JUSTIFICATION FOR THE USE OF BIOCONCRETE FOR THE CONSTRUCTION OF HYDRAULIC STRUCTURES

Norboev Azizbek Akromjon ugli

Abstract. Innovative building materials for the construction of hydraulic structures are presented, namely, self-healing concrete - a new stage in the development of building materials. The new self-healing concrete differs from classical recipes by adding fungi and bacterial spores to the composition, which can survive in alkaline conditions and give the building material new properties.

Keywords: Construction Materials, hydraulic structures, self-healing concrete, bioconcrete.

INTRODUCTION

Concrete is a building material that, in its liquid state, has the fluidity of water, which makes it possible to pour cement mortar into any shapes and niches 1 . In its hardened state, concrete has the hardness of stone, which makes it indispensable in the construction of large objects (bridges, high-rise buildings, dams, etc.). Moisture, temperature changes, exposure to chemicals, and corrosion have a destructive effect on concrete; over time, the material tends to dry out. Self-healing concrete is characterized by higher resistance to the influence of external destructive factors and has the property of self-healing [1–4].

Concrete is a durable building material that has the necessary properties for the construction of both large structures (bridges, overpasses, dams at hydroelectric power stations, etc.) and small construction products (curbs, street lighting masts, reinforced concrete fences, etc.).

MATERIALS AND METHODS

For the first time, the use of self-healing concrete was proposed by Henk Jonkers from the Netherlands Delft University of Technology, who managed to introduce bacteria of the genus bacilli into concrete, which can exist for decades in an alkaline environment. As a result, it was possible to add to the strength of concrete and reinforced concrete structures

the ability to self-heal and heal cracks [3]. Moreover, bacteria remain in a "dormant" state for a long time. When cracks form and moisture gets inside the structure, bacteria act actively. However, during a series of experiments, scientists were able to establish two problems: bacteria do not take root well on the surface of already built structures, cement poses a danger to bacteria, therefore, special microcapsules with nutrients for bacteria should be added to concrete, in which they can live for a long time . This circumstance, of course, increases capital costs in the production of concrete, but significantly reduces operating costs.

RESULTS AND DISCUSSION

The newest building materials discussed in this work are promising and will soon become increasingly popular among designers, builders and direct users. These materials are unique and technologically complex to produce, but their price-quality ratio is justified, but rather in the long term, since their service life is much longer. By using these materials in construction production, we significantly expand our capabilities and ease of use of the constructed objects, while in price they do not differ so significantly from their usual analogues. In addition, the construction industry, as one of the most resource-intensive, must develop in accordance with the requirements of the time and become more and more knowledge-intensive, including in the development of building materials.

Table 1

Estimated costing for the production of 1 m3 of precast concrete class B15

Name of components	Consumption rate
Portland cement, t	0,490
Crushed stone, m3	0,909
Sand, m3	0,899
Additive SP JK-08, kg	2,079
Water, m3	0,170
Total	

In addition to the listed costs, it is necessary to take into account the fact that during the period of reconstruction of concrete structures, as a rule, all work at the enterprise is stopped due to the complexity of the work. Therefore, the search for solutions for automatic sealing of cracks with self-healing mixtures becomes relevant. When conducting a feasibility study, it is impossible not to take into account the significant advantage of bioconcrete - the elimination of cracks and cracks without the use of special machines and

mechanisms, as well as its absolute environmental friendliness. The only waste product of bacteria is calcium carbonate, which completely dissolves in building structures without entering the environment.

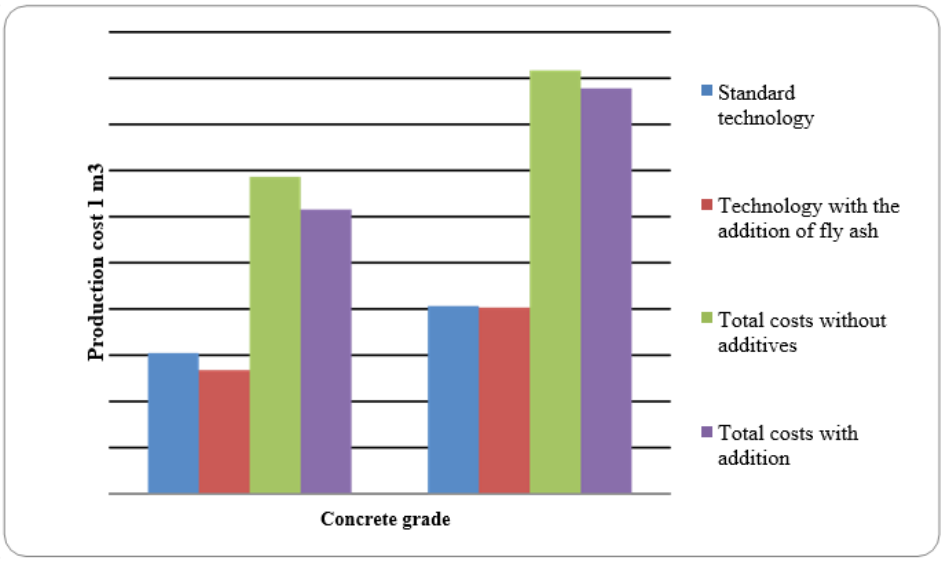

Figure 1. Comparative analysis of the application of technologies for the production of self-healing concrete

CONCLUSION

Thus, the use of bioconcrete makes it possible to increase the resistance of concrete and reinforced concrete to adverse environmental conditions, as well as significantly reduce the costs of reconstruction of structures. Despite the increase in capital investments, the proposed technology is effective by increasing the durability of the structure, obtaining a new material with improved physical and chemical properties and reducing operating costs. This area of research is very promising; the potential profit from the use of such concrete in hydraulic structures is enormous.

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