the next step, the amount of separated reactive water was determined and compared with the calculated amount (the calculated amount was taken in relation to the complete conversion of imidozoline).

ISSN NO: 2770-4491
Date of Publication:11-07-2023

Table 1.3
Amount of water released in imidozoline synthesis

Reaction conditions	Separated water of reaction	Calculated water separation
after the first stage of two-stage heat treatment	4.3	7.2
after the second stage of two-stage heat treatment	5.3	7.2
in the presence of an acidic catalyst	6.5	7.2

The comparative ratios of the reactants and the calculated amount of water (Table 1.4) confirm the high conversion of the starting reagents to the target imidozoline. While the ratios are large when °the thermal production is carried out at 190 C, °at 230 C, a sharp increase in conversion leads to an increase in the yield of imidizoline formation. [6-9]

Since the determination of the acid number of the produced substances is one of the important parameters indicating the degree of conversion of fatty acids, we considered it the goal to determine the same indicators during our research. Since temperature is the main influencing factor of the synthesis, the determination of the acid number can be carried out at an arbitrary step of the synthesis. [8-10]

1. Table 4
Amount of water released in imidozoline synthesis
The calculated amount of separated water is 7.2 KOH/g

Reaction conditions	Acid number, KOH/g
after the first stage of two-stage heat treatment	4.3
after the second stage of two-stage heat treatment	4.5
in the presence of an acidic catalyst	8.1

Analysis results that's it showed that the acid number at 190 and 230 °C is 4-5 mg KO H /g, and for the product obtained with the presence of a catalyst it is equal to KS = 8.1 KOH/g, and we considered this to be related to the acidic nature of the catalysis process.

Another way to determine the composition of reaction products is the use of IR-spectroscopy. Figures 1-3 show the IR-spectra of the mixture of fatty acids included in cottonseed oil and the products obtained from the reaction of ethylenediamine. [7,10-11]

IR-spectra were obtained on the " Agilent Technology FTIR-640" device under the following conditions: recording range 4000-400 cm $^{-1}$, number of glasses - 12.

Absorption lines at 1605 cm –1 C = N-bond, and absorption lines at 1650 and 1550 cm –1 C = O-bond corresponding to linear amides were observed in all conditions of the synthesis .

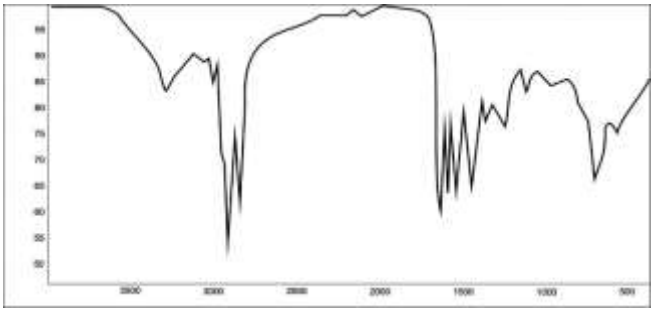
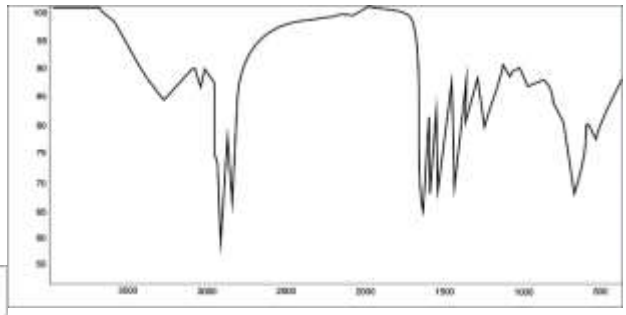


Figure 1.2. IR-spectrum of the sample taken at a temperature of 190 C°

ISSN NO: 2770-4491
Date of Publication:11-07-2023

Figure 1.3. IR-spectrum of the sample obtained at a temperature of 240 C°



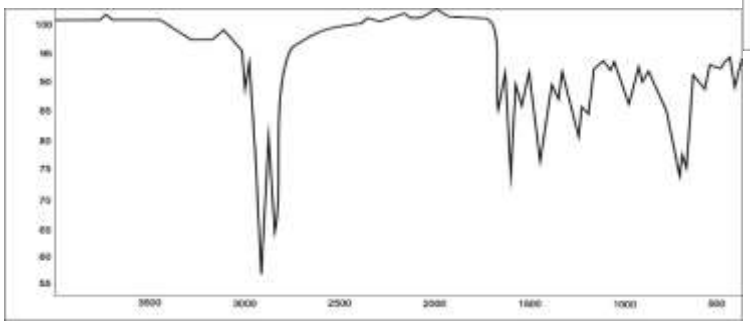


Figure 1.4. IR-spectrum of a sample obtained by acid catalysis

190 °C (Fig. 1.2), the characteristic absorption lines for the C=N bond °are observed less than in the IR-spectrum of the samples taken at a temperature of 230 C and in the presence of a catalyst (Figs. 1.3 and 1.4). C=N-bond intensity absorption typical for the imidozoline group is greater in the sample obtained by acid catalysis. Here, we see that the intensity of absorption for C = N- and C = O-bonds is interrelated, as the intensity of one bond increases, the intensity of the other decreases. It is possible to prove the existence of imidazaline derivatives by comparing the intensities of the C=N- bond in the IR-spectra of the studied samples under different conditions.[11,12]

Conclusions

1. Imidozoline derivatives were synthesized by condensation of soap stock and polyethylene-polyamine, a secondary product of the oil-oil industry, in the presence of an acidic catalyst in a mixture of aromatic hydrocarbons at low temperatures.
2. The technology of production of solvents consisting of aromatic hydrocarbons benzene, toluene and xylene with vacuum driving on the basis of TAR dissolved in secondary liquid hexane using the secondary products of JV "Uz-Kor Gas Chemical" LLC was recommended and used as an effective solvent of heterocyclization processes .

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