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The Technology of Getting Anti Rust Cover Based on Local Resources and Oil Industry Waste Materials of Gossypol Resin

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ABSTRACT. In connection with the need to increase production efficiency, there is a need to develop new technologies that ensure the integrated use of raw materials and the disposal of industrial waste, which, in turn, will lead to the preservation of raw materials and to improve the environmental situation. Currently, the need of the Republic of Uzbekistan for anticorrosive materials is provided through imports. The creation of the technological foundations for the chemical processing of waste in order to obtain import-substituting, anti-corrosion commercial products for the country's needs is relevant.

Synthesized anticorrosive compositions based on gossypol resin and phosphoric acid, the mechanism of action of which is characterized not only by the barrier type of protection, but also by the acquisition of the properties of rust modifiers

KEYWORDS: gossypol resin, anticorrosive composition, phosphoric acid, urotropin.

I. INTRODUCTION

In the production of cottonseed oil and fatty acids, many secondary products and wastes are generated, such as gossypol resin and soap stock. Gossypol resin is known to be an aromatic compound with phenolic hydroxyl groups and a carbonyl group in ortho to the hydroxyl group. 12% of nitrogen-containing compounds, 36% of the conversion products of gossypol, which preserved naphthol hydroxyls and 52% of fatty and hydroxy fatty acids in the form of lactones, were found in gossypol resin [1]. It exhibits acidic properties, properties of phenolic and aldehyde compounds. The presence of phenolic, carboxyl, carbonyl functional groups allows modification of the gossypol resin - to transfer it to a water-soluble state [2, 3, 4, 5].

In order to reduce production costs and increase operational properties, a technology of anticorrosive coating based on gossypol resin has been developed and introduced into production. Based on the use of cheap and affordable raw materials, the production of anticorrosive coatings has a high level of organization of technological processes and a relatively high economic efficiency.

II. SIGNIFICANCE OF THE SYSTEM

In connection with the need to increase production efficiency, there is a need to develop new technologies that ensure the integrated use of raw materials and the disposal of industrial waste, which, in turn, will lead to the preservation of raw materials and to improve the environmental situation. The study of literature survey is presented in section III, methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and conclusion.

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III. METHODOLOGY

Creation of physico-chemical and technological foundations for the production of anti-corrosion materials from waste oil and fat industry.

Experimental studies were carried out using modern physical and chemical methods, such as x-ray phase, IR spectroscopic, elemental analysis

It has been established that as a result of the interaction of gossypol resin, zinc oxide, urotropin and phosphoric acid, stable modified anticorrosion coatings are formed

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Research was carried out using modern chemical, physico-chemical methods.The raw materials for research were gossypol resin, phosphoric acid, urotropin and zinc oxide.

IV. EXPERIMENTAL RESULTS

Theoretical studies on the fractionation of gossypol resin, the identification of physico-chemical and mechanical characteristics served as the basis for the development of stable anti-corrosion compositions of a complex nature.

It is known that gossypol resin contains polyphenols, fatty acids, hydrocarbons, nitrogen and phosphorus compounds, as well as gossypol conversion products. The presence of naphthalene core compounds in its composition also makes the modification of the gossypol resin thermo-, chemo-, and radiation-resistant, and the presence of phenolic hydroxyls and an aldehyde group make them reactive with high complexing properties. In many ways, it can successfully replace expensive anti-corrosion coatings, a deficit of which is felt every year. Obtaining anticorrosive materials on its basis has its own specific feature and requires the search for certain conditions, as well as the use of non-traditional additives of modifiers [6, 7, 8].

According to the requirements of GOST No. 18-114-73, the water content in gossypol resins should not exceed 1-2%, despite this, gossypol resins contain 15-20% of water, which is one of the disadvantages of this resin. Before thermal oxidation, dehydration plays an important role. Therefore, the processes of dehydration and thermal oxidation were studied by an azeotropic method in the synthesis of alkyd resins. The results of a study of the dehydration process of gossypolous resins brought from Yangiyul, Kattakurgan and Urgen oil-fat plants are shown in Fig. 1

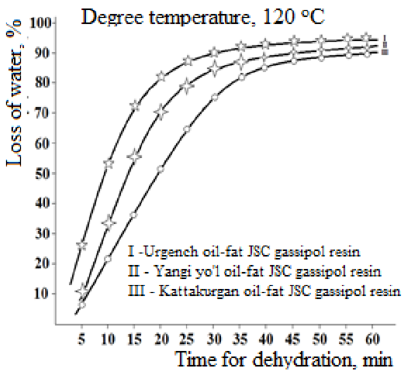

Fig. 1.Dehydration processgossypol resin from various sources.

After thermal modification, polyphenols, fatty acids, hydrocarbons, nitrogen and phosphorus containing a compound, the compounds of gossypol changes and the compound of the naphthalene series provide thermal, chemo and radiation stability of gossypol resin. The reactivity of phenolic hydroxyls, aldehyde and carboxyl groups increases, and they exhibit enhanced complex formation properties. As a result, it becomes possible to synthesize anti-corrosion coatings.

One of the advantages of the obtained bitumen-like materials is their versatility in use in various sectors of the national economy. In particular, by selecting the appropriate modifiers and solvents from them, one can obtain improved anti-corrosion coatings and paints and varnishes [9].

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Today, in domestic practice, there are over 100 different compositions for inhibiting steel corrosion. The disadvantages of existing anti-corrosion materials are the high cost and inaccessibility, as well as the inability to use them to combat multicomponent salt and acid corrosion.

