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Obtaining Bitumen-Substitute Mixture from Local Waste Oil and Oil-Fat Production

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ABSTRACT: A formulation of safe products has been developed and 4 pilot batches of bitumen have been obtained in small quantities - replacing binding mixtures from local waste of oil and fat-oil production. The origin and characteristics of the used local waste and additional components are considered. A scheme for obtaining a bitumen-replacement mixture for the use of insulating and roofing coverings has been developed. Experiments on the utilization of local waste by the physicochemical process and the process of raw material oxidation have been carried out. Experimental batches of bitumen-replacement mixture for the use of insulation and roofing have been prepared.

KEYWORDS: Bitumen, oil sludge, gossypol resin (oil-fat plant), industrial sulfur, insulating coatings, roofing.

I. INTRODUCTION

At the Tashkent State Technical University named after Islam Karimov at the Department of "Life Safety" with specialists and researchers, a recipe for obtaining safe products from local waste oil and fat-and-oil production was proposed.

The formulation of the bitumen-replacement mixture consists of the following components: oil sludge, tar (gossypol resin), quicklime and technical sulfur.

Briefly consider the origin and characteristics of the local waste and components used.

1- Oil sludge (NS) is the most significant waste of the oil industry by weight. To date, there is no comprehensive solution to the issue of disposal of environmentally aggressive oil-containing waste generated at all stages of the production processes of oil refining [1, 2].

2- The object of the following raw materials is non-food oil and fat products – gossypol resin, produced and sold on the territory of the Republic of Uzbekistan.

Gossypol resin (tar) obtained from the fatty acids of the cotton soapstock of the Yangiyul Oil and Fat Combine can be used without additional preparation as a raw material for the production of bitumen-a substitute binder mixture.

3- quicklime - is a mixture of pieces of various sizes formed after coarse grinding of the firing product. By chemical composition, it is a mixture of calcium and magnesium oxides with a predominant content of CaO.

4- The obtained technical lsulfur (S) attheMubarekgasprocessingplantcanbeusedtoproduceconstructionbitumen.

The analysis of the sources [3, 4] showed the relevance of the problem of studying the effect of sulfur on the structure formation and rheological properties of bitumen.

In [5], for the first time, highly effective bitumen compositions based on gossypol, lignin, urotropin and tar were obtained at low temperatures (70 °C) and for 60 minutes. The optimal composition of this composition (mass.%): gossypol - 35.5-38.5; urotropin - 0.33-0.40; lignin mixture - 26.5-30.0. It was found that the introduction of the above components into the bitumen contributes to an increase in the softening temperature to 65 ° C, the depth of immersion of the needle decreases to 25-30 mm-1 [5].

The aim of the work is to obtain a safe product from local waste of oil and fat-and-oil production, such as oil sludge and gossypol resin, while using auxiliary materials.

At the Tashkent State Technical University named after Islam Karimov at the Department of "Life Safety" with specialists and researchers, a scheme for obtaining a bitumen-replacement mixture for the use of insulation and roofing was developed (Fig. 1).

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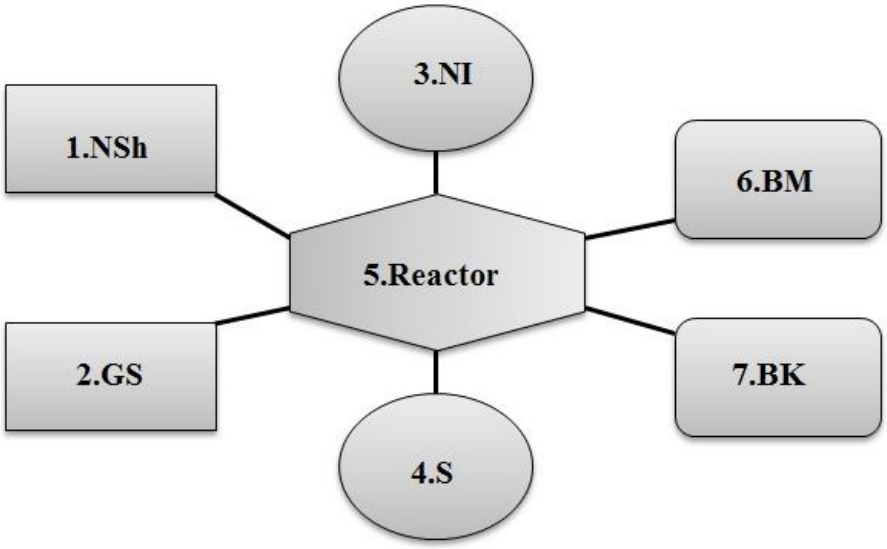

Fig. 1.Scheme of obtaining bitumen-replacement mixture for the use of insulation and roofing

1.NSh - oil sludge; 2.GS - gossypol resin; 3.NI - quicklime; 4.S - sulfur; 5. Reactor with agitator; 6.BM - bitumen mastic; 7. BK - roofing bitumen

In the scheme 1-NS (oil sludge) and 2-GS (gossypol resin), a certain amount is poured into the reactor, then 3-NI (quicklime) is added in small quantities and 4-C (technical sulfur) is added in an amount of 5%, then all components are mixed and heated to a certain temperature, after a certain time, safe products are obtained, such as anticorrosive bitumen mastic and bitumen for roofing, which can be obtained in detail in experimental batches in laboratory conditions.

