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Anti-Corrosion Composition Materials Based On Organomineral Ingredients for Protecting Wholesale Corrosion of Metal Products

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ABSTRACT: An anti-corrosion composite material based on gossypol resin and amino alcohols has been developed to protect metal equipment from aggressive environments. The interaction of amines with fatty acids contained in gossypol resin can give a range of different substances, both due to interaction with the main product and among themselves; therefore, the isolation of the reaction product in a pure form is difficult. Substances of this group have been studied as a corrosion inhibitor.

KEYWORDS: gossypol resin, monoethanolamine, diethanolamine, inhibitor, corrosion, degree of protection, corrosion rate, hydrogen chloride environment.

I. INTRODUCTION.

The problem of corrosion protection of equipment and pipelines during the production and transportation of gas is very relevant, since the safety of their operating conditions and their service life largely depend on the timely application and quality of the anti-corrosion measures taken. The most accessible method of protecting equipment for the production and transport of gas from hydrogen sulfide and carbon dioxide corrosion and acid treatment is to inhibit their surface.

Unfortunately, the demand for inhibitors in the country is currently being met by imported inhibitors, which has caused the need to search for domestic inhibitors based on available local raw materials.

To reduce the cost of obtaining corrosion inhibitors, local raw materials should be used wherever possible. Based on the fact that in Uzbekistan there are numerous sources of raw materials suitable for obtaining corrosion inhibitors, based on vacuum distillation waste - cotton soap stock - gossypol resin, we attempted to develop with their help effective composite inhibiting materials to protect equipment in the oil and gas industry from corrosion.

The object and the research method were gossypol resin, which is a waste of oil and fat production, liquid ammonia, amino alcohols - monoetonolamine (H_2NCH_2CHOH), diethanolamine ($HN(CH_2CH_2OH)_3$),triethanolamine ($N(CH_2CH_2OH))_3$, β(N,N diethylamine ($(C_2H)_2NCH_2CH_2OH$).

The process of obtaining amidated gossypol resin was carried out by us as follows: 100 g of gossypol resin was heated to a temperature of 80-1000C with stirring in a laboratory mixer and the calculated amount of the modifier was added. The fatty acids that make up the gossypol resin undergo a condensation reaction with the modifier to form a modifiedgossypol resin.

In the modified gossypol resin, the amount of amino alcohol was gradually introduced according to a certain calculation in a ratio of 2: 1, 4: 1, 10: 1, then it was heated for an hour with stirring with laboratory stirrers, as a result of which a thick amidated gossypol resin was formed.

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The results of the study and their analysis in the laboratory "Mechanochemical technology of composite materials" State Unitary Enterprise "Fan va tarakkiyot" TSTU together with LLC "KOMPOZIT NANOTEXNOLOGIYASI" on the basis of the waste of gossypol resin selected at the Yangiyul oil and fat plant, a composite preparation of the corrosion inhibitor was obtained. Gossypol resin, as shown above, is formed at oil and fat plants in large quantities as a secondary raw material.

The chemical composition of gossypol resin [1,2] is heterogeneous and has not been fully established due to its variability to this day. The basis of gossypol resin is free fatty acids, then polymerized fatty acids, as well as gossypol and products of its thermal and chemical transformation due to polycondensation with amino acids, carbohydrates and other components present in cottonseed.

The gossypol molecule is a hexahedral dialdehyde phenol of homologous 2,2-binaphthyl. The substance is soluble in most organic solvents and practically insoluble in water.

As a polyhydric phenol, gossypol is capable of producing a number of derivatives due to hydroxyls. When treating gossypol with soluble alkalis, water-soluble gossypolates (sodium, potassium, ammonium) are formed, which are destroyed with the release of free gossypol under the action of mineral acids [1].

Gossypol resin is a black, thick, viscous and sticky mass, specific gravity 0.90-0.91 g / cm3, moisture content not higher than 0.3%.

The physicochemical characteristics of gossypol resin are shown in Table 1.

Table 1

Physicochemical characteristics of individual fractions of gossypol resin

№	Fractions	Yield,% by weight of gossypol	Tm, C0	Color	Fraction composition
1	Non-saponifiable part	21-24		Dark brown	Hydrocarbons $C_{27}, C_{28}, C_{29}, C_{30}, C_{31}, C_{32}$
2	Fatty acid part	52-57		Black, oil-shaped	Alcohols and cytosterol Fatty acid C_{16}- C_{18}
3	Phenolic part	22-24	180-181	Brown to dark brown	Phenols

Table 1 shows that the resin contains about 60% fatty acids, a significant part of which are unsaturated high molecular weight acids, namely oleic and linolenic acids.

Amino alcohols (mono and diethanolamine), the production of which has been mastered by the domestic industry and is not in short supply, were used as the second component to obtain composite corrosion inhibitors [3].

Amino alcohols used to obtain a corrosion inhibitor are a thick, oily liquid; they are mixed in all proportions with water and alcohols [4]. The main physical and chemical characteristics of amino alcohols are shown in Table 2.

