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Development of Optimal Technological Modes for Obtaining Bitumen-Rubber Compositions

Ilhom Akbarov, Soyibjon Negmatov, Murotbek Boydadayev

Senior Lecturer, Namangan Institute of Civil Engineering, Uzbekistan, Namangan
Doctor of Technical Science, State Unitary Enterprise "Fan va Taraqqiyot", Tashkent State Technical University, Uzbekistan, Tashkent
Senior Lecturer, Namangan Institute of Civil Engineering, Uzbekistan, Namangan

ABSTRACT: In this article highlights of determination of optimal technological modes for obtaining bituminous rubber compositions

KEYWORDS: bitumen, technology, softening temperature, brittle temperature, elasticity.

I.INTRODUCTION

Elasticity, strength, water resistance, heat resistance and durability of roofing materials is an important and urgent task. When solving this problem, a special place is given to the use of modified bituminous materials that can provide elasticity, strength, water resistance, heat resistance and durability of roofing materials during the annual cycle. In this regard, there is a need to develop new compositions of polymer-bitumen materials using mineral ingredients for the production of effective, durable, roofing materials and technologies for their production for use in the construction of buildings and structures in dry and hot climates.
Analysis of the literature data and experience in the operation of roofing coverings made of traditional bituminous rolled materials have shown that in dry and hot climates, they quickly lose their original properties, prematurely collapse due to the influence of solar radiation and intensive thermal aging of the bitumen binder.
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II. SIGNIFICANCE OF THE SYSTEM

Let among the constrains (1) first l , and among the constrains (2) first d be the constrains of the first kind. If we In addition, one of the priorities of the developed economy of independent Uzbekistan is the localization of production and replacement of imported materials with local ones. This fully applies to roofing materials. Therefore, for the extreme climatic conditions of Uzbekistan, there is a need for scientific justification of the production of roofing bituminous materials of improved quality, with an increased service life.
In order to determine the optimal technological modes for obtaining bitumen-polymer compositions, the influence of the thermomechanical processing time, the temperature of the rubber powder destruction process, and its content on the degree of destruction of the rubber powder, as well as the softening temperature of the initial bitumen and their content were studied (figures 1.1-1.5).

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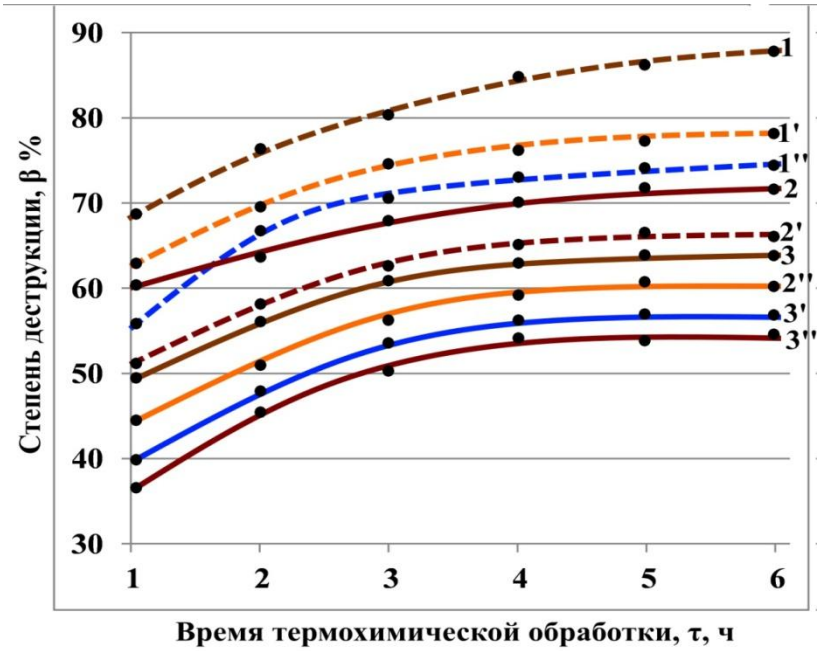

Figure 1.1. Dependence of the degree of destruction of rubber powder on the time of thermomechanical treatment in the pump-disperser of a bituminous-rubber composition with different contents of rubber powder (1, 2, 3 – 20 wt.h, 1^{I}, 2^{I}, 3^{I} – 30 wt.h, 1^{II}, 2^{II}и 3^{II} – 40 wt.h and temperature of the thermomechanical treatment process (1, 1^{I} and. 1^{II} – 230^{0}C; 2, 2^{I} and 2^{II} – 210^{0}C; 3, 3^{I} and 3^{II} – 190^{0}C).

