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TECHNOLOGIES FOR PRODUCING A MIXTURE OF ALKYLIMIDAZOLINES AND ACID CORROSION INHIBITORS

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ABSTRACT:

Imidazoline is a class of heterocycles formally derived from imidazoles by reduction of one of the two double bonds. Imidazolines are thermally stable. The ability to form cations allows imidazoline salts to be strongly adsorbed on negatively charged surfaces of metals, plastics, glass, etc., while hydrophilic surfaces are converted to hydrophobic ones. Imidazoline salts are significantly more hydrophilic than imidazolines themselves. They are compatible with aqueous systems and are capable of forming a thin film. Thus, contact of the surface with water or aggressive acidic environment is reduced, which reduces corrosion [1].

KEYWORDS: Surfaces of metals, plastics, glass.

INTRODUCTION

Imidazoline is a class of heterocycles formally derived from imidazoles by reduction of one of the two double bonds. Imidazolines are thermally stable. The ability to form cations allows imidazoline salts to be strongly adsorbed on negatively charged surfaces of metals, plastics, glass, etc., while hydrophilic surfaces are converted to hydrophobic ones. Imidazoline salts are significantly more hydrophilic than imidazolines themselves. They are compatible with aqueous systems and are capable of forming a thin film. Thus, contact of the surface with water or aggressive acidic environment is reduced, which reduces corrosion [1].

The issues of synthesis, structure, reactivity and synthesis of five-membered heterocycles are covered in a number of works. A method for producing 2-alkyl-2-imidazoline by the interaction of carboxylic acids (acetic, butyric, isobutyric, valerianic or isovaleric) with ethylenediamine upon heating in the presence of a catalyst has been investigated and proposed; according to the

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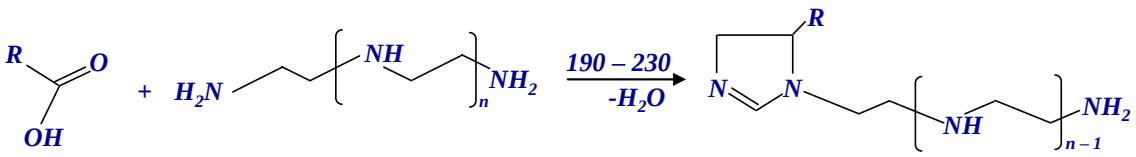
invention, copper nanoparticles or a 50% aqueous suspension of iron oxide Fe3O4 are used as a carboxylic acid, [2] as a catalyst; the patterns of the acylation reaction of diethylenetriamine (DETA) with saturated monocarboxylic acids of the composition C16 – C18 are presented in works [3–5], synthesis [6, 7] contains the following ingredients, % by weight: clay powder 3.0–20.0; stabilizer 0.3–0.5; condensation product of high-molecular fatty acids and still residues of monoethanolamine 3.0-4.0; oil 10-20, water - the rest.

As a starting component with a carboxyl group for the synthesis of alkylimidazolines, we studied the composition and properties of cotton soapstock - a secondary product of the oil and fat industry of the Republic of Uzbekistan.

As a result of the study, optimal conditions for the process of fatty acid extraction from soap stock (FAS) were established. To do this, it is necessary to carry out the hydrolysis process by diluting the original soap drain with process water at a temperature of no less than 100 °C. The soap drain content in the solution fluctuates within 10 - 25%. Soapstock hydrolysis was carried out for 30-60 min. After cooling this mixture to 80 °C, the calculated amount of sulfuric acid solution was added to decompose the resulting mixture. For this, the system temperature was maintained at 80-90 °C for 10-20 min. The hot mixture was then transferred to a settling tank for cooling and separation. A rapid separation of the liquid was observed, the upper layer of which consisted of fatty acid mixtures, and the lower layer of an aqueous solution of sodium sulfate. The top layer was washed from traces of sodium sulfate, as well as sulfuric acid.

