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USE OF CONSTRUCTION WASTE CONCRETE FOR THE PREPARATION OF NEW BUILDING WALL MATERIALS

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Abstract

In this paper, the feasibility of using construction waste concrete to prepare new building wall materials is studied. In order to realize the maximum resource utilization of waste concrete, the chemical composition and properties of waste concrete raw materials were studied. The effects of different materials such as straw fiber and graphene oxide on the mechanical properties, water absorption and shrinkage of waste concrete are explored respectively.

Key words: construction waste, recycling of waste concrete, building wall materials, mechanical properties, cement, recycling.

INTRODUCTION

In recent years, with the economic and social development and the accelerating pace of urbanization, new projects and reconstruction of old buildings have produced a large amount of construction waste. The amount of construction waste in China has accounted for 30% - 40% of the total amount of urban waste. Based on the standard of 500-600 tons/10,000 square meters, by 2025, China will have an additional building area of about 30 billion square meters, and the newly generated construction waste will be a shocking figure[1-3]. If the traditional disposal method of landfill or open stacking is continued, it will cause greater damage to the ecosystem. With the increasing prominence of this problem and the emergence of the concept of circular economy, people gradually attach importance to the resource value of construction waste.

Many other countries require official proof that the waste is not recyclable when receiving waste at landfills. In Finnish legislation, the owner's individual responsibility for disposal is enshrined [4].

MAIN PART

The use of construction waste recycling technology in the production of structural and heat-insulating wall materials will allow to reduce the costs of expensive binders in raw material mixtures. Scientific developments provide for the application in construction practice of the resource-saving technology of forming wall materials using autoclaveless technology, which in turn allows to transform the obtained results in the conditions of the construction site without the use of special equipment and complex technologies [5].

Wall products with a hollow structure obtained using construction waste recycling technologies based on a mineral binder are significantly inferior in strength to autoclaved aerated concrete, but such material is allowed to be used for self-supporting structures of external walls and internal partitions. The obtained new solutions of the recipe and technological parameters of the production of artificial wall materials allow to reduce energy consumption due to the internal heating of the formed massif and intensification of the processes of chemical interactions of the components of the raw mixture and to improve the kinetics of gas formation in the formed massif. During the exothermy of the physical interaction and due to the increase in temperature of the array and the presence of chemically active components, the growth of the plastic strength of the formed porous array accelerates under normal production conditions [5].

In terms of quality and quantity, recycling of waste concrete is the main way to deal with construction waste. Therefore, most of the research focuses on the application of recycled concrete aggregate[6]. The recycling approach is narrow and the efficiency is low. There is less research on the application of waste concrete in new building wall materials.

In this theses, the feasibility of using construction waste concrete to prepare new building wall materials is studied. In order to realize the maximum resource utilization of waste concrete, the chemical composition and properties of waste concrete raw materials were studied. The effects of different materials such as straw fiber and graphene oxide on the mechanical properties, water absorption and shrinkage of waste concrete are explored respectively. Different silane coupling agents were used to modify straw fiber to determine the best modifier and concentration. By preparing graphene oxide (GO,

the same below) and ultrasonic dispersion with different water reducing agents, GO water reducing agent uniform dispersion is obtained. Recycled concrete blocks were prepared with recycled aggregate, cement, straw fiber, GO water reducer dispersion, etc. The effects of different raw materials on the properties of recycled concrete blocks were compared. The mechanism of different materials improving the mechanical properties of recycled block was obtained through microscopic characterization.

By analyzing and studying the chemical components and mechanical properties of waste concrete, the test results show that the content of SiO_2 in the waste concrete components is high, the content of calcium silicate hydrate in the XRD atlas is high, the water consumption for the standard consistency of waste concrete, the setting time and the stability meet the standard requirements, and the 28d strength of the mortar made when the waste concrete is mixed with 40% reaches 32.5 cement strength, indicating that the waste concrete itself has certain activity.

The mix proportion test results of new wall materials prepared from waste concrete show that the strength of the products prepared from waste concrete as a single silica raw material is too low, and the products with dry density of 624.19 kg/m^3 and compressive strength of 3.57 MPa are successfully prepared under the condition of mixing fly ash and waste concrete. The single factor test results show that the factors affecting the product performance, such as water material ratio, lime, cement, and aluminum powder content, have an optimal value respectively. When the water material ratio in the formula is 0.6, the lime content is 18%, the cement content is 12%, and the aluminum powder content is 0.09%, the product performance under each test condition corresponds to an optimal value respectively. When the waste concrete is milled for 55 min, it is the best to stimulate its activity; after calcining at high temperature, the activity of waste concrete is improved to a certain extent, and the activity of waste concrete increases with the increase of calcining temperature. At 900 ℃, the activity is the best, and the product strength is the largest; The strength of the product was improved to a certain extent after adding different proportions of SiO_2 powder.

CONCLUSION

The use of construction waste recycling involves a reduction in the number of vehicles for transporting waste, reduces the area for storage of construction waste, and controls the quality of secondary raw materials directly on the construction site. The positive economic aspect of recycling is the reduction of costs for extraction, transportation of natural resources, disposal of construction waste, and reduction in the price of final construction products. The feasibility of using construction waste concrete to prepare new building wall materials is studied. In order to realize the maximum resource utilization of waste concrete, the chemical composition and properties of waste concrete raw materials were studied.

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