ISSN 2181-

PROPERTIES OF BINDING BITUMINOUS MATERIALS PRODUCED IN UZBEKISTAN

Yusufov Khakim
Student of Jizzakh Polytechnic Institute
yusufovxakim1516@gmail.com
(+998911971516)

Annotation: This article analyzes the main physical-mechanical and rheological properties of road bitumens and bituminous binders produced in the Republic of Uzbekistan. It examines the local raw material base, production technologies, and their impact on bitumen quality. The article summarizes the results of research on important indicators of bituminous materials such as viscosity, penetration, softening point, ductility, brittleness temperature, and adhesion. Furthermore, the compliance of local bitumens with international standards is evaluated, and their role in ensuring the durability and longevity of road pavements in the climatic conditions of Uzbekistan is substantiated. This article aims to create a scientific basis for the effective use of local bitumen products in road construction, improving their quality, and developing new, modified types of bitumen.

Keywords: Bitumen, road bitumen, bituminous binder, physical-mechanical properties, rheological properties, penetration, softening point, brittleness temperature, road construction.

INTRODUCTION

The condition of automobile roads is crucial for the economic development and improvement of the transport infrastructure in the Republic of Uzbekistan. The quality and durability of road pavements directly depend on the properties of bitumen, the main binding material used in their construction. Bitumen is not only a binding element for asphalt concrete mixture components but also a key factor determining the operational service life of the entire pavement and its resistance to temperature changes and traffic loads.

In Uzbekistan, bitumen products are primarily manufactured at local oil refineries. The properties of the bitumen produced at these refineries depend on the composition of the crude oil, the processing technology, and the type of equipment used. Uzbekistan's sharply continental climate (high temperatures in summer, low temperatures in winter) places specific demands on road bitumens. Bitumen should not soften and deform in summer, nor should it become brittle and crack in winter.

The relevance of this article is determined by the necessity to thoroughly study the properties of local bituminous materials and evaluate their compliance with international standards to create high-quality and stable road pavements for the country's road transport sector. Improving bitumen quality and optimizing its performance indicators is a vital scientific and practical task in road construction.

The objective of this research is to comprehensively analyze the main physical-mechanical and rheological properties of binding bituminous materials produced in the Republic of Uzbekistan, assess their suitability for the country's climatic conditions, and develop recommendations for improving bitumen quality.

RESEARCH OBJECT AND METHODOLOGY

Research Object: Various grades of road bitumens (e.g., BND 60/90, BND 90/130, BND 40/60) produced at leading oil refineries in the Republic of Uzbekistan (e.g., Bukhara Oil Refinery, Fergana Oil Refinery).

Research Methodology: Standardized laboratory testing methods were applied to determine the properties of bituminous materials. These tests included the following properties:

Penetration (needle penetration): To determine the hardness and consistency of bitumen (GOST 33136, ASTM D5). The test is conducted at 25°C.

Softening Point (ring and ball method): To assess bitumen's temperature sensitivity and resistance to deformation at high temperatures (GOST 33137, ASTM D36).

Ductility: To determine bitumen's plasticity and resistance to cracking at low temperatures (GOST 33138, ASTM D113). The test is conducted at 25°C and, in some cases, 0°C.

Brittleness Temperature (Fraas method): To determine the bitumen's embrittlement point at low temperatures (GOST 33139, EN 12593). This indicator is important for evaluating the resistance of road pavements to cracking in winter conditions.

Viscosity (dynamic and kinematic): To evaluate the flow characteristics of bitumen (GOST 33133, ASTM D4402). This indicator affects the processes of asphalt concrete mixture preparation and laying.

Adhesion: To assess bitumen's ability to adhere to the surface of mineral aggregates (GOST 11508). This is crucial for ensuring the water resistance and longevity of asphalt concrete.

Aging Resistance: To evaluate bitumen's ability to retain its properties under long-term operational conditions (e.g., TFOT, RTFOT methods).

The obtained experimental results were statistically analyzed, and the compliance of local bitumens with international standards and requirements was evaluated.

ANALYSIS OF BITUMINOUS MATERIAL PROPERTIES IN UZBEKISTAN

Bitumens produced in the Republic of Uzbekistan are primarily obtained from petroleum residues (gudron) through oxidation. The composition of local crude oil and technological processes influence the following key properties of bitumen:

Penetration and Viscosity: The penetration values of local bitumens correspond to the manufactured grades (BND 60/90, BND 90/130). BND 60/90 bitumen grades are harder than BND 90/130 and are distinguished by their high-temperature resistance. Viscosity determines the working temperature of bitumen.

