

Production of composite materials based on rice husk processing products

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Abstract

Rice is one of the three main agricultural crops and is the main food source of a number of densely populated countries. When growing rice, a large amount of waste is accumulated annually, primarily rice husk (RH). Despite a significant number of developments in ways to dispose of husks, most of it is not disposed of, which increases the environmental burden on the environment.

The gel of silicic acid present in the husk makes it possible to obtain valuable silicon-containing products. A significant part of scientific work is devoted to the production of silicon compounds from RH. However, the most effective is the complex processing of RH, which allows using its inorganic and organic components. The result of processing can be composite materials that combine a low density and sufficient strength of the cheap organic part of the RH, durability, and temperature stability of the inorganic product of processing.

The relevance of the work is determined by the solution of the problem of utilization of multi-tonnage agricultural waste, combining the use of their organic and inorganic parts, and obtaining products with consumer value.

Object of research: technology and methods of synthesis of composite materials from rice husks for construction.

Subject of research: processes of synthesis of sodium liquid glass using silica obtained from rice husks, technology of structural thermal insulation materials based on rice husk processing products and research of their properties.

The purpose of the study is to obtain composite materials for thermal insulation and structural purposes based on rice husk processing products and determine their properties.

To achieve this goal, the following **tasks** were completed:

1. The composition and structure of RH produced in the Republic of Myanmar were studied and compared with similar wastes from other regions.
2. The influence of the heat-treatment conditions of the RH in order to obtain raw materials for the production of an inorganic binder – liquid glass (LG) was studied.
3. The possible methods of synthesis of liquid glass based on RH silica were investigated and the synthesis parameters were established to ensure its high quality.
4. The efficiency of using synthesized LG as a binder for the manufacture of molding mixtures used for casting metals has been established.
5. Heat-insulating and insulating-structural composite materials for construction purposes were obtained from RH and its processing products.

The scientific novelty of the research is determined by the following provisions:

1. It is shown that the synthesis of soluble sodium silicate (liquid glass) using RH and silica obtained by heat treatment of RH can be carried out by both autoclave and non-autoclave methods, and the most stable results (modulus-2.5 and density-1.36 of liquid glass) are achieved by the autoclave production method.
2. It was found that the liquid glass synthesized using RH silica contains fragments of nanoparticles of silicon poly-acids anions with a higher weighted average degree of polymerization (2 times – 30 and 60) than the standard one, and allows to obtain cold-hardening molding mixtures with increased strength.
3. Maximum use of rice waste processing products allowed us to develop recipes for mixtures and determine technological parameters that allow us to obtain composite materials for construction purposes that are comparable in

the basic properties (density, strength, thermal conductivity and water resistance) with materials based on cement and polymer binders.

Practical significance of the work:

- Parameters of synthesis of active silica of the Republic of Myanmar for the production of LG, as well as parameters of synthesis of liquid glass from silica of the Republic of Myanmar;
- With the use of synthesized LG, molding mixtures are obtained – with greater manipulator strength, which allows to increase the productivity of the process and reduce the roughness of castings. With their use, castings of cast iron parts with good surface quality are obtained. The developed mixtures can be recommended for small-scale production of large-sized parts;
- Composite materials of heat-insulating and heat-insulating-structural purpose with high performance characteristics were obtained using the products of rice production waste processing.
- A technological scheme for the production of composite materials for construction purposes using RH as raw materials has been developed.

Defense Provisions

1. Results of research on the synthesis of liquid sodium glass from RH and its ash;
2. Results of research on the production of cold-hardening mixtures of metal casting using synthesized liquid glasses;
3. Parameters for obtaining composite materials based on rice waste processing products and their properties;
4. Technological scheme of complex processing of RH.