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PRECISION ENGINEERING OF "IIK-D1" SERIES CORROSION INHIBITORS: PRODUCTION INSIGHTS

Davlyatova Zulfiya Muratovna
PhD, Teacher of the Department of Chemistry and
Chemical Technology, Fergana Polytechnic Institute, Fergana, Uzbekistan
E-mail: davlyatova0409@gmail.com

Polvonov Khurshid Madaminovich
Candidate of Technical Sciences, Docent, Department of Chemistry and
Chemical Technology, Fergana Polytechnic Institute, Fergana, Uzbekistan
E-mail: akad.hurshid@mail.ru

Abstract
The article notes that the technology for the production of corrosion inhibitors of the "IIK-D1" series was introduced in the joint venture "Elektrokimyozavod", which made it possible to develop an energy-saving technology for producing corrosion inhibitors based on secondary products of the fat and oil industry based on acid catalysts, which eventually cost 1.5-1.8 times cheaper. The technology of mass production of corrosion inhibitors was introduced in the joint venture “Elektrokimyozavod”, the result allowed to obtain a corrosion inhibitor soluble in hydrocarbons based on imidozoline with a degree of protection of oil production and processing plants 93%.

Keywords: inhibitor, corrosion, technology, Fat and oil industry, hydrocarbon, imidazoline.

Introduction

Today, one of the important problems of the petrochemical industry is to create new corrosion inhibitors for structural materials and increase the efficiency of their use. As a result of corrosion, the weight of metal losses is greater, and the volume of spending due to accidents in pipe transfers, industrial chemical and technological equipment, etc.is increasing. It is considered important to obtain polyfunctional heterocyclic compounds with material degradation prevention activity in an aggressive environment based on multi-ton olefins, Glycols, amines [1-4].

On the basis of local raw materials and secondary material resources in our republic, measures are being taken in the field of creation and production of high- performance corrosion inhibitors and certain results are being achieved. The development strategy of the new Uzbekistan sets out important tasks for "deepening structural changes, increasing the competitiveness of the national economy by modernizing and diversifying its leading sectors, including the chemical industry, taking into account the development of production of fundamentally new types of products and technologies." It is important to carry out these tasks, including the development of resource efficient technologies based on domestic raw materials and secondary products, the creation of an effective corrosion inhibitors composition as an import substitute.

Obtaining high-performance inhibitors that are soluble in hydrocarbons P. on determining the areas of their application.K. Gogoy, B. Barhai, S. Radjendran, R.M. Giovanni, A.F. Amalradj, Michael G. Trulear, Richard H. Tribble, N.M. Dyatlova, A.P. Kovalchuk, F.F. Cheusov, V.Ya. Temkin, N.V. Sirkulnikova, G.F. Yaroshenko, R.P. Lastovsky, Z. Virshpa, Ya. Bjenizinski, P.A. Diray, S.A. Bolezin, L.I. Antropov, N.V. sirulnikova, B.N. Dpikep, Yu.N. Kalimullin, A.C. Mikhalev, V.K. Pinigin, Ye.M. Urinovich, F. Kurbanov, A. Alovitdinov, A.T. Djalilov, D. Yusupov, V.P. Guro, A. Ikramov, S.M. Turabdzhanov, H.I. Akbarov, A.J. Kholikov, H.E. Kadyrov and others conducted scientific research [5-11].

Corrosion inhibitors of the" IIK-D1 " series are applied to protect oil and gas industry devices from hydrogen sulfide corrosion. The drug" IIK-D1 " can be used to transport, store sulfuric and hydrochloric acid in railway cisterns and in other industries.

The extirpation of the oil and gas production and processing industry in the Republic of Uzbekistan for this type of inhibitors is 800-1200 tons per year. In our republic, this type of corrosion inhibitor is not produced.

The purpose of the study is to create technology for the development of effective corrosion inhibitors soluble in hydrocarbons based on domestic raw materials and secondary products of the industry.