III. LITERATURE SURVEY

In this article highlights of determination of optimal technological modes for obtaining bituminous rubber compositions Figure 1.1 shows the results of a study of the dependence of the degree of destruction of rubber powder on the time of thermomechanical processing in a pump-disperser of a bituminous rubber composition, with different contents of rubber powder (20 wt. h; 30 wt.h; 40 wt.h) and the temperature of the processing process of thermomechanical processing of the composition(190^{0}C, 210^{0}C, 230^{0}C).

From the curves in figure 1.1, it can be seen that in all cases, with increasing time of thermomechanical processing, the degree of destruction of rubber powder increases in all temperature modes of thermomechanical processing. The degree of destruction increases from 40-68 to 55-88%, respectively. It is also shown that the degree of destruction decreases with increasing content of rubber powder. Thus, with an increase in the content of rubber powder from 20 to 40 wt. h. the degree of destruction decreases from 88 to 70%. The most degree of destruction of rubber powder is affected by the temperature of the heat treatment process. Thus, when the temperature increases from 190^{0}C to 230^{0}C, the degree of destruction increases from 68 to 88%, with a 20% content of rubber powder [1]. As can be seen, the greatest degree of destruction is observed at a temperature of 200^{0}-230^{0}C and a processing time of 4-6 hours. At the same time, the temperature of the initial bitumen was assumed to be 38^{0}C by the definition of KiSh.

IV. METHODOLOGY

Thus, the optimal mode of preparation of the modified bitumen-rubber composition is the temperature of thermomechanical processing of the composition-220^{0}C, in the processing mode of 5 hours and the temperature of the initial bitumen is 38^{0}C.

Figure 1.2 shows the results of softening of bitumen-rubber compositions, depending on the temperature of the initial bitumen, with different content and size of rubber powder particles.

With an increase in the content of rubber powder, for all the studied parameters, both at different contents and particle size, the softening temperature from the beginning is insignificant, and then, sharply increasing, tends to stabilize. In this regard, taking into account the technological and operational process, we selected the softening temperature of the initial bitumen in the range of 38-40^{0}C.

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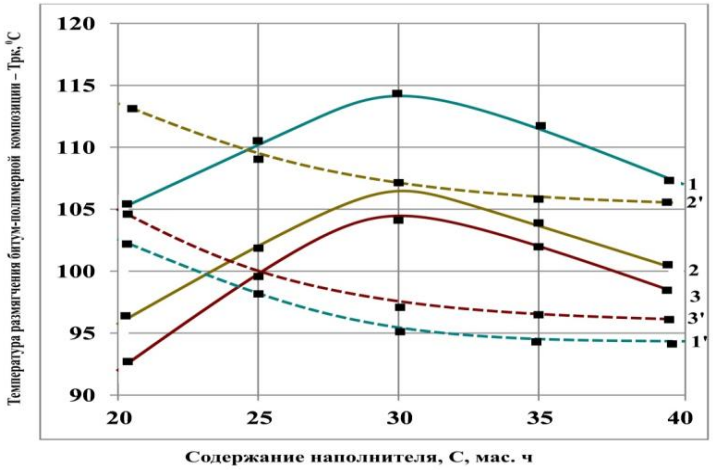


Figure 1.2 Dependence of the softening temperature of bituminous polymer compositions on the content and size of the filler particles-rubber powder.

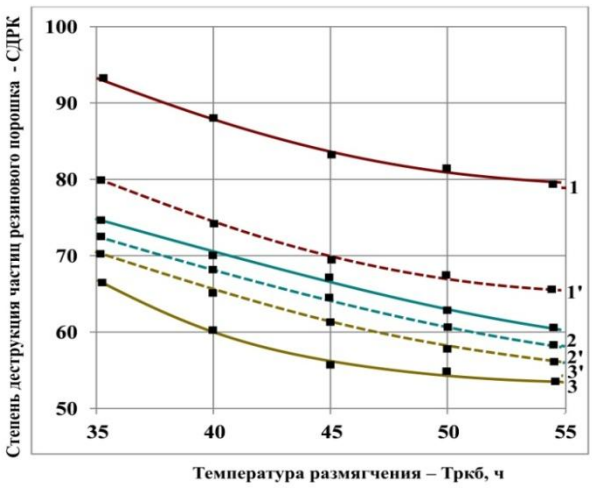
1 – 0,3mm; 2 – 0,6mm; 3 – 0,9 mm. 1^I – 20 wt.h; 2^I – 30 wt.h; 3^I – 40 wt.h.

