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Gurbanov Shikhi Azizaga
Azerbaijan State University of Oil and Industry
researcher

Nargiz Abulfaz Mamoyeva
Azerbaijan State University of Oil and Industry
researcher
kerem_shixaliyev@mail.ru

PURCHASE OF BITUMENS ON THE BASIS OF ALTERNATIVE RAW MATERIALS

***Abstract**: The study of the effect of raw material components on the properties of bitumen is of scientific and practical importance, as well as one of the current issues. The study of a three-component system (asphaltene, resin, oil) showed that the penetration rate of bitumen oil increases with increasing oil content: asphaltene. However, the cost of penetration does not depend entirely on the amount of resin. Oil: Decreasing the ratio of asphaltene leads to a decrease in the softening temperature of bitumen. The softening temperature of bitumens is not significantly affected by the amount of resin in them. Oil in bitumen: an increase in the proportion of asphaltene results in a decrease in its brittleness temperature. Depending on the nature of the raw material, the quality of bitumen depends on the amount of fat components in the raw material, especially the softening temperature - the change in penetration dependence, as well as the penetration rate and ductility during oxidation of the same oil tar at the same softening temperature. Thus, in order to obtain bitumen for any purpose on the basis of oxidation of heavy oil residues, the nature of the primary oil, the softening temperature of the raw material, the amount of oil and paraffin compounds in it must be taken into account.*

***Key words**: raw material, bitumen, asphalt, resin, softening temperature, penetration, Viscosity, acidification.*

***Language**: English*

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Introduction

In the field of preparation of theoretical bases of the process of bitumen production from Azerbaijani oils and improvement of quality indicators of bitumens in the NKPI of ANAS the corresponding member of the National Academy of Sciences, professor F.I. Fundamental research was conducted under the leadership of Samadova. Also, the research conducted by RB Gun and his colleagues in the development of technology for the production of oxidizing bitumens and methods for determining the properties of commodity products is of exceptional importance.

The composition and physical and chemical properties of bitumen are significantly [1-8].affected by the technological conditions of the oxidation process of raw materials. Studies have shown that in order to obtain bitumen for any purpose based on the oxidation of petroleum tar, the nature of the primary oil, the softening temperature of the tar, the amount of oil, paraffin and naphthenic compounds in it must be taken into account. In addition, the physicochemical and mechanical properties of bitumen vary depending on technological factors - the oxidation temperature of the raw material, air consumption and oxidation time.

Oxidizing bitumens can be obtained from all oils containing asphalt-resin substances higher than 5.0% (by weight). However, studies have shown that high-resin and low-paraffin oils, which contain more than 25% of these substances, are more suitable for bitumen production, especially from the point of view of technological classification[9-11]

Our research showed that the maximum values of tensile strength (ductility) and penetration of tar obtained from a mixture of marine oils in Azerbaijan at 250C are obtained at 250OC of the oxidation process. The minimum result is observed when the process is carried out at 275 0C. Intermediate results are obtained at oxidation temperatures of 215-255 0C. Thus, increasing the oxidation temperature from 215 0C to 255 0C increases the ductility and penetration rates of bitumens. when the toxin is ≥250 0C, the values of both properties decrease. In bitumens with the same softening temperature, air consumption and oxidation time of the raw material reach a minimum value at 250 ° C and a maximum value at 215 ° C.

RESEARCH PART

Influence of raw material components on the properties of bitumens

The amount and chemical composition of each component in bitumen significantly affects their physicochemical properties. When the content of asphaltenes in each of the four-component system (asphaltenes, resins, aromatic and saturated compounds) is 25%, as well as the ratio of the other two components remains constant, the properties of bitumen change as follows: aromatic compounds do not affect the penetration rate, resins increase penetration. saturated compounds, on the other hand, decrease, resins increase the softening temperature, saturated compounds decrease, and aromatic compounds have no effect. Resins also cause a slight increase in bitumen coverage. Saturated compounds reduce the viscosity and also change the temperature dependence of the viscosity. Aromatic compounds have no effect on viscosity and temperature dependence of viscosity[11-17].