One of the most common methods for synthesizing alkylimidazolines is the reaction of polyaminoethylene with fatty acids:



When searching for optimal conditions for the synthesis of alkylimidazolines from LCS and polyethylenepolyamines (PEPA), a common method for obtaining alkylimidazolines was taken as a basis, which involves a one-time mixing of a carboxylic acid with a small excess of a diamine at room temperature and subsequent stepwise heating to 250-270 °C, during which amidation reactions of the carboxylic acid and further cyclization of the amide occur. Azeotropic agents or inert gas purging can be used to facilitate the removal of reaction water at the amidation stage, and vacuum at the cyclization stage. We reproduced the above conditions, but were unable to achieve a high yield of alkylimidazolines, so we subsequently improved the method for their preparation. To determine the effect of temperature on the course of the heterocyclization reaction, experiments were carried out in the following sequence (1st experiment): 106 g (~ 0.5 mol in relation to the average value of the fraction of three acids) of ZCS taking into account moisture and 103 g (1 mol) of polyethylenepolyamine were loaded into a three-necked flask equipped with a thermometer, a Wurtz trap with a Liebig condenser, a tube for supplying inert gas and a magnetic stirrer. The mixture was heated to 70 °C, they waited until the liquid-crystal

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complex melted, began intensive stirring, turned on the argon supply and raised the heating to 180 °C.

At temperatures above 130 °C, condensation of water vapor was observed in the refrigerator, and the condensate was collected in the receiver. The reaction mixture was kept at 180 °C for 1 h until the evolution of water ceased. Then the temperature continued to rise up to 270 °C.

Above 210 °C, excess PEPA was distilled off; after 250 °C, reaction water began to distill off. The reaction mixture was kept at 270 °C for 1 hour, then, without reducing the temperature, it was evacuated at 200 mm Hg for another 1 hour to complete the cyclization and remove traces of water.

The resulting mixture of alkylimidazolines, conventionally called IK-2YU, was tested as a corrosion inhibitor: the corrosion behavior of steel was studied on plate-shaped samples; studies were conducted in background solutions of 5% Na2SO4 + 5% H2SO4 at various temperatures.

The effect of background solutions and inhibitors on the corrosion behavior of metal samples was determined by the gravimetric method (Table 1).

Table 1
Effect of Corrosion Test Duration on the Efficiency of Carbon Steel Protection with SNPKh-6301 inhibitor

Inhibitor concentration, C_{inh}, mg/l	360 hours		720 hours	
	Corrosion rate, g/(m^2/day)	Degree of protection, %	Corrosion rate, g/(m^2/day)	Degree of protection, %
at a temperature of 25 ^{0}C				
Without inhibitor	216,09	-	172,64	-
10	10,43	95,17	7,19	95,83
15	9,25	95,72	7,13	95,87
20	9,44	95,63	6,89	96,01
at a temperature of 50 °C				
Without inhibitor	175.05	-	189,90	-
10	10,95	93,74	20,19	89,37
15	9,71	94,45	17,84	90,60
20	9,91	94,33	18,01	90,05

The technological process of inhibitor production is carried out in the following sequence:

