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Production Of Heavy Oil Products From Oil Sludge At Atmospheric Pressure

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ABSTRACT

Technology for producing petroleum products based on oil sludge, the method of heat treatment of oil-containing waste at atmospheric pressure was used. The resulting cubic residues of oil sludge processing were tested for compliance with GOST 22245-90 and GOST 9812-74. The dependence of the qualitative indicators of cubic residues on the oxidation time is presented. Depending on the oxidation time, the physical and mechanical characteristics of bitumen can significantly change.

KEYWORDS

Petroleum products, oil sludge, cubic residues, oxidation, secondary bitumen, pyrolysis, oil-containing waste.

INTRODUCTION

The technology for producing commercial petroleum products based on oil sludge has become the heat treatment of oil-containing waste at atmospheric pressure. This method of processing is technologically the closest to the standard method of obtaining bitumen from conventional raw materials and the simplest from a technological point of view.

In the process of industrial extraction of oil sludge from storage tanks, it is not possible to effectively separate them into different layers, which is why the component composition of NSO (oil-containing waste) is averaged. Based on this, in the laboratory" Petrochemistry " of the Institute of General and Inorganic Chemistry of the Academy of Sciences of the

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Republic of Uzbekistan, averaged samples were studied (top layer + bottom layer in the proportion of 1:1) the largest representatives of oil sludge disposal facilities of various compositions, presented in Table 1.

Research

Six averaged samples of the upper and bottom layers were taken as objects of the study, in a ratio of 1:1 from the sludge accumulator.

- Samples of 1P, 2P, ZP, 4P, 5P and 6P correspond to samples from the sludge accumulator.

The selected waste samples were subjected to atmospheric distillation to isolate the gasoline and diesel fractions in the temperature range of 20-360°C, by analogy with the work [6]. As a result, KO (cubic residues) were obtained, which, as a rule, are subjected to thermal destruction (pyrolysis, incineration, etc.) in the industrial conditions of existing production facilities.

In this paper, for the CO-processing of oil sludge, their use as bitumen, bitumen compositions and bitumen raw materials is proposed.

Current regulatory and technical documents [1, 2, 3, 4, 5] the following types of bitumen have been established in the directions of their economic use:

- Road Bitumen;
- Roofing Bitumen;
- Construction Bitumen;
- Insulating Bitumen.

RESULTS AND DISCUSSIONS

The most stringent requirements are imposed on oil road bitumen [1]. In this regard, the obtained oil sludge processing products were tested for compliance with this standard. The results obtained are presented in Table 1.

Table No. 1

Test results of oxidized cubic residues of NSO obtained at atmospheric pressure for compliance with GOST 22245-90

Name of the indicator	Requirements of GOST 22245-90 for bitumen of the BND 90/130 brand	Sample No. 1	Sample No. 2	Sample No. 3	Sample No.4	Sample No. 5	Sample No. 6	Test method
Needle penetration depth, 0.1 mm:								According to GOST 11501-78
at 25 ° C	91-130 at least 28	94	96	92	94	95	93	
at 0 ° C, not less		31	39	32	33	34	31	
Softening temperature for the ring and	not lower than 43	56	54	58	55	57	56	According to GOST 11506-73

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ball, °C, not lower								
Extensibility, cm, not less:								According to GOST 11505-75
at 25 ° C	at least 65	56	59	58	53	54	52	
at 0 ° C, not less	at least 4,0	3,6	3,7	3,8	3,3	3,4	3,1	
Brittleness temperature, °C, not higher	not higher than -17	-17	-15	-16	-14	-16	-15	According to GOST 11507-78
Flash point, °C, not lower	not lower than 230	242	249	246	250	245	249	According to GOST 4333-87
Change in the softening temperature after heating, °C, no more	no more than 5	12	13	12	11	11	10	According to GOST 18180-72, According to GOST 11506-73
Penetration index	From-1.0 to +1.0	2,0	1,5	2,4	1,7	2,9	2,0	According to Appendix 2

The presented samples turned out to be the closest to the requirements of the standard for bitumen of the BND 90/130 brand, but they did not fully comply with it due to the low extensibility index, which does not allow the use of secondary bitumen obtained in this way in road construction directly. Most likely, the reason for this is that oil sludge is a multicomponent system of non-permanent composition, and the oxidized bitumen obtained from them differs greatly in properties and in most cases does not meet the requirements of standards.

However, as mentioned above, bitumen can be used not only as part of an asphalt concrete mixture, but also for the installation of roofs and waterproofing of building structures. In these cases, extensibility does not play such an important role.

The above predetermined the formulation of an experiment on the oxidation of the obtained CO under conditions similar to the industrial production of roofing and insulating bitumen (for 20 hours at a temperature of 260°C and bubbling air with a flow rate of 3.2 l / min) by analogy with the work [7]. The qualitative parameters of the oxidation products were determined after 4, 8, 12, 16 and 20 hours of the process.

Depending on the oxidation time, the most important qualitative indicators of bitumen, such as the softening temperature, penetration and extensibility, can significantly change. This is confirmed by the results of determining these indicators in samples taken at different oxidation durations. Probably, the reason is the fact that with an increase in the depth of oxidation, the content of resins and oils in oxidized bitumen decreases and the accumulation of resinous-asphaltene substances [8]. The dependence of the change in the main qualitative indicators of CO, normalized for insulating bitumen on the duration of oxidation, is shown in Figure 1 in graphical form.