Figure 1.2 shows the results of studies of the dependence of the softening temperature of bituminous polymer compositions on the content and size of rubber powder particles. As can be seen from the curves of figure 1.2 the softening temperature of the bitumen-polymer compositions, depending on the filler content, have an extreme character passes through a maximum, and depending on the particle size with the increase in dispersion of rubber powder in the beginning sharply and then slowly decreases.

V. EXPERIMENTAL RESULTS

Based on the analysis, by us. the optimum particle size of rubber powder were taken 0.6 mm and the content was in the range of 28 – 30 wt.h.

Thus, the optimum compositions of hot bitumen of retinolacetate is the Temperature of original bitumen - 40^0C, content and particle size of rubber powder – 28 - 39 wt.h. and 0.6 mm, respectively [2].



1-0,3 mm; 2-0,6 mm; 3-0,9 mm; 1^1-20 wt.h.; 2^1-30 wt.h.; 3^1-40 wt.h.

Figure 1.3 Dependence of the degree of destruction of rubber powder on the softening temperature of the initial bitumen at different particle sizes and the content of rubber powder.

Figure 1.3 shows the results of studies of the dependence of the degree of destruction of rubber powder on the softening temperature of the initial bitumen at different particle sizes and the content of rubber powder. The curves of the figure show that the degree of degradation decreases with increasing filler content, both for different particle sizes and the

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Vol. 7, Issue 10 , October 2020

content of rubber powder. As can be seen, high destruction of rubber powder in the bitumen-rubber composition is observed at a particle size of 0.3-0.6 mm and 20 wt.h. content.

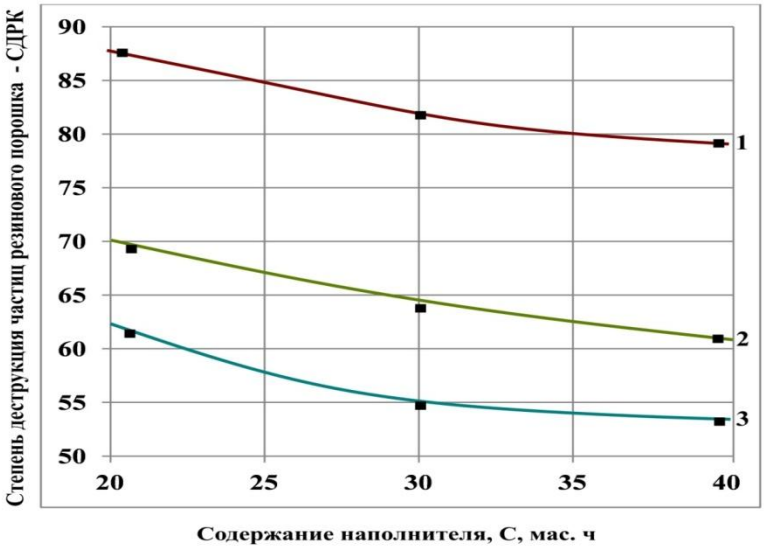

Figure 1.4. Dependence of the degree of destruction of rubber powder on the content of the filler-rubber filler at their different softening temperatures of the initial bitumen: 1-38^{0}C, 2-46^{0}C, 3-54^{0}C

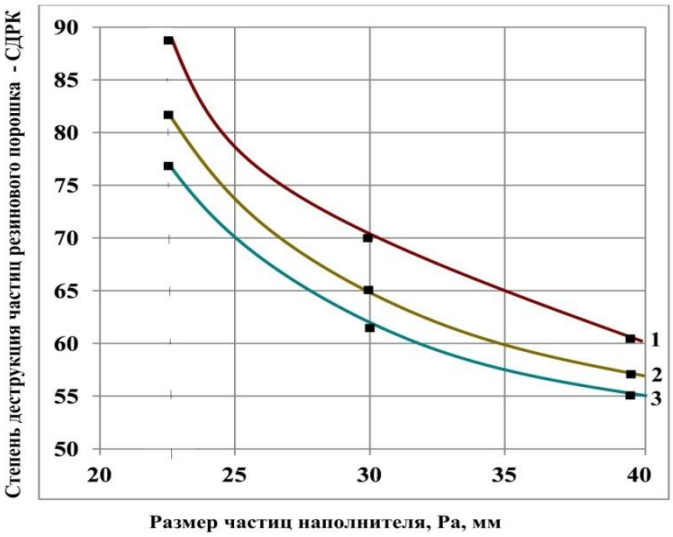

Figure 1.5. Dependence of the degree of destruction of rubber powder on its particle size at different contents of rubber powder: 1-20 wt.h; 2-30 wt.h; 3-40 wt.h.

