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SUBSTANDARD WOOD IN CONCRETE PRODUCTS

Relevance. The rising cost of traditional building materials and the need to reduce CO_2 emissions from cement production make the search for alternative concrete aggregates extremely important. The usage of substandard wood, such as wood processing waste, commercial wood residues and used wood, in a crushed form can reduce the cost of block concrete products and reduce the consumption of primary resources [1-9]. In addition, the combination of wood fractions, including used wood with industrial waste (slag and ash), provides not only material but also environmental efficiency. The volume of waste in landfills is reduced [3-7], the energy efficiency of building structures is increased due to the better thermal insulation properties of such composites, and the carbon footprint of the entire product life cycle is reduced.

Analysing the state of the problem and identifying issues. Many scientific studies have been devoted to the usage of industrial waste (slag, ash) in concrete mixtures in order to reduce cement costs and improve environmental friendliness. Less attention has been paid to the usage of substandard wood - shredded wood waste, woodworking residues and used wood - despite its potential as a lightweight, heat-insulating aggregate. There are some studies that demonstrate a decrease in concrete density with the addition of wood fractions, but they are mostly experimental and limited to a narrow range of wood content (up to 10-15%).

Literature review. Published studies of wood waste cement composites emphasize certain advantages of using wood [5, 10-12]. In [13], it was noted that wood waste can be considered a CO2 absorber when producing wood concrete. This type of composite can also provide additional functional characteristics, such as contributing to heat and sound isolation, and thus compensating for their reduced mechanical properties [14]. The usage of wood waste in combination with other types of waste is less common. Researchers of such construction mixtures discuss the potential use of wood waste in cement composites [10-14], where the chemical, physical and mechanical properties of the resulting concrete and the possibility of their usage in construction were characterized.

Analysis of the problems to be solved in this area of research. Different moisture content, size and composition of substandard wood lead to unpredictable properties of the mixture. There are no clear requirements for the fractional composition and heat treatment to ensure adhesion to cement stone. There are no comprehensive tests for frost resistance and long-term service life of concrete with a high wood content. To achieve a significant improvement in thermal insulation properties, it is necessary to increase the proportion of wood, which reduces the compressive strength. Optimal proportions are required to ensure the normative strength values (≥5 MPa for block products) with a sufficient thermal conductivity coefficient (<0.2 W/m·K). Wood may rot inside the concrete massif without previous preservation or antiseptic treatment. There is a lack of researches on the release of organic compounds from wood and their environmental impact during operation. No national or international standards have been developed for the usage of wood waste

in concrete products. It is impossible to start commercial production of such products until the relevant technical regulations and product certification are in place.

Prospects of the subject and ways of research. The further development of the technology for the production of concrete products with unconventional components, in particular, substandard used wood, opens up several areas of research and practical applications. Firstly, optimizing the composition of mixtures with different fractions of wood and industrial admixtures will help to find a balance of strength, durability and thermal isolation. Secondly, standardization of the preparation and processing of wood raw materials will help the technology reach the mass level. Thirdly, the introduction of such materials in construction will help meet national and international environmental standards (e.g. LEED or BREEAM) and reduce the environmental burden on regional waste management systems. In general, the development of this area will contribute to the formation of a circular economy in construction and increase the sustainability of infrastructure solutions. From eco-friendly saman to environmentally friendly arbolite - these are the topics of scientific research on energy-efficient construction materials for modern construction.

Conclusions. The usage of substandard wood in the form of crushed fractions as a partial replacement of quartz aggregate in concrete blocks can reduce production costs without significantly decreasing the strength characteristics. The integration of industrial waste (slag, ash) with wood components helps to reduce the consumption of natural resources while ensuring the stability of concrete mix properties. Non-traditional aggregates improve the thermal insulation properties of concrete products, which helps to reduce energy consumption for heating and air conditioning of buildings, increasing their energy efficiency. The usage of recycled wood waste in concrete mixtures helps to reduce CO_2 emissions associated with cement production and brings the technology closer to the principles of green building. The recycling and reuse of additional wood resources reduces the burden on waste landfills and contributes to a cleaner environment, creating the preconditions for the introduction of a circular economy in the construction industry.

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