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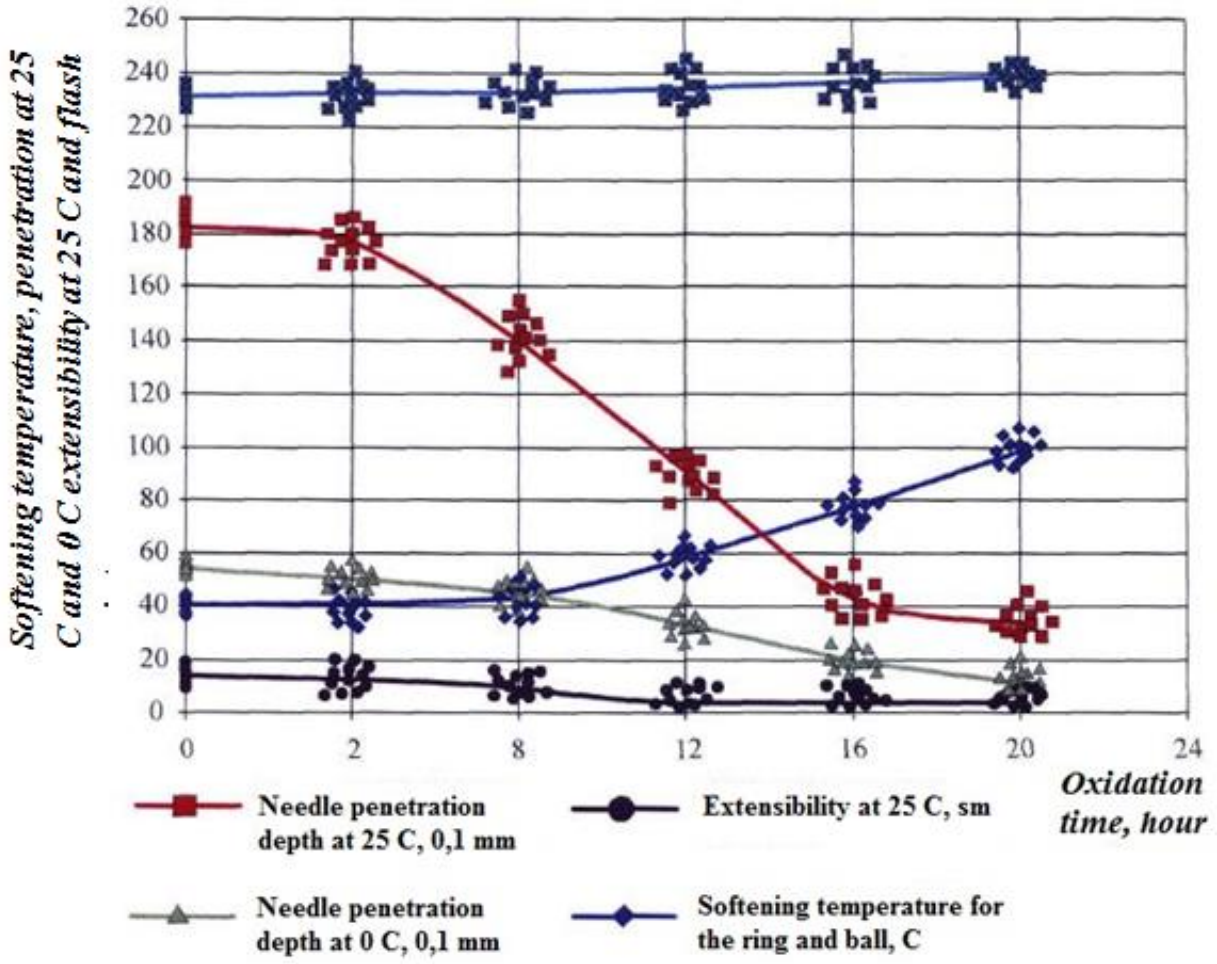

Fig. 1. The dependence of the qualitative indicators of KO on the oxidation time

From the graphs shown in Figure 1, it can be seen that with an increase in the oxidation time to 20 hours, the values of penetration and softening temperature significantly changed, which brought the physical and mechanical parameters of the obtained secondary bitumen into compliance with the requirements of GOST 9812-74 [3] for insulating bitumen of the BNI-V brand. This is confirmed by the experimental data of all the studied samples presented in Table 2.

Also, it can be seen from the graphs presented in Figure 1 that the behavior of cubic residues during oxidation is largely similar to the behavior of standard raw materials for the production of bitumen [8-10].

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Table No. 2

Test results of oxidized cubic residues of NSO obtained at atmospheric pressure for compliance with GOST 9812-74

Name of the indicator	Requirements of GOST 22245-90 for bitumen of the BND 90/130 brand	Sample No. 1	Sample No. 2	Sample No. 3	Sample No.4	Sample No. 5	Sample No. 6	Test method
Needle penetration depth, 0.1 mm:								According to GOST 11501-78
at 25°C	20-40 at least 9	39	35	29	37	33	33	
at 0°C,		15	11	13	16	10	12	
Softening temperature for the ring and ball,°C	90-110	96	90	99	93	98	92	According to GOST 11506-73
Extensibility at 25 ° C, sm, not less:	2	4,8	4,6	4,5	4,3	3,8	4,1	According to GOST 11505-75
Flash point, °C, not lower	210	239	240	235	233	236	238	According to GOST 4333-87
Mass change after warming up, °C, no more	0,5	0,2	0,4	0,4	0,5	0,2	0,2	According to GOST 18180-72
Water saturation in 24 hours	no more than 0.10	0,08	0,06	0,05	0,08	0,07	0,03	According to GOST 9812-74 по п. 3,2

CONCLUSION

It is shown that the thermal processing of NSO typical for the Bukhara region at atmospheric pressure and temperature up to 360°C, followed by the oxidation of CO at 260°C and an air flow rate of 3.2 l / min, makes it possible to obtain insulating bitumen of the BNI-V brand.

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