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USE OF DRY CONSTRUCTION MIXTURE WASTE

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Анотація

Ця робота присвячена аналізу сучасних тенденцій та перспектив вторинного використання відходів сухих будівельних сумішей (СБС). Розглянуто види та особливості відходів, придатних для повторного використання, практичні напрями їх інтеграції у будівельну галузь, а також обговорено перспективи розвитку технологій повторного використання для забезпечення сталого будівництва.

Ключові слова: сухі будівельні суміші, відходи, переробка, критерії, властивості, будівництво.

Abstract

This work is devoted to the analysis of current trends and prospects for the secondary use of dry construction mix (DCM) waste. The types and features of waste suitable for reuse, practical directions for their integration into the construction industry, and the prospects for the development of reuse technologies to ensure sustainable construction are considered.

Keywords: dry building mixtures, waste, recycling, criteria, properties, construction.

Introduction

In modern construction, the problem of the formation of significant volumes of construction waste, in particular residues of dry building mixtures (SBS), is becoming more acute. These materials, not relying on the loss of primary characteristics, often remain suitable for reuse, but usually fall into landfills of solid household waste. SBSs are formed at different stages: from storage (due to damaged packaging, caking or moistening) to the completion of construction work, when unused prepared solutions or expired mixtures remain [3].

The potential for reuse of such waste is due to the preservation of loose stru-ktura, chemical activity and mechanical properties of the mineral fraction [2]. According to their technological solutions, these residues can be used in the production of new building mixtures or as a filler in products of low responsibility.

Research Results

Dry building mixtures (DBM) - a powdery material consisting of a mineral or an organic substance, knitting, fillers and fillers, additives manufactured in the factory.

Waste of dry construction mixtures is the remains of unused or hardened dry construction mixtures (for example, plaster, glue, putty, for screeds, etc.) that are formed during construction, repair or dismantling.

1. Characteristics and suitability of DBM waste for reuse.

1.1. Sources of DBM waste generation

Waste of dry construction mixtures (SBS) is an inevitable companion of construction activities and is formed at different stages of the life cycle of materials. A significant part of the waste occurs at the stage of storage and transportation, which is often associated with damage to the package, exposure to high humidity, which leads to caking of the material, or due to delay in shelf life. Such mixtures may partially lose their astringent properties, but their potential for reutilization in other areas remains significant [2].

During direct construction work, the main sources of waste include excessively mixed mixtures that were not used before setting, as well as material residues on tools and work surfaces [3]. Effective management of this waste requires a systematic approach that includes accounting, sorting and timely processing.

1.2. Criteria for reusability

To ensure the possibility of reuse of DBM waste, they must meet the following criteria that guarantee their further functionality and safety:

- Preservation of loose structure: This is one of the main conditions, since flowability provides ease of further processing, mixing and dosing of waste in new areas of use.
- Absence of visible inclusions (organics, fungi, impurities): The presence of organic substances can lead to biological decomposition, which will adversely affect the properties of the final product.
- Permissible humidity level: Excessive humidity can lead to premature setting of astringent components, a decrease in the activity of the material, as well as to a state of fossilization, which complicates processing.
- Residual binder activity: Even if the waste is partially hydrated, maintaining a certain astringent activity allows them to participate in hardening reactions as part of new mixtures [10-13].

It should be noted that some wastes can completely lose their functionality as a binder due to complete hydration or degradation, but their value as a mineral filler or aggregate for other mixtures can be maintained.

1.3. Physical and chemical properties

The physicochemical properties of DBM wastes play a key role in determining their recycling potential. Cement-mineral components, even those that have survived partial hydrate-cium, can show satisfactory adhesion in new mixtures [11-14].

Such waste fractions are capable of performing several important functions in new materials:

- Improved filling of voids: Small particles of waste effectively fill the voids between large aggregates, thymizing the grain composition of the mixture and reducing the porosity of the finished material.
- Acting as a background filler: They can replace part of the primary fillers, which reduces the cost of raw materials without significant loss of quality.
- Improved wear resistance: In the case of coarse fractions of waste, they can increase the resistance of the material to abrasion and mechanical loads [4].

2. Practical directions of secondary use of DBM waste

Recycling of DBM waste is a key element of partial cost reduction in construction projects, allowing to reduce waste volumes and reduce the demand for primary raw materials.