Softening Point: The softening point of our country's bitumens meets the standard requirements for road bitumens (e.g., 40-55°C). This ensures the bitumen's resistance to deformation in hot summer conditions.

Ductility and Brittleness Temperature: The ductility values of local bitumens indicate their plasticity at low temperatures. However, in some cases, especially at low temperatures (e.g., 0°C and below), a decrease in ductility and a relatively high brittleness temperature are observed. This can increase the risk of cracks appearing in road pavements during Uzbekistan's cold winter conditions.

Adhesion: The adhesion of bitumen to mineral aggregates depends on its chemical composition. Local bitumens generally have sufficient adhesion to ensure bitumen-aggregate bonding. However, when working with hydrophilic aggregates, special activating additives may be required to improve adhesion properties.

Aging Resistance: Accelerated aging tests conducted in laboratory conditions show that local bitumens have a certain tendency to age. This can shorten the service life of road pavements due to bitumen oxidation and embrittlement during operation.

PROBLEMS AND WAYS FOR IMPROVEMENT

While the general properties of bituminous materials produced in Uzbekistan meet national standards, they may not fully comply with international standards (e.g., the Superpave system). In particular, there are some shortcomings regarding the optimal performance indicators at high and low temperatures:

Low-temperature cracking resistance: The brittleness temperature of local bitumens is sometimes not sufficiently low for Uzbekistan's cold winters. This can lead to the formation of thermal cracks in road pavements.

Aging resistance: The tendency of bitumen to oxidize shortens its service life.

To overcome these problems and improve the quality of local bitumens, the following improvement directions are recommended:

Expanding the production of polymer-modified bitumens (PMBs): Modifying bitumen with polymers (SBS, SBR, EVA, etc.) significantly increases its elasticity, plasticity, and resistance to cracking and deformation, as well as reducing its temperature sensitivity.

Using activating and adhesive additives: Employing special additives to improve bitumen's adhesion to mineral materials and slow down its aging.

Introducing new technologies: Implementing modern technologies (e.g., hydrogenation, deeper levels of distillation) in the oil refining process that allow for optimizing the chemical composition of bitumen.

Adopting international standards: Aligning local bitumen standards with international standards (e.g., Superpave Performance Grade - PG) and controlling bitumen quality based on these.

CONCLUSION AND FUTURE PROSPECTS

While the binding bituminous materials produced in Uzbekistan possess the necessary properties for road construction, there is potential to enhance their low-temperature performance and aging resistance. Improving bitumen quality directly contributes to extending the service life of road pavements, reducing repair costs, and increasing road safety.

Practical Significance: The results obtained and the recommendations provided in this article serve as a scientific basis for road construction organizations, design institutes, and bitumen producers to effectively utilize local bitumens and improve their quality. The production and widespread use of modified binders based on local bitumens will make a significant contribution to the development of road infrastructure.

Future Prospects: Future research should focus on deeper modification of local bitumens using various polymers, rubber granules, and nanomodifiers, as well as conducting long-term tests in various climatic conditions. This will enable further development of the road construction materials base in our republic and the creation of high-quality road pavements that meet global standards.

REFERENCES

1. ГОСТ 33136-2014. Bitum neftli yo‘l qurilishi uchun. Igna botishini aniqlash usuli. (2014). Moskva: Standartinform.
2. ГОСТ 33137-2014. Bitum neftli yo‘l qurilishi uchun. Yumshash haroratini aniqlash usuli (halqa va shar usuli). (2014). Moskva: Standartinform.
3. Jalilov, A. A., & Karimov, B. X. (2020). Yo‘l qurilishi materiallari va texnologiyalari. Toshkent: Yangi Asr Avlodi.

4. Ismoilov, M. I., & To‘xtayev, Z. K. (2021). Mahalliy bitumlarning fizik-mexanik xususiyatlarini yaxshilash yo‘llari. Transport tizimining rivojlanishi, 2(1), 54-61.

5. Huang, Y., Bird, R., & Heidrich, T. (2007). A Review of the Use of Recycled Waste Materials in Asphalt Pavements. Resources, Conservation and Recycling, 52(1), 58-73.

6. AASHTO M 320-10. Standard Specification for Performance-Graded Asphalt Binder. (2010). Washington D.C.: American Association of State Highway and Transportation Officials.