УДК 691.16

INFLUENCE OF STRUCTURE-FORMING ADDITIVE AND POLYMER ON THE AGING OF ROAD AND ROOFING BITUMEN

Kasimov Ibraxim Irkinovich
Candidate of Technical Sciences, Associate Professor of the Department "Building Materials and Chemistry",
Tashkent Architectural Construction Institute

Abstract: *Scientific researches for increase of durability and operational properties of the modified bitumen's are conducted. By research it has been proved that complex application polymer SBS «Kraton D1101» and structure-forming additive of SAS of "SP"- (SP-BWTP-Sulfur Product or Byproduct of Welding Electrode Production), raises firmness of bitumen's to ageing. Thus, the development of new compositions of bitumen-polymer binders for asphalt concrete used in the upper layers of pavement, it seems an urgent task*

Key Words: *Bitumen, aasphalt concrete, ageing, the structure-forming additive, surfactants, the road and roofing polymeric-bitumen binders.*

1. INTRODUCTION:

Modern automotive construction roads places high demands on road construction materials, especially to binding substances, in particular to bitumen for asphalt concrete. This is due to a number of their positive qualities: high mechanical strength, good plastic properties, sufficient simplicity repair, the possibility of complete mechanization paving, reuse removed from the coating of asphalt, opening movement immediately after construction, and also sufficient economic efficiency.

Service life and performance asphalt coatings to a greater extent depend on the design of the road, level pavement technology, composition and intensity of movement, quality road maintenance, and especially on the quality asphalt concrete pavement, from physic mechanical properties used asphalt mixes.

Usually asphalt coatings based on petroleum bitumen incapable provide in the face of modern heavy traffic required physical and mechanical properties of coatings and their durability. Low elasticity insufficient crack resistance and temperature interval performance limit the use of products from them in hot summer period and winter. These are the main disadvantages according to which bitumen does not stand up to him requirements. One of the main ways increase the life of asphalt concrete coatings due to physical nature and structural features of asphalt is changing the structure and properties of organic binding materials used for it cooking.

The most common tricks is a modification of fillers, surfactants as well polymer additives or their waste production. In the last 15-20 years bitumen polymer knitting (BPV) began to be applied especially widely. First, because synthetic polymeric materials produce hundreds of thousands of tons a year and they become more available, and secondly, with this modification bitumen is transferred a number of valuable properties inherent polymers: plasticity and elasticity in a wide temperature range, strength and heat resistance with positive temperatures, aging resistance and aggressive wednesdays.

Application of bitumen-polymer binders in road construction increases durability coatings and reduces repair costs. Asphalt concrete prepared using modified bitumen, possesses improved properties: increased heat and frost resistance, water resistance, strength, shear stability.

The required cost-effective life of road and roofing is the most important characteristic of asphalt and roofing. Aging of bitumen and bitumen-mineral mixtures is a combination of irreversible changes in the chemical composition and physical properties when exposed to temperature, atmospheric oxygen, sunlight, aggressive media and water, leading to a deterioration in performance properties.

Aging of bitumen-mineral materials can be divided into two periods. In the initial stage of operation from the effects of external factors, their adhesion to mineral materials improves, the viscosity and the thermal stability of bitumens increase. This period has a positive effect on the resistance of the bitumen-mineral coating to corrosion and various deformations. Then there comes a period of change in the structure, increasing brittleness of bitumen and the destruction of asphalt concrete and roofing coatings is observed [1].

2. LITERATURE REVIEW:

In-depth study of the effects of polymers different molecular weight per structure bitumen dedicated to a number of works Gon, R. B., Gureev A.A., Zolotarev V.A. Kasimov I.U, Kasimov I.I., Rosental D.A., and other scientists [1-7].

As a rule, polymer additives are not chemically interact with bitumen. Dissolving or dispersing in bitumen in a turbulent process (cavitation) mixing, they contribute to the hardening of its structure.

With the introduction of polymer in bitumen about 5%, the first is distributed as separate, not interconnected particles, thereby creating coagulation structure with thixotropic intermolecular properties adhesion forces of structural elements. Effect their actions in the composition are similar to the influence filler.

3. RESULTS AND DISCUSSION:

In the process of technological mixing of asphalt concrete mixtures, at a temperature of 140-1600C, an intensive change in the chemical composition occurs — aging in a thin layer of bitumen when interacting with mineral materials. Further aging under the influence of external factors, road paving at temperatures from +80 to -26 ° C is slower, with reversible and irreversible changes in the properties of bitumen, which are accompanied by increased viscosity, fragility, reduced hydrophobicity, and, consequently, increased stiffness of asphalt concrete. -coatings [2].

One of the most important areas in recent decades has been to conduct targeted research to improve the durability and performance properties of bitumen binders by introducing polymers into their composition, structure-forming and flavored additives, rubbers, crumb rubber, sulfur, various surface-active substances (surfactants), and others. bitumens have improved adhesion-cohesion and rheological properties, have the ability to resist deformation at low and high rates Aturi.