The novelty of the work is as follows: for the first time, bitumen was obtained-a replacement binder mixture based on oil sludge 46%, tar (gossypol resin) 46%, quicklime 3% and technical sulfur 5%.

II. THE RESEARCH METHOD

In the laboratory, experiments were carried out on the utilization of local waste by the physico-chemical process and the process of oxidation of raw materials.

The work process takes place in the following order:

1) Preparatory process - pilot batches are prepared from oil sludge (NS), gossypol resin (GS), quicklime (NI) and technical sulfur (C) in the ratio: (NS):(GS):(NI):(WITH) – (45-50):(45-50):(1-3):(5) the addition of quicklime and technical sulfur is used to improve the physical and mechanical characteristics and obtain a safe product as construction bitumen.

2) Physical process - after the preparation of experimental batches, first of all, the gossypole resin is dehydrated, that is, it is separated from water as much as possible. But we know that when the gossypol resin is evaporated to 100 ° C, light components such as poisonous gases that are dangerous to humans evaporate from it.

With a capacity of 500 ml, gossypol resin is poured in a vessel in an amount of 200 ml and a burner is turned on to increase the temperature of the raw material. Toxic gases begin to be released from the raw materials already at a temperature from 40oC to 90oC. In the refrigerator, the poisonous gases are cooled and another lubricant product is obtained. Further, at the temperature of the raw material from 90 ° C to 105 ° C, water vapor is released and condensed into a water tank after the refrigerator. The finished gossypol resin is sent to the chemical process after the removal of light components and water. But before that, oil sludge is poured into another vessel in the amount of 200 ml and a burner is also turned on to increase the temperature. When the oil sludge is heated to 90 ° C, gases and vapors of gasoline-kerosene fractions are released, which are cooled by a water refrigerator and the resulting condensate flows

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down into another container. After the temperature of the raw material has reached 90 ° C to 105 ° C, the container is changed to obtain water that has condensed in a water refrigerator.

The finished components were obtained: dehydrated gossypol resin and oil sludge were sent to a chemical process to obtain safe products.

3) Chemical process – this process can be called as the process of oxidation of two components. Experimental samples were obtained in the laboratory at the following stages:

a) with a capacity of 1000 ml, the reactor is filled with ready-made gossypol resin 300 ml and 300 ml of oil sludge and heated to 160 ° C using a burner and stirred with a stirrer adding 1% quicklime and 5% sulfur from the total mass.

b) with a capacity of 1000 ml, the reactor is filled with ready-made gossypol resin 300 ml and 300 ml of oil sludge and heated to 160 ° C with a burner and stirred with a stirrer adding 2% quicklime and 5% sulfur from the total mass.

c) with a capacity of 1000 ml, the reactor is filled with ready-made gossypol resin 300 ml and 300 ml of oil sludge and heated to 160 ° C with a burner and stirred with a stirrer adding 3% quicklime and 5% sulfur from the total mass.

d) with a capacity of 1000 ml, the reactor is filled with ready-made gossypol resin 300 ml and 300 ml of oil sludge and heated to 160 ° C using a burner and stirred with a stirrer adding 4% quicklime and 5% sulfur from the total mass.

III. RESULTS

Experimental batches of bitumen-replacement mixture were prepared according to the following recipe are shown in Table 1:

Table 1

Name of the raw materials and residues used	Experimental Batch №1	Experimental batch №2	Experimental batch №3	Experimental batch №4
Gossypole resin, %	45-50	45-50	45-50	45-50
Oil sludge, %	45-50	45-50	45-50	45-50
Quicklime,%	1	2	3	4
Technical sulfur (S) ground, %	5	5	5	5

The obtained samples a - sample No. 1, b - sample No. 2, c - sample No. 3 and d - sample No. 4 were sent for physico-mechanical tests in accordance with GOST 6617-76.

The obtained samples according to the recipe of the experimental batch No. 1 and No. 2 allow us to obtain a high-quality bitumen mixture and recommend further implementation for foundation and pipeline anticorrosive coating. Experimental batch No. 3 allows you to obtain a high-quality bitumen mixture and recommend further implementation for roofing.

IV. CONCLUSION

1. At the Tashkent State Technical University named after Islam Karimov at the Department of "Life Safety" with specialists and researchers, a recipe for obtaining safe products from local waste oil and fat-and-oil production was proposed.

2. The formulation of safe products has been developed and 4 experimental batches of bitumen have been obtained in small quantities-replacing binder mixtures from local waste of oil and fat-and-oil production.

3. The origin and characteristics of the used local waste and additional components are considered.

4. A scheme for obtaining a bitumen-replacement mixture for the use of insulation and roofing has been developed.

5. In the laboratory, experiments were carried out on the disposal of local waste by the physico-chemical process and the process of oxidation of raw materials.

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6. Samples were obtained according to the recipe of experimental batch No. 1 and No. 2, which allows obtaining a high-quality bitumen mixture and recommending further implementation for foundation and pipeline anticorrosive coating.

7. The experimental batch No. 3 obtained allows obtaining a high-quality bitumen mixture and recommending further implementation for roofing.

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