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WASTE PROCESSING AND THEIR USE IN THE CONSTRUCTION INDUSTRY

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Annotation:This article explores the importance of waste recycling and the possibilities of its use in the construction industry. It analyzes the technologies for producing building materials by processing waste generated in the construction industry and other types of waste, their advantages and disadvantages. The properties of materials obtained from waste, their strength, thermal insulation, and other physical and mechanical indicators are considered. The article is aimed at providing scientifically based recommendations for expanding the processing and use of waste in the construction industry.

Keywords:Waste, processing, construction, construction materials, ecology, technological, industrial waste, raw materials.

Аннотация:В данной статье рассматривается важность переработки отходов и возможности их использования в строительной отрасли. Анализирует технологии производства строительных материалов путем переработки отходов, образующихся в строительной отрасли, и других видов отходов, их преимущества и недостатки. Учитываются свойства материалов, полученных из отходов, их прочность, теплоизоляция и другие физико-механические показатели. Статья направлена на предоставление научно обоснованных рекомендаций по расширению переработки и использования отходов в строительной отрасли.

Ключевые слова:Отходы, переработка, строительство, строительные материалы, экология, технологические, промышленные отходы, сырье.

Along with the work that needs to be done in the development of regions and the placement of production facilities, it is necessary to pay attention to environmental issues. In particular, special attention is paid to defining the construction materials and infrastructure sector as a priority area of development, developing the construction industry, that is, creating energy- and resource-saving environmentally friendly building materials in the production of high-tech construction materials and products. In the process of implementing these tasks, design and survey institutes, research laboratories, and specialized enterprises in the construction industry are recommended to pay attention to the following requirements:

- taking into account the specifics of scientific research and experiments conducted on building materials and products, paying attention to the environmental friendliness and acceptability for the environment in the process of determining the physical, mechanical, and chemical composition of building materials, climatic conditions, and physical properties of building products;
- ensuring the creation of an effective system for monitoring and early prevention, identification of situations that may pose a threat to human life and health in the process of development and modernization of technologies of enterprises specializing in the production of high-tech construction materials and products;

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- geological study, use and protection of lands during the standard design of energy-saving buildings with the introduction of high-tech building materials, products and structures, restoration of disturbed lands;
- participation as an observer in the implementation of environmental control at the facilities of enterprises specializing in the production of building materials and products.

In the creation of energy- and resource-saving environmentally friendly building materials, the processing of industrial waste is considered important. The use of industrial waste in construction allows for 40% coverage of the need for raw materials. The use of industrial waste in the preparation of building materials, compared to production from natural resources, reduces costs by 10-30%, and saves capital investments by 35-50%. All industrial waste can be divided into two large groups.
1. Mineral (inorganic) waste.
2. Organic waste.

Products of the first class (quarry waste and waste after beneficiation in minerals) - have the mineralogical and chemical properties and compositions of the corresponding rocks. The area of their application is interconnected with their physical and mechanical properties, granular and chemical compositions, and aggregate states. Second-class products are synthetic substances. They are mostly obtained as by-products as a result of physicochemical processes occurring at high temperatures or in normal conditions. Compared to first-class products, the scope of applicati on of this industrial waste is wider.

Third-class products are formed as a result of physicochemical processes flowing through the rock mass. Such processes include spontaneous combustion, slag weathering, and powder formation. A definite representative of this class of waste includes burnt rocks.

The main mass of waste is formed during the production of metals in the form of slag and ash and during the combustion of solid fuels. In the production of metal, except for slag and ash, a dispersed aqueous solution (suspension 16) - a large amount of waste is formed in the form of sediments. As valuable and widespread mineral raw materials for the production of building materials, burnt rocks and sorted coal waste, open-pit minerals and enriched waste are considered. The area of application of slag in the production of mineral binding materials is considered the most effective. Gravel binders can be divided into the following main groups. Mineral waste is of paramount importance for the production of building materials. Their share accounts for the majority of all mined and processed waste in the industrial sector. At the time of separation from the main technological processes, industrial waste can be classified into three classes:

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1. Slag Portland Cements.
2.Sulfate-slag binders.
3. Lime-slag binders.
4. Slag-alkaline binders.