Polymeric materials are more vulnerable to thermal decomposition than bitumen. With aging, the polymer chains break, with a decrease in molecular weight, monomers are formed and, in general, the material brittleness increases. The action of ultraviolet rays forms free radicals due to the detachment of hydrogen from an excited and ionized molecule, which contributes to the destruction. In the oxidation of bitumen, destruction occurs through reaction chains through a radical mechanism. Therefore, in the technological process of modification of bitumen, and its subsequent use in bitumen-mineral materials, it is necessary to observe the temperature regime for the preparation of mixtures [3].

However, the destruction of bitumen and polymer cannot be considered separately, and most likely an integrated approach is needed, where attention is paid to the structural formations of compositions that are resistant to aging and lead to an increase in the operational properties of the coating based on them.

The most promising are structure-forming and polymeric bitumen modifiers, especially with complex use, which ensures the stability of coatings during operation by extending the plasticity temperature range, since the modifiers help to increase the deformability in a wider temperature range [3].

As a structure-forming additive surfactant "SP-OEP" was used surfactant "SP-OEP" - sulfoproduct based on the waste of the electrode industry is obtained by sulfonation of volatile products of pyrolysis of coal tar pitch followed by neutralization with ammonia.

$$\sum R - Ar - H + HOSO_3H \rightarrow \sum RAr - SO_3H + H_2O,$$

where the Ar-aromatic core is the basis of polycyclic, aromatic and partially heterocyclic compounds;

R – other hydrocarbons attached to the core.

Surfactant "SP-OEP" has a molecular weight of 210-330 amu, decomposes at + 260 ° C. The elemental composition, wt.%: C = 5.00-5.22; H = 84.10-88.14; O = 2.00-2.30; N = 2.00-2.30; S = 1.00-1.58.

The most promising, representative and accessible types of polymers were selected as polymers. These are SBS (styrene – butadiene - styrene “artificial rubber”) highly elastic modifiers: “Kraton D1101”

To confirm the results of research, the durability of the material was determined by its ability to maintain properties for a long time at 180 ° C for 10 and 20 hours and 80 ° C with an assessment of the properties of the binder after 168, 336 and 672 hours, in the same way as in operating conditions.

Table 1 shows the dependence of the softening temperature on the time of temperature control of bitumen without an additive, bitumen of optimal compositions with the addition of 1% surfactant SP-OEP and bitumen supplemented with 2.0% polymer SBS Kraton D1101 with 1% surfactant SP-OEP [4,5].

Table 1

Changes in the physicochemical properties of bitumen without additives and modified bitumens from the time of temperature control

№	The amount of additive,% by weight	Physico-chemical properties of bitumen		The indicator at the time of temperature, hour				
			0	10	20	168	336	672
1	Bitumen without additives	Softening temperature, 0C, ^{0}C	47,5	49,0	49,5	52	55	59
2		Needle penetration depth 0,1мм, at 25^{0}C. (viscosity)	133	108	102	95	93	90

3		Brittleness temperature ^{0}C	-18	-16	-14	-13	-11	-12
4		Weight loss %	-	0,19	0,29	0,35	0,57	0,78
5	Additive bitumen 1% SIA "SP-OEP"	Softening temperature, ^{0}C	61,5	62,5	63,0	64,5	66,5	68
6		Needle penetration depth, 0,1 mm, at 25^{0}C. (viscosity)	66	60	58	57	55	54
7		Brittleness temperature, ^{0}C	-16	-15	-14	-14	-13	-13
8		Weight loss, %	-	0,07	0,15	0,22	0,28	0,32
9	Additive bitumen 2,0% polymer SBS "Kraton D 1101» and 1% SIA "SP-OEP"	Softening temperature, ^{0}C	65	67	67,5	68,5	70	72
10		Needle penetration depth, 0,1 mm, at 25^{0}C. (viscosity)	60	58	55	53	52	50
11		Brittleness temperature, ^{0}C	-29	-28	-27	-27	-26	-26
12		Weight loss, %	-	0,04	0,09	0,18	0,25	0,29

The initial bitumen without a modifier has a significantly lower softening temperature than the modified one, however, already in the initial period of time for temperature control, an intensive increase in the softening temperature is observed in it. Analysis of the parameters of the studied compounds: needle penetration depth (viscosity), 0.1 mm, at 250 ° C, fragility temperature - 0 ° C and weight loss,% showed that aging increases particularly faster in unmodified bitumen.

The samples of modified bitumen with the addition of 1% of the surfactant SP-OEP turned out to be very thermos table, where aging is slower compared to bitumen's without an additive.

Studies have shown that the surfactant "SP-OEP" is an inhibitor of aging, and blocks the interaction between the structure-forming components, preventing the negative influence of various external factors.