Table 2

Physicochemical characteristics of amino alcohols

Amino alcohols	Specific gravity, г/см^3	Boiling point, C^0	Solubility
Monoethanolamine	1,017	170,5	Soluble in water and alcohols
Diethanolamine	1,0966	269,0	Soluble in water and alcohols

The second component of the compositions, amino alcohols, are bifunctional compounds, when they interact with the above acids, two different reactions are possible:

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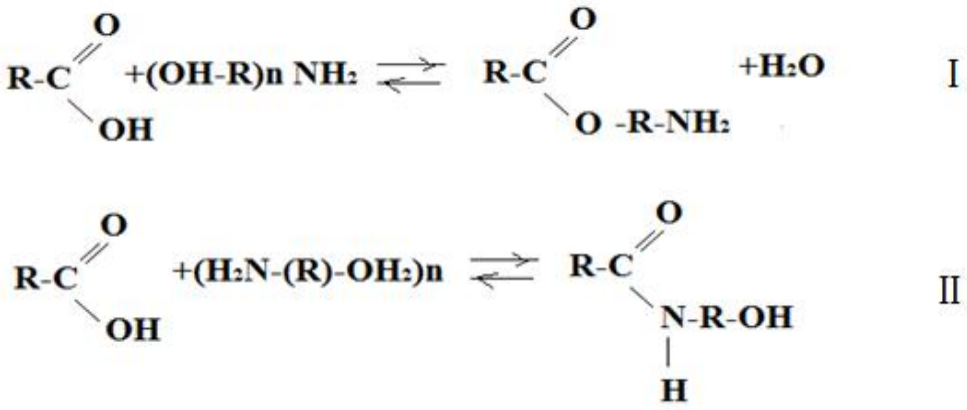


where R-C_2H_5 n-1, 2, 3

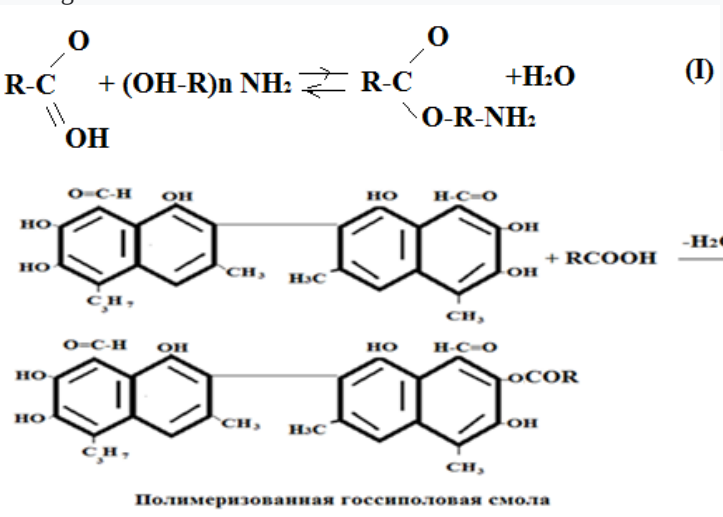
The composition and properties of gossypol resin depend on the quality of the feedstock, compliance with the technological regimes for the decomposition of fats, the depth of distillation of the obtained fatty acids, and other factors.

The process of synthesis of obtaining amidated gossypol resin was carried out by us as follows: 100 g of dehydrated gossypol resin was heated to a temperature of 160-2000C with stirring in a laboratory mixer and the calculated amount of the modifier was added. The fatty acids that make up the gossypol resin undergo a condensation reaction with the modifier to form a modified gossypol resin.

In the modified gossypol resin, the amount of amino alcohol was gradually introduced according to a certain calculation in a ratio of 2: 1, 4: 1, 10: 1, then it was heated for an hour with stirring with laboratory stirrers, as a result of which a thick amidated gossypol resin was formed.

When the modified gossypol resin interacts with monoethanolamine, an amine-containing modified polymerized gossypol resin is formed according to the following scheme:

1st stage:



Полимеризованная госсиполовая смола

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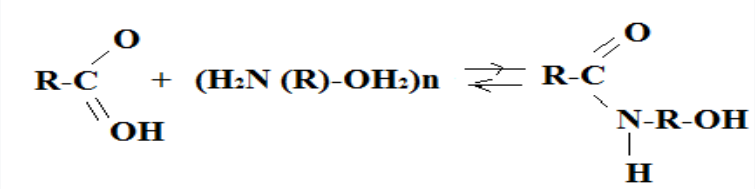
Stage 2:



Amino-containing polymerized gossypol resins were conventionally called PGS (polymerized gossypol resin).

The drug was supplied as a 20% solution in an organic solvent (purified gas condensate from the Shurtan field) and is a dark mobile liquid with a characteristic solvent odor.

In a more specific form, the interaction of higher carboxylic acid esters that are part of the gossypol resin with aminospira (monoethanolamine) proceeds according to the following schemes [5]:

$R\text{-}COOR+H_2N\text{-}CH_2\text{-}CH_2\text{-}OH \rightarrow R\text{-}COHN\text{-}CH_2\text{-}CH_2OH+R\text{-}OH$

As can be seen from the above formula, the interaction of amines with fatty acids contained in gossypol resin can give a range of different substances, both due to interaction with the main product and among themselves, therefore, the isolation of the reaction product in a pure form is difficult. Substances of this group have been studied as a corrosion inhibitor.

II. CONCLUSION

Thus, on the basis of gossypol resin and amino alcohols, it is possible to develop anticorrosive composite materials to protect metal equipment from aggressive environments.

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