Experience part

Taking corrosion inhibitors based on imidozoline to study reactions, diethylenediamine, polyethylenpoliamine, oleic acid, fatty acid mixture, gossipol Tar, solvents pure benzene, aromatic hydrocarbon mixture (benzene, toluene and xylols), chloroform, acetone, distilled water were used. Below are some of the physicochemical properties of the starting substances used [12-17].

Physical and chemical properties of the finished product

Corrosion inhibitor in the series "IIK-D1" - liquid of dark brown color, physico-chemical indicators are given in Table 1.

Table 1. "Iik-D1" series corrosion inhibitor physicochemical pointers

№	Display name	Pointers
1	The number of amines, HCl mg per 1 g of inhibitor, is not less than the indicator	45,0
2	Hydrogen sulfide storage water-the level of protection in a hydrocarbon environment, not less than %	90,0
3	Solubility:	
4	in hydrocarbons	thaw
5	in the water	dispersing
6	Hardening temperature, no more than S	minus -35
7	20-s-S-mm2/s-in kinematics meltdown, not much	25

Corrosion inhibitor production technology in the series" IIK-D1"The technological process of production of corrosion inhibitors in the series" IIK-D1 " covers the following stages:

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A solvent and fatty acid mixture (or gossipol tar) is sent to the reactor - a device equipped with a yakor mixer and an external heating and cooling device-in
calculated quantities. Under conditions of intensive stirring, the mixture of fatty acids and the solvent is mixed until it becomes a different mass. If necessary, a temperature of 40 C can be raised by sending hot water to the heating device of the reactor, in which the breakdown of fatty acids dissolves faster. An acid catalyst is then loaded into the reactor, raising the temperature to 60 C and stirring is continued. In this case, a complete dissolution of fatty acids is observed. Then ethylenediamine (diethylentri-Amine or polyethylene polyamine) is loaded into the reactor at the same temperature, and water separation is ensured by gradually increasing the temperature by 130 – 140^{o}C. The moisture contained in the fatty acids leaving the reactor, the water formed by the reaction, as well as the water- soluble azeotropic mixture, were cooled in a coolant installed on the top of the reactor, separated using a phase separator, the water part was cleaned, the organic part - solvent (aromatic hydrocarbons), ethylenediamine was lined up in a regular reactor.

This process is carried out for 6 to 8 hours, and the completion of the reaction is controlled by taxilies on the amount of nitrogen. In the finished product, organic and inorganic additives are passed through a filter (a"Belting" fabric filter) to obtain the Olid from which the solid byproducts of the reaction remain. Filtrate is placed in the planned capacities for the finished product and sent to the finished product warehouse [16-19].

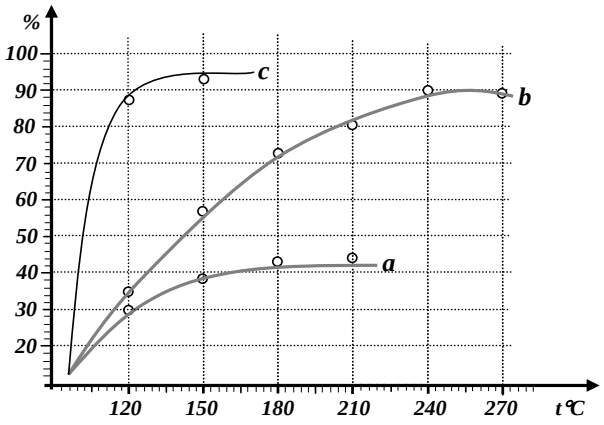

Figure 1. Temperature dependence of imidozoline yield:
a) after the first stage of two-stage heat treatment; b) after the second stage of two-stage heat treatment; c) in the presence of an acidic catalyst

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

Recommendations for the study of corrosive processes in oil wells in the northern Urtabulak disposal, selected as the object of research, and the protection of devices, were developed in cooperation with specialists of JSC "Geo Research and Development Company".