Studies of three-component systems (asphaltenes, resins and oils) have shown that the penetration rate increases with increasing oil asphalt content in bitumen, but penetration does not depend on the amount of resin. Oil: Decreasing the asphaltene ratio causes the bitumen softening temperature to decrease. The amount of resin does not significantly affect the softening temperature. Oil in bitumen: an increase in the ratio of asphaltene leads to a decrease in its brittleness temperature. The maximum value of breaking capacity (above 100 cm) manifests itself when the ratio of oil in bitumen: asphaltene increases from 2.0 to 5.0. In relatively hard bitumens, the effect of the amount of resin is negligible. The plasticity of bitumen is almost directly proportional to the amount of asphaltenes in it. In some cases, an increase in fat: asphaltenes positive leads to an increase in the plasticity interval.

Summarizing the results of the research, we can conclude that the dependence of viscosity on the group chemical composition is analogous to the dependence on the temperature of regeneration and softening: this dependence tends to increase with decreasing ratio of oil: asphaltenes. Aromatic compounds and resins have the same effect on the properties of bitumens. The penetration rate is almost independent of the combined amount of aromatic compounds and resins. The penetration value is determined by the ratio of saturated hydrocarbons to asphaltenes and begins to increase as this ratio increases. If the content of asphaltenes in bitumen is less than 20%, the softening temperature of bitumen depends on the penetration. As the ratio of saturated compounds to asphaltenes increases, the softening temperature of bitumen decreases.

At temperatures around 200C, the brittleness temperature of bitumen does not depend on the amount of aromatic compounds and resins such as penetration. However, the brittleness temperature is determined by the ratio of saturated compounds to asphaltenes. The brittleness of bitumens at temperatures - 180C and below depends on the saturated compounds. The plasticity interval is mainly determined by the ratio of the sum of aromatic hydrocarbons and resins to asphaltenes. The higher the value of this ratio and the amount of saturated compounds, the lower the plastic interval. The ratio of saturated compounds to asphaltenes must be 2.3 in order for the value of bitumen's permeability to reach more than 100 cm at a temperature of 250C.

The properties of bitumen are significantly affected by the properties of its components, especially the structure and composition of asphaltenes. This depends mainly on the technology of bitumen production. The nature of the raw material plays little role in this. Asphaltenes and asphaltene fractions separated by different fractions of benzene solutions from petroleum of different origin are slightly different from each other. However, studies have shown that it is the characteristics of the oil components that most affect the quality of bitumen. Thus, as the viscosity of the oil increases, the softening temperature and brittleness of bitumens increase.

In this case, the penetration is reduced, exceeds the maximum by traction. The aromaticity of oils plays a greater role, in other words, the ratio of the number of carbon atoms in the aromatic ring to the total number of carbon atoms in the molecule is important. As for the aromatic mass and its size, it is equal to 1/3 of the total sum of the carbon aromas in the aromatic ring. Paraffin compounds in the oil fraction do not have the ability to dissolve asphaltenes. However, the solubility of naphthenes in relation to aromatic compounds is 3 times higher than that of aromatic hydrocarbons.

Increased solubility of oil components of bitumen and asphaltene: decrease in the ratio of resin leads to a decrease in the structural strength of the bitumen system. This phenomenon occurs due to the high dispersion of the asphaltene complex in the oil fractions, which is due to their high solubility. As a result, bitumen turns into a sol, loses its viscosity and elasticity, and leads to a decrease in its softening temperature and penetration. At the same time, the tensile strength of bitumen increases and the penetration index decreases.

During the research, the study of the effect of paraffins on the physical and mechanical properties of several models of bitumen aroused great interest. Thus, when 5% paraffin was added to bitumen with a melting point of 460C, its softening temperature decreased from 520C to 460C. In this case, the penetration of bitumen increases from 91 to 220x0.1 mm, as well as the disintegration of bitumen decreases from 100 cm to 35 cm. Experiments have shown that the brittleness of bitumens remains stable. When 5% paraffin with a melting point of 760C was added to the bitumen sample, the softening temperature of the bitumen increased from 520C to 620C and the penetration increased from 91 to 127x0.1mm. At the same time, the tensile strength of bitumen decreased from 100 cm to 12 cm. The brittleness temperature increased from -130C to -110C.