2.1. Use of new building materials in production[15-18].

Waste of dry building mixtures can be effectively used as aggregates in the production of new building products, especially where the requirements for final characteristics are not super-usually high. In particular, they find application in such areas:

- Adhesive mixtures with low requirements: Waste can be added to the composition of adhesive mixtures intended for less work, where high adhesion is not critical.
- Gypsum putties: Due to its finely dispersed structure, waste can be used as filler in gypsum putties, improving their plasticity and manufacturability.
- Inexpensive plaster and ties: The addition of recycled waste can reduce the cost of production of plaster mixtures and materials for screeds, while maintaining the necessary strengths and operational characteristics [1, 3].

Leading companies in the construction industry are already actively implementing such practices. For example, the Fiber.ua develops formulations containing 10-40% recycled fractions of DBM waste, which allows to maintain the critical performance characteristics of the finished product [3].

2.2. Application in construction

Even completely inactive residues of dry building mixtures, hardened or gaining moisture-resistant to a gel-like state, do not lose their value. After appropriate grinding, they must be used as secondary materials in various construction processes:

- Floor base filler: Shredded waste is an ideal material for leveling and filling the space under the floor, creating a stable base.
- Backfilling of trenches: Instead of using primary soils, recycled waste can be used to fill trenches after laying communications.
- Stabilizing layer for road bases: Small waste fractions can be applied in road construction, increasing the bearing capacity of the base and reducing deformation [10].
- Concrete products of low responsibility: Hardened, crushed waste is found in the production of concrete products that do not require high strength characters-joints, such as curbs, trays, paving slabs [2, 5].

3. Prospects for the development of reuse technologies

Large-scale and efficient use of DBM waste in construction requires significant investment in infrastructure development, educational and information activities and the use of international experience.

3.1. Infrastructure development

A key element of successful recycling is the availability of modern infrastructure. It is necessary to waive:

- Mobile crushing and screening plants: These plants allow the recycling of construction waste directly on construction sites, reducing tran-sporting costs and CO_2 emissions**.**
- Centers for receiving and sorting construction waste: The creation of specialized prices for the separate collection and sorting of DBM waste by their type and degree of contamination will improve the quality of secondary raw materials**.**
- In-building regulations for accounting and labeling of DBM residues: Clear rules for the collection, identification and labeling of waste at construction sites are the key to their effective processing [1].

Developed countries such as the Netherlands, Denmark and Belgium already have highly developed break-side systems that allow recycling of 80-90% of building materials, which indicates the high potential of this direction. [1].

3.2. Educational and informational events

The success of the introduction of reuse technologies largely depends on the level of education and qualification of specialists. The following areas are important:

- Training of builders and engineers on the principles of "green building": Inclusion of topics on waste management and reuse of materials in educational programs of higher and vocational institutions**.**
- Promotion of circular economy practices: Conducting information campaigns, seminars and conferences to increase the understanding of all participants in the construction process about the benefits of reusing waste**.**
- Creation of online knowledge bases on the characteristics and reuse of DBM: Access to reliable information on the properties of waste, methods of their processing and areas of concern will contribute to the wider implementation of these practices [1, 3].

3.3. International experience

The experience of the European Union countries is a valuable reference point for Ukraine. In the EU countries, Zero Waste Construction pro-games are actively operating, providing for:

- Separate collection and labeling of all types of waste: A systematic approach to waste collection at the construction site, which greatly facilitates their subsequent sorting and processing**.**
- Mandatory audit of residual materials: Regular monitoring of the volume and composition of VDood allows you to optimize the processes of their formation and processing**.**
- Public-private partnership in the creation of recycling centers: Cooperation between the state and the private sector stimulates the development of processing infrastructure and creates favorable conditions for investment in this industry [1].

This approach not only reduces the environmental burden, but also creates new economic opportunities, turning waste into valuable resources.

Conclusion

In this work, an analysis of the properties, sources and possibilities of re-use of waste of dry building mixtures testifies to their high resource value. Under the conditions of proper assembly, sorting and processing, these materials can be effectively used in various areas of construction - from the formation of new mixtures to the manufacture of concrete products and the stabilization of foundations.

For the widespread implementation of such practices, it is necessary to create infrastructure: special-purpose processing lines, mobile crushing plants, a regulatory framework for the regulation of re-use. Along with this, it is important to provide professional training, information support and adaptation of European approaches - in particular, by implementing the principles of Zero Waste Construction.

Thus, the use of DBM waste is not only a step towards reducing environmental loading, but also a real tool to increase the economic efficiency of the construction industry.

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