The degree of corrosion protection of the composition of imidozoline-based inhibitors gost 9.502-87 for water systems is determined using the method of monitoring corrosion inhibitors (corrosion testing methods), Gost 9.905-85 corrosion testing methods (general requirements),

gost 9.506-87 for water-oil systems, metals corrosion inhibitors (determined according to the requirements of protection methods), and gost 9.502-87. The foundation used terms and expressions corresponding to the Uzbek State Standard O‘zdst 8.012:2005.

SP1 - UPN North Urtabulak oil well. During the period under study, the object's monitoring corrosion rate trench indicators were found to be 0.0111 mm per year, more than the encouraged Meyers (DSK 0.1 mm per year). In a corrosion witness- plate sample from a checkpoint, corrosion is evenly coated on the surface. Corrosion stains can be observed from local corrosion effects.

SP2 - UPN North Urtabulak oil well. During the period under study, the object's monitoring corrosion rate trench indicators were found to be 0.0073 mm per year, less than the encouraged Meyers (DSK 0.1 mm per year). In a corrosion witness-plate sample from a checkpoint, corrosion is evenly coated on the surface. From local corrosion effects, recurrent early-stage corrosion cracks can be observed.

SP3 - UPN North Urtabulak oil well. During the period under study, the object's monitoring corrosion rate trench indicators were found to be 0.0054 mm per year, less than the encouraged Meyers (DSK 0.1 mm per year). In a corrosion witness-plate sample from a checkpoint, corrosion is evenly coated on the surface. From local corrosion effects, recurrent early-stage corrosion cracks can be observed.

Conclusions on Monitoring. It is recommended to periodically (at least 7 days per month) load a corrosion inhibitor (in the amount of 20-25 grams per ton of oil) to protect the central systems of North Urtabuloc SP1-UPN, SP2-UPN and SP3 - UPN oil wells from corrosion [4].

Table 2. Results of corrosion monitoring of oil well installations of the SP1-UPN object of the North Urtabulak field (sample platins were placed on April 25, 2021 and obtained on June 30)

Monitor object name	Sample	day	Mass until the sample is located, g	Mass after sample dissolution, g	Mass loss, g	Plate surface, m^2	Corrosion average speed
SP1-UPN	№1	66	40.4340	40.4151	0.0189	0.003136	0.0045
SP2-UPN	№2	66	41.9184	40.98	0.9384	0.003129	0.3110
SP3-UPN	№3	66	40.0177	39.9794	0.0383	0.002530	0.0131

Table 3. Control of corrosion processes in well structures

№	Monitor object name	Check point	Corrosion witness-plastina sample exposure period			Monitoring preliminary displays, mm / year	Corrosion rate, mm / year
			positioning	soldering	Day’s		
1	SP1 - UPN North Urtabulak oil well	Oil well	25.04.2021	30.06.2021	66	0.0119	0.0111
2	SP2 - UPN North Urtabulak oil well	Oil well	25.04.2021	30.06.2021	66	0.0151	0.0073
3	SP3 - UPN North Urtabulak oil well	Oil well	25.04.2021	30.06.2021	66	0.0131	0.0054

Table 4. Consumption of raw materials and secondary products for the production of 1 ton of corrosion inhibitors

№	Type of consumption	Measure.unit.	1 t spent for corrosion inhibitor
1	PEPA	t	0.57
2	54 g fatty acids (gossipol Tar)	t	0.48
3	Catalyst	t	0.03
4	Solvent	t	0.60
5	Separating water	t	0,03

Conclusion

The "IIK-D1" series developed corrosion inhibitors manufacturing technologies. Prepared, approved and agreed with the consumer regulatory and technical documents-technical instructions, technological regulations and specifications.

An experimental batch of 500 kg of corrosion inhibitors of the series" IIK- D1 "was produced at JSC" Elektrokimyozavod " in Navoi, and the SP1-UPN North Urtabulok oil well was tested under real conditions. It turned out that the inhibitor is not inferior to the inhibitors of the SNPX series purchased abroad in terms of its physicochemical, organoleptic and operational properties. The cost of the inhibitor obtained according to the recommended technology is 1.5-1.8 times cheaper than available.

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