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Methods for Obtaining Modified Sulfur Bitumen

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Abstract

Analysis of methods of production of serobitum. Adding the necessary components to the composition of serobitum and obtaining serobitum with a high degree of strength on their basis. They improve the physico-chemical properties of serobitum.

Keywords: serobitum, bitumen, sulfur, urea.

Currently, there is a shortage and rising prices for bitumen in the petroleum products market. Analysis of the bitumen market shows that the main market factors are: price and quality. The cost of sulfur bitumen is 35-40% lower than usual. The relevance of the work lies in the fact that for the production of this product we use chemical production waste, namely: sulfur, catalyst-products of petrochemical processing waste. Several attempts were made to implement this process, but it had a number of significant drawbacks, namely: sulfur and bitumen were mixed only in a ratio of 20:80 - when this mixture was heated to more than 140 ° C, a rapid release of hydrogen sulfide occurred; a mixture of bitumen and sulfur in this ratio did not provide the quality of bitumen for road work. All this made the process difficult to implement. We have proposed a unique technology for producing not a physical mixture of sulfur and bitumen, but the formation of a chemical bond between sulfur and bitumen with the formation of bitumen polymers; thiokol has approximately a similar structure. This technology becomes possible when using a unique catalyst developed by us and has no analogues in world practice. The technical solution relates to the field of production of road building materials, in particular, to means for the preparation of sulfur-bitumen mixtures used (in combination with mineral inert fillers) for road surfaces, installation of waterproof roofing coatings, etc.

The inventive line consists of a sulfur preparation unit, including: a sulfur smelter, equipped with an elevator for loading lump sulfur, an automatic oil station, connected by a heated pipeline for supplying molten sulfur with a sulfur bitumen preparation unit, which is an intensive mixing reactor, equipped with a measuring doser for supplying a catalyst, a hatch for bitumen supply, a heating system consisting of two stainless pipes and two automatic liquid burners, an intensive mixing system, two gear pumps to ensure mixing of the mixture and a pipeline for supplying finished sulfur bitumen to the consumer. The design of the claimed technological line ensures the production of high-quality sulfur bitumen with a sulfur content of up to 70%, corresponding to, and in some indicators exceeding, the quality of standards.

A method for producing sulfur asphalt concrete, including the interaction of sulfur with dicyclopentadiene followed by mixing modified sulfur with bitumen and filler, characterized in that the interaction of sulfur with dicyclopentadiene is carried out by intensive mixing with a submersible sulfur pump for 45-60 minutes at a temperature of 140-145oC, then sulfur bitumen is first obtained by mixing modified sulfur and bitumen in a reactor for 25-35 minutes at a ratio of 1:1 - 1:1.5, followed by mixing the resulting sulfur bitumen with a mineral filler, and sulfur bitumen is

introduced in an amount at which its volumetric concentration corresponds to the volumetric concentration of ordinary bitumen for a given brand of concrete and type of filler [1].

A method for producing sulfur asphalt concrete, including the interaction of sulfur with dicyclopentadiene followed by mixing of modified sulfur with bitumen and filler, characterized in that the interaction of sulfur with dicyclopentadiene is carried out by intensive mixing with a submersible sulfur pump for 45-60 minutes at a temperature of 140-145 oC, then preliminarily obtained sulfur bitumen by mixing modified sulfur and bitumen in a reactor for 25-35 minutes at a ratio of 1:1-1:1.5, followed by mixing the resulting sulfur bitumen with a mineral filler, and sulfur bitumen is introduced in an amount at which its volumetric concentration corresponds to the volumetric concentration of ordinary bitumen for a given brand of concrete and type of filler [2].

The possibility of using an accelerated method for determining the adhesive properties of bitumen based on dielectric constant is proposed. The method is introduced into the educational process. Based on the dielectric constant values of modifying additives, the possibility of their selection to increase the adhesive properties of road bitumens has been established. Effective additives and their best concentrations for bitumen have been proposed to reduce the consumption of bitumen in asphalt concrete and improve its quality indicators. [3].

The theoretical and methodological basis of the dissertation work are the developments of domestic and foreign scientists in the field of building materials science, the theory of composite materials, asphalt concrete technology, inorganic chemistry, and systems analysis. The information base consists of monographic works, materials of scientific and technical conferences, articles in periodicals and scientific collections on the problem under study. When conducting research, modern physicochemical methods for studying structure formation processes (Fourier-IR spectroscopy, powder X-ray diffraction) and standardized methods for determining the properties of asphalt concrete were used; systems analysis methods; methods of regression and correlation analysis and statistical processing of experimental data, as well as other normative and highly informative research methods. During testing, certified equipment from your accredited laboratory was used [4].

The paper presents a model of sulfur distribution by types of states and a model of coalescence of sulfur droplets in sulfur bitumen binder, as well as experimental data demonstrating the influence of sulfur content on the basic properties of sulfur bitumen binder and the mechanical properties of sulfur asphalt concrete. The model for the distribution of sulfur by type of state demonstrates that with increasing sulfur content in a sulfur bitumen binder, the proportion of sulfur in a physically free state increases, which forms a dispersed phase that increases the viscosity of the binder. This increase leads to a natural increase in the properties of sulfur bitumen binder with the introduction of sulfur. The coalescence model of sulfur droplets shows that this process is energetically favorable. The driving force for coalescence is the Laplace pressure, which increases with increasing ratio of the sizes of contacting sulfur droplets. Also, with an increase in sulfur content, the probability of overcoming the interphase film of bitumen between sulfur drops increases, which naturally increases the likelihood of the formation of spatial sulfur structures that negatively affect the crack resistance of sulfur asphalt concrete [5].

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