The use of cheap gossypol resin and its modifications as the basis of the anticorrosion coating is due to the fact that it contains phenolic, hydroxyl and carboxyl groups that interact with corrosion products and bind iron ions to complex compounds of the chelate structure [10].

From this point of view, gossypol resin can be an effective anti-corrosion material only if appropriate solvents and another synergistic inhibitor are selected. For this purpose, we used hexamethylenetetramine (CH2) 6N4, which is one of the most famous representatives of acid corrosion inhibitors [11, 12].

We have developed a method for producing a corrosion inhibitor composition based on gossypol resin, zinc oxide, phosphoric acid and HMTA, which solves the problem of eliminating the above disadvantages. A distinctive feature of such an anticorrosive composition is that its components are easily accessible, the technology for preparation and use is simple. In this composition, the constituent components, individually or together as an intermediate complex, can change the nature of the interaction of the metal surface with the surrounding aggressive environment and, thereby, enhance the protective effect of inhibitors. This technique is of particular relevance for the protection against corrosion of metal structures in contact with multicomponent media and acid solutions.

Numerous studies have been carried out to determine the optimal ratios of the components of the composition. Corrosion behavior of the metal was evaluated by accelerated corrosion tests using electrochemical methods of investigation on samples made of carbon steel (Art. 3) with a size of 40x40x160 mm. The tests were carried out on samples without corrosion damage (standard), with corrosion damage (thickness of the layer of corrosion products from 150 to 300 microns). Samples were prepared for testing in accordance with the CMEA standard 4421-83. Assessment of the corrosion state of the samples was carried out by the nature of the anode polarization curves.

Polarization tests showed that at the beginning, the gossypol resin is adsorbed onto the steel electrode as a surfactant (Fig. 2.) And forms a thin shell on the surface. This shell protects further corrosion of the metal. It can be seen from the figure that a shift of the zero charge to the positive side indicates an increase in hydrogen evolution, a decrease in the corrosion loss.

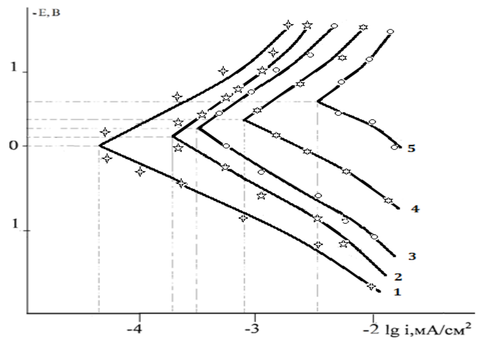

Fig. 2. Polarization curves gossypolic aqueous suspensions resins: 1–0,38%; 2–0,77%; 3–1,16%; 4–1,55%; 5– in a solution of 1,55% triethanolamine

This, in turn, portends hydrophobization of fats and fatty acids on the surface of a steel electrode. The mechanism of the influence of inhibitors of this type lies in the fact that there is a reliable protective layer against aggressive substances after the formation of stable fine dispersed microfilms on the metal surface. In order to increase the peculiarity of acid-resistant coatings, the drying rate and enhance adhesion, also to provide rust modification, CaO, zinc oxide, phosphoric acid, and an acid corrosion inhibitor, urotropine (CH2) 6N4, were introduced into the composition of gossypol resin. On the basis of laboratory studies and testing in a laboratory model installation, a process flow diagram (Fig. 3) for the production of acid-resistant anticorrosive coatings from gossypol resin was developed and the material balance was calculated.

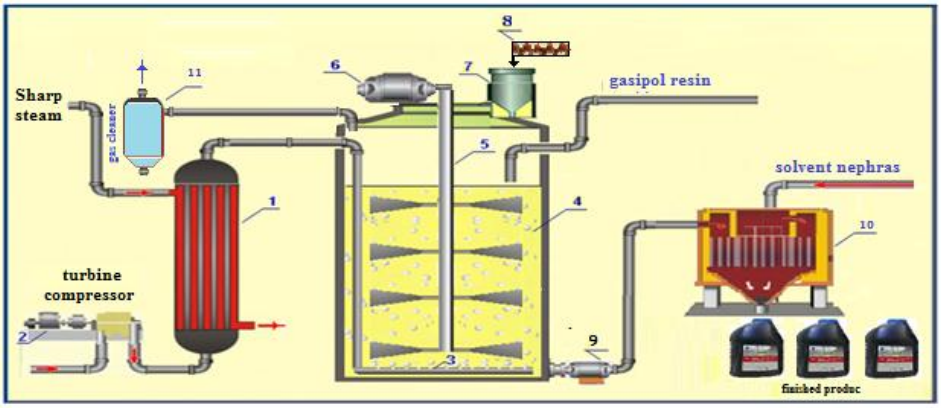

Fig. 3.Schematic diagram of the process for obtaining anticorrosive coatings of their gossipolresin. 1 heat exchanger; 2-compressor; 3-bubbler; 4-synthesis reactor; 5-mixer;6-electric motor (20 kV); 7- hopper for components; 8-screw feeder; 9 - grate pump; 10-pack equipment; 11- gas cleaning equipment

V. CONCLUSION AND FUTURE WORK

The developed and anticorrosion agents passed tests with a positive result in the Aral Sea region, where water and starting materials are highly saline. Experimental batches of the developed material were produced at the Khorezmanticorre invest manufacturing enterprise and MAXAM-CHIRCHIK JSC

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