E-ISSN: 2997-9382
American Journal of Technology Advancement
https://semantjournals.org/index.php/AJTA

| Research Article

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# Research of the Properties of Mechanically Activated Organic-Mineral Ingredients for Road Coating

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**Annotation**
This article presents the results of research on the microstructure and physical-mechanical properties of organomineral ingredients based on local and secondary raw materials, methods and devices for mechanochemical activation of mineral ingredients, and their influence on the physical-mechanical and deformation-shift-resistant properties of the developed composite asphalt-concrete materials for road pavements.

**Keywords:** asphalt concrete materials, organic-mineral fillers, modification, shear strength, compressive strength, bitumen, rubber powder, natural sands, mechanical activation.

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**Introduction.** Today, worldwide, increasing the durability of roads, bridges, and airfields through the complex physical and chemical modification of asphalt concrete compositions with high values of elastic-deformation-shift resistance and deformation crack resistance is a pressing task. This necessitates fundamental and applied research in the field of studying the physicochemical and strength properties of elastic-deformation-shift-elastic composite materials for obtaining asphalt concrete materials for road surfaces. [1-5]

**Object and methods of research.** The objects of research are BN60/90, BN40/60 bitumens [8-9], Chirchik and Chinaz (river), Boz, Zhamashuy, Yazyavan and Yangiyer (barchan) sands.

**Research results and their analysis.** The study established that barchan sands differ significantly from river sands in both chemical and mineralogical composition. From a practical, especially technological, point of view, the important properties of natural sands are their granulometric composition, bulk and true density, specific surface area, and grain roughness.

The natural sands of six deposits were investigated, which differ in their nature: Chirchik and Chinaz (river), Boz, Zhamashuy, Yazyavan, and Yangiyer (barchan).

In this regard, to conduct a comparative analysis of the influence of river and barchan sands on the properties of asphalt concrete composition and to establish the possibility of their use as mineral fillers for

asphalt concrete coatings, we conducted research on the physical and mechanical properties of the developed asphalt concrete composition using them [5-10].

The main role in physicochemical mechanics in the field of activation of mineral raw materials used in the creation of various composite materials is played by the mechanochemical activation of organomineral ingredients. It is known that for the mechanical activation of mineral raw materials, crushers are currently used, in which the impact-splitting effect is realized.

However, implementing the impact-splitting effect for natural sands, including barchan sands, is impractical not only from the perspective of energy and labor costs but also from the perspective of overconsumption of binding materials for asphalt concrete pavements.

The study established that the compressive and shear strength limit of the compositions and the optimal amount of dismembrator loading is 3 kg/min, as such loading leads to the highest dispersity and specific surface area of the sands.

The mechanism of mechanoactivation during the processing of minerals and natural sands in a dismembrator unit occurs as follows. In the impact-rubbing treatment regime, activation occurs mainly due to the formation of new surfaces with a slight change in the granulometric composition, and in the impact-splitting-rubbing treatment regime, activation occurs both due to changes in the granulometric composition and due to the exposure of new surfaces.

**Specific surface area of sand** - The total surface area of sand grains per 1 g. Depends on the size of the grains (with decreasing grain size, it increases), its composition and the nature of the grain surface, and the grain composition of the sand. There are many different methods. The method of determining the specific surface area based on the oil content of minerals is the most accurate. This indicator is the most important for the purpose of our research, since with the help of the value of the specific surface, it is possible to indirectly assess the change in the surface roughness of grains, the value of which is one of the main criteria for mechanoactivation. In addition, under equal and other conditions, it is possible to predict the specific surface area based on the change in bulk density, the determination of which is associated with significant time and labor costs.

One of the main indicators of sands used in asphalt concrete pavements is their bulk density and specific surface area.

Based on the foregoing, these indicators of the selected sands were studied, the results of which are presented in Table 1. From the table data, it is not difficult to verify that the specific surface area and bulk density are interconnected.

**Table 1. Surface and volume properties of local natural sands**

| Deposit natural sand | Specific surface area, cm2/g | Embankment density, kg/m3 | Density, kg/m3 |
|---|---|---|---|
| Chinaz (river) | 438 | 1452 | 2345 |
| Jamashui (barchan) | 426 | 1488 | 2315 |
| Yazyavan (barchan) | 422 | 1486 | 2286 |
| Boz (barchan) | 418 | 1492 | 2395 |
| Yangiyer (barchan) | 402 | 1482 | 2312 |
| Chirchik (river) | 384 | 1461 | 2324 |

It should be noted that from a practical, especially technological, point of view, in addition to these properties, important properties of natural sands are their granulometric composition, as well as the roughness of grain (particle) surfaces.

**Conclusion.** Thus, the introduction of mechanoactivated river and barchan sands into the compositions made it possible to increase the strength properties, especially the shear and

compressive strength, the deformation and shear resistance of the developed compositions for asphalt concrete pavements of highways.

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