The physical and mechanical properties of oils and resins in bitumen depend primarily on the nature of the oil from which they are obtained. Therefore, as the amount of paraffin in bitumen increases, the density and refractive index of oils and resins in it decrease. The paraffinic nature of bitumens is due to the viscosity of the resins. Thus, it was found that the viscosity of resins in high-paraffin bitumens (8-10% paraffin) is about 1000 times less than the viscosity of resins in bitumens containing up to 0.5% paraffin. While the viscosity of resins in low-paraffin bitumens at 200C is 108 PZ (107 n / sec / m2), in bitumens containing 3.0% paraffin, the viscosity of resin is 107 PZ (106 n / sec / m2), when 8% paraffin is 8%, this figure is 106 PZ (105 n / s / m2) and 108 PZ (105 n / s / m4) in the presence of 10% paraffin.

Table 1. Physical and mechanical properties of bitumen samples

An example of bit	Amount of paraffin,% / mass	Viscosity of resins, at , 20^0C	
		Puaz	n.min / m2
1	0,5	10^8	10^7
2	3,0	10^7	10^6
3	8,0	10^6	10^5
4	10,0	10^5	10^4

Another interesting fact is that the resins separated from bitumens of different nature at different oxidation depths have practically the same viscosity. Removal of paraffins from paraffin and high paraffin bitumens does not change the viscosity of resins. This can be explained by the fact that bitumens derived from paraffinic oils contain not only paraffins, but also aliphatic side-chain naphthenes and aromatic structural elements. Therefore, the separation of paraffins from bitumen almost does not change its chemical structure and properties. All this leads to the conclusion that it is important to know the nature of the compounds that make up all the components of bitumen. That is, the presence of paraffins in bitumen is only an indirect indicator of its aliphaticity.

During the chromatographic separation of paraffins from bitumen, other components are also removed.

The structural-group composition of 3 samples of bitumen paraffins separated by chromatographic method and calculated with H: C atomic ratio is shown below (Table 2).

Table 2. Structural-group composition of 3 samples of bitumen paraffins separated by chromatographic method and calculated by H: C atomic ratio

Examples	Molecular weight	H:C	$G_{paraffin}$	G_{naften}	$G_{aromatic}$
		% kütlə			
Bitumen – 1	464	1,706	68,0	17,0	33,0
Bitumen – 2	486	1,828	66,0	21,0	14,0
Bitumen - 3	450	1,956	85,0	8,0	8,0

Paraffin's were separated from the alcohol-ether solution of bitumen oils by crystallization at -200C. From the above results, it can be concluded that the structural-group composition of paraffin's separated from different bitumen's varies, but also depends on the chemical composition of the primary bitumen. Thus, the amount of non-paraffinic hydrocarbons in the paraffin's of the 1st bitumen sample is 37.0%, in the 2nd paraffins it is 33%, in the 3rd sample only 15%.

The structure of paraffin's separated from the 2nd bitumen sample by different methods and the oil content in that bitumen are shown in Table 3 below.

Table 3. The structure of paraffin's separated from the 2nd bitumen sample by different methods and the composition of the oil in that bitumen

Components separated from bitumen	Molecular weight	Amount of hydrocarbons,% by mass		
		$G_{paraffin}$	$G_{nafften}$	$G_{aromatic}$
1. Paraffins				
a) separated by selective solvents	316	78,0	17,0	5,0
b) separated by chromatographic method	482	68	19	14,0
2. Oils	550	35,0	32,0	33,0

As can be seen from the table, the content of aromatic hydrocarbons in paraffins separated from bitumen by chromatographic methods is 2.8 times higher than the amount of aromatic hydrocarbons in paraffins treated with selective solvents.

Studies have shown that the quality of bitumen - especially the "softening temperature - penetration" - varies depending on the nature of the raw material. Penetration and tensile strength (ductility) of oxidation of the same oil tar at the same softening temperature depends on the amount of oil in the tar. The deeper the oil fraction extracted from the fuel oil, the lower the penetration of bitumen and the higher the tensile strength.

RESULT

1. The master's dissertation devoted to the scientific researches carried out in the field of change of quality of oxidizing bitumens depending on the nature of raw materials attracts attention with its relevance. For the production of oxidizing bitumens for any purpose, the characteristics of the primary oil must take into account the softening temperature of the raw material and the amount of oil and paraffin compounds in it.

2. The article examines the possibility of obtaining its own oxidizing bitumens based on a mixture of residual oil (OG) accumulated after settling in tanks, cisterns and tankers containing tar and paraffin Sangachal offshore oil from a mixture of Azerbaijani offshore oils.

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