This indicates the preservation of the plastic properties of bitumen and a slight increase in its fragility. A slight change in the softening temperature in the period of time for temperature control of bitumen's modified with a structure-forming additive is explained by the high content of the oily part, which was shown in studies of group chemical analysis of the compositions [6].

The bitumen modified with the SBS Kraton D1101 polymer and with the structure-forming additive surfactant SP-OEP shows an increase in aging resistance, the rate of increase in the softening temperature decreases by 44% during the period of time, and when used with the structure-forming additive by 77%.

The bitumen modified with the SBS Kraton D1101 polymer and with the structure-forming additive surfactant SP-OEP shows an increase in aging resistance, the rate of increase in the softening temperature decreases by 44% during the period of time, and when used with the structure-forming additive by 77%.

4. CONCLUSION:

As a result of the research, it was shown that the integrated application of the proposed structure-forming and polymer modifying additives increases the aging resistance of bitumen.

REFERENCES:

1. Gong, R. B. Oil bitumens. Moscow. "Chemistry", 1989. 152 s.
2. Gureev A.A., Chernysheva E.A., Konovalov A.A., Kozhevnikova Yu.V.
3. Production of oil bitumen. - Moscow .: RSU Oil and Gas. THEM. Gubkina, 2007. - 103 p.
4. Zolotarev V.A. Effect of the joint introduction of polymers and adhesive additives on the properties of bitumen / V.A. Zolotarev, S.V. Kudryavtseva, S.V. Efremov // Herald HNADU. - 2008. - № 40. - p. 15-22.
5. Kasimov IU, Khodzhayev SA, Kasimov II, Modification of road and roofing bitumens with polymer and structure-forming additives in the conditions of Uzbekistan // Architecture and Construction of Uzbekistan. - Tashkent, 2016. No. 4-5. - p. 86 - 89.
6. Kasimov I.I. PhD. Tashkent Architecture and Construction University. Tashkent. Uzbekistan. Low-Viscosity Bitumen and Asphaltic Concretes. USA. AASCIT Journal of Materials and Applications 2017; 3 (5): 79-92 ttp: //www.aascit.org/journal/jmsa ISSN: 2381-0998; ISSN: 2381-1005

7. Rosental, D.A., Tabolina, LS, Kasimov, I.K., Tilyabaev, B.A., Kasimov, I.I. Composition and properties of bitumen, obtained by energy-saving technology with the introduction of structure-forming additive Journal. Moscow // Construction materials. - 1991, № 7.-p.20,21.
8. Umurzakov, U.P., Ibragimov, A.G., Durmanov, A.S. Development of the organizational-economic mechanism and development of scientific, methodological and theoretical foundations for improving the efficiency of the rice growing industry to ensure the country's food security // Science and Practice Bulletin. Electron. journals 2017. №11 (24). P. 103-118. Access mode: http://www.bulletennauki.com/umurzakov. DOI: 10.5281 / zenodo.1048318
9. Mirzaev B.S., Mamatov F.M. Erosion preventive technology of crested ladder-shaped tillage and plow design . European Applied Sciences. 2014, №4. 71-73. p.
10. Durmanov, A. (2018). Cooperation as a basis for increasing the economic efficiency in protected cultivation of vegetables. Bulletin of Science and Practice, 4(8), 113-122.
11. Durmanov, A., & Umarov, S. (2018). Economic-mathematical modeling of optimization production of agricultural production. Asia Pacific Journal of Research in Business Management, 9(6), 10-21.
12. Durmanov, A. Sh., & Yakhyaev, M. M. (2017). Measures to increase the volume of exports of fruit and vegetables. Herald of the Caspian, (4).
13. Tulaboev, A., (2013). Blended learning approach with web 2.0 tools," 2013 International Conference on Research and Innovation in Information Systems (ICRIIS), Kuala Lumpur, pp. 118-122. doi: 10.1109/ICRIIS.2013.6716695
14. Tulaboev, A., & Oxley, A. (2012). A case study on using web 2.0 social networking tools in higher education. In Computer & Information Science (ICCIS), 2012 International Conference on (1). 84-88.
15. Tulaboev, A., & Oxley, A. (2010). A pilot study in using web 2.0 to aid academic writing skills. In Open Systems (ICOS), 45-50.
16. Ibragimov, A. G., & Durmanov, A. S. (2017). Issues of the development of competitiveness and the prospects of specialization in rice farms. SAARJ Journal on Banking & Insurance Research, 6(5), 14-19. doi:10.5958/2319-1422.2017.00021.2.
17. Durmanov, A. Sh., & Khidirova, M. H. (2017). Measures to increase the volume of exports of fruit and vegetable products. Economics, (9), 30-34. (in Russian).
18. Durmanov, A. Sh. (2018). Foreign experience the organizational-economic mechanisms of improving the activities of greenhouse farms. Economics and Finance (7), 20-28.