Sulfate-slag cements are hydraulic binders in which gypsum or anhydride is obtained with a small amount of alkaline strengthening additive: lime, Portland cement, or calcined dolomite (mineral) during the joint fine grinding of domed granular slag and hardening by sulfate agent. The most common of the sulfate-slag group is gypsum-slag cement. It contains 75-85% slag, 10-15% anhydrous gypsum or anhydride, up to 2% calcium oxide, or up to 5% Portland cement clinker. High activation is ensured by the use of high aluminum oxide in calcined anhydrite and basic slags at a temperature of about 700°C. The activity of sulfate-slag cement is significantly dependent on fine grinding. Upper specific surface area of the binder (4000 - 5000 cm2/g) with the help of moisture extraction. With sufficiently high fine grinding of the optimal composition, the strength of sulfate-slag cement is not inferior to the strength of Portland cement. Sulfate-slag cement, like other slag binders, has a small thermal water saturation over 7 days. This makes it possible to use it in the construction of integrated hydraulic structures. Also, the influence of soft sulfate water is facilitated by its high strength. The chemical strength of sulfate-slag cement is considered higher than that of slag Portland cement, which is expedient if it is determined that it can be used in various abrasive conditions.

Limestone-shale and lime-ash binding cements are hydraulic binders obtained together with lime and ash from thermal power plants or domed granular slags powder. More than the M200 mark is used for the preparation of non-construction mortars. When preparing these substances, up to 5% gypsum stone is added to control the improvement of their setting times and other properties. The lime content is 10-30%. Lime-slag and lime-ash binding cements surpass sulfate-slag cements in strength. Their brands are 50, 100, 150, and 200. The beginning of hardening should not be earlier than 25 minutes, and the end should not be later than 24 hours after the beginning of hardening. Especially after 10°C, the increase in strength with a decrease in temperature slows down sharply and, conversely, contributes to intensive hardening with an increase in temperature in a sufficiently humid environment. Air hardening is possible only after sufficient hardening duration (15-30 days) under humid conditions. Such cements are characterized by low frost resistance, high water resistance, and low exothermicity.The slag-alkaline binder consists of finely powdered granular slag (specific surface area >3000 cm2/g), potassium and alkaline metallic sodium binder - alkaline composition. Granular slags of various mineral compositions are optimal for obtaining slag-alkaline binders. The phase component in the form of glass, which has the property of interacting with alkali, determines the conditions of their activity.

The properties of slag-alkaline binders depend on the mineral composition and type of slag, the fineness of its powder, the appearance and thickness of the slag-forming mixture. When the specific surface area of slag is 3000-3500 cm2/g, the amount of water required to form a mixture of standard consistency is 20-30% of the binder's mass. When testing mixture samples of standard consistency, the strength of the slag-alkaline binder is 30-150 MPa constitutes. For them, the subsequent characteristic of such a hardening period is the rapid increase in strength within a month. Thus, if the strength of Portland cement increases by approximately 1.2 times after 3 months of hardening under optimal conditions, then the slag-alkaline binder increases by 1.5 times. During heat-moisture treatment, the hardening process accelerates faster than that of Portland cement. With ordinary steaming, adopted in precast concrete technology, a strength grade of 90-120% is achieved within 28 days. The binders, which are part of the slag components, perform the function of an anti-cold additive, therefore slag-alkaline binders harden sufficiently intensively even at negative temperatures. Slag and ash waste has a rich supply of raw materials for the production of heavy and lightweight aggregate concrete.

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Conclusion

This research has shown the importance of waste recycling and its use in the construction industry. Construction materials obtained from waste make it possible to reduce the negative impact on the environment, save natural resources, and obtain economic benefits. Taking into account the nature of scientific research and experiments conducted on building materials and products, it is recommended to pay attention to the physical, mechanical, and chemical composition of building materials, climatic conditions, and environmental friendliness in the process of determining the physical properties of building products.

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