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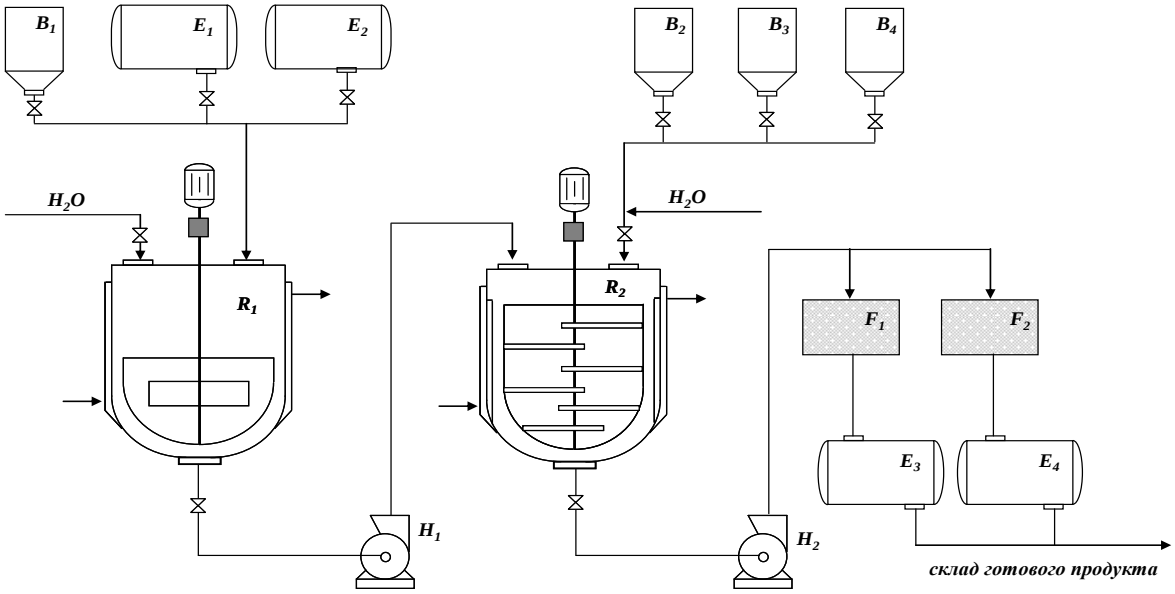

Fig. 1. Technological scheme for the production of corrosion inhibitor IK-2[YU:]
E_1, E_2- containers for polyethylenepolyamine; B_1, B_2, B_3, B_4 - Fatty acid mixture bins; R_1 и R_2 - reactors; H_1 and H_2 - pumps; F_1 and F_2 - filters; E_3 and E_4 - inhibitor containers

REFERENCES

1. Liu, H. and Du, D.-M. Recent Advances in the Synthesis of 2-Imidazolines and Their Applications in Homogeneous Catalysis. 351: 2009, P.489-519. DOI: 10.1002/adsc.200800797
2. A.I. Slivkin [and others.]. Azotsoderjashie geterotsiklicheskie lekarstvennie sredstva. Uchebniy modul podgotovlen s ispolzovaniem materialov: Kurs lektsiy po farmatsevticheskoy ximii. Ch. 2 / - M.: GEOTAR-Media, 2015,chapter 6: p. 14 .
3. Popov Yu.V. Sposob polucheniya 2-alkil-2-imidazolinov [Method of producing 2-alkyl-2-imidazolines] Patent RU, 2599989 p. 20.10.2016 Бюл. № 29
4. Yusevich A.I., Salko V.V., Osipenok Ye.M., Kuzemkin D.V. Sintez i svoystva 2-alkil-1-(2-aminoetil)-2-imidazolinov // Trudы BGTU. Ser. 2, Ximicheskie texnologii, biotexnologii, geoekologiya. 2021. № 2 (247). p. 144–152.
5. Finšgar M., Jackson J. Application of corrosion inhibitors for steels in acidic media for the oil and gas industry: A review. Corrosion Science vol. 86, September 2014, pp. 17-41. http://dx.DOI.org/10.1016/j.corsci.2014.04.044
6. Cheng N., Salas B.V., Wiener M.S., Martinez J.R.S. Vapor Inhibitors for Corrosion Protection in Humid and Saline, Natural, and Industrial Environments. Corrosion Inhibitors, Principles and Recent Applications, December 2017, pp. 165-180. http://dx.DOI.org/10.5772/intechopen.72815
7. Patent RU 2664511 C2. Iyang B., Gershun A., Uoisiesdjes P.M. Jidkosti-teplonositeli i sostavы ingibitorov korrozii dlya ix primeneniya [Heat transfer fluids and corrosion inhibitor formulations for use thereof], заявл. 20.08.2018.