Figures 1.4 and 1.5 show the results of studies of the dependence of the degree of destruction of rubber powder in a bitumen-rubber composition on the content and size of filler particles at different temperatures and the content and filler, respectively.The curves of the figures show that with increasing content and size of rubber powder particles, the destruction of rubber powder decreases in all the samples studied.

Based on a comprehensive analysis of the above results, taking into account the technological process of the degree of destruction, the optimal softening temperature of the initial bitumen is 38-400C, the content of the rubber powder of the bitumen-rubber composition is 28-30 wt.h. and the powder particle size is 0.3-0.6 mm [3].

Quantitative indicators of the degree of destruction of rubber chips in the bitumen-rubber composition, depending on the duration of thermomechanical activation and the softening temperature of the initial bitumen, are also confirmed by the qualitative characteristics of the structure determined by IK spectroscopy. For this purpose, IK spectra of BRS of the composition 70%-bitumen + 30% rubber powder were taken. the initial bitumen had the initial softening temperature: 38, 42, 16, 50 and 540C, according to KISH.

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VI.CONCLUSION AND FUTURE WORK

Thermomechanical destruction of BPK was performed at the optimal temperature in the plastic pump for 6 hours. Every 2 hours, samples were taken and IK spectra were taken. The analysis showed that the most significant changes in the IR spectra of the studied BPK are observed in the absorption band (PP) with a frequency of 970 sm-1. This band is caused by out-of-plane deformation vibrations of the CH-groups and 1,4-transdvion bond, which is characteristic of the structure of rubbers. Therefore, the relative content of double bonds can serve as a measure of the "dissolution" of rubber in bitumen.

It is known that the penetration and brittleness temperature of waterproofing and roofing materials to a certain extent characterize their elasticity. In order to justify the softening temperature of the initial bitumen in the bitumen-rubber composition for the roofing material cover composition, experimental studies were performed. Their results showed that the greatest elasticity of the bitumen-rubber composition is achieved when using bitumen with an initial temperature of 38-and 42^0C (table 1). Therefore, in order to obtain bitumen-rubber cover roofing compositions for further research, bitumen-polymer compositions prepared on this initial bitumen are accepted.

Table 1.

Indicators of aeration and brittleness temperature of BRK.

№	T r the source of bitumen	Pen, x 0,1 mm	T x p,-^{0}C
1	38	72	35
2	42	64	30
3	46	54	28
4	50	43	26
5	54	38	24
6	62	33	22

Based on the results obtained, the following conclusions can be drawn:

- the most significant factor is the softening temperature of the initial bitumen by KiSh. With increasing $Tp_{исх.бит}$the softening temperature of the filled bitumen composition also increases outside the study area. For technical reasons, the softening temperature of the initial bitumen should be limited by default and take -38^0C:
- the second most important factor is the dispersion (diameter) of the rubber crumb. The obtained value of the optimal dispersion of the rubber crumb is 0.35 mm;
- the third most important factor, but no less important than the dispersion of the rubber crumb, is the degree of filling of the modified bitumen composition. As a result, the optimal value of the degree of filling of the composition is 28%.

Thus the optimal parameters of the modified bitumen composition should be considered D = 0,35 mm. C_v = 28% и$Tp_{исх.бит}$-38°C, the content of bitumen - 72%.

Consequently, the conducted research confirmed the theoretical and practical prerequisites for the structure formation of a bituminous-rubber composition, which allows us to develop the optimal composition and technological mode for obtaining bituminous-polymer compositions with good physical, mechanical and operational characteristics.

The developed bitumen-polymer compositions can be used independently, as an elastic cover composition of roofing material, and for obtaining waterproofing and roofing materials.

REFERENCES

[1] Negmatov S.S., Salimsakov Yu.A. and dr. «Issledovanie varochnyx i fiziko-khimicheskix svoystv mestnyx bazaltovyx porod // Kompozitsionnye materialy, 2003. -№ 2. -S. 44.

[2] Ruzieva B.Yu., Negmatov S.S. and dr. Prospects for the use of basalt ingredients in the development of composite materials. // Compositional materials, 2004. - №2. - S.60.

[3] Akbarov I.G., Negmatov S.S., Boydadaev M.B. Issledovanie osobennostey i fiziko-khimicheskix svoystv nemodifitsirovannyx neftyanyx bitumnyx materialov // Universum: Texnicheskie nauki: elektron. nauchn. jurn. 2020. № 2 (71). URL: http://7universum.com/ru/tech/archive/item/8809