Research on Polymer Materials Based on Building Material Recycling

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Abstract. With the rapid development of the social economy, polymer materials are widely used in various construction and production industries, and at the same time, a considerable amount of polymer material waste is also generated. Waste polymer materials pose a great threat to the environment. In today's world where both economic and environmental benefits are valued, how to recycle and utilize waste polymer materials is an important topic in the theoretical research of circular economy. This article focuses on the analysis and exploration of this topic, hoping to contribute to improving the application efficiency of recycling waste polymer materials in the construction industry.

Keywords: building materials; Waste polymer materials; Recycling

1 Introduction

In terms of theories related to the reuse of waste materials, Li Ling (2016) analyzed the artistic expression forms of metal waste materials in landscapes, specifically elaborated on how metal waste is used in design, and proposed protective measures for corrosion of metal waste materials. Yao Wanqiu (2017) Combining industrial waste materials with landscape design, this paper compares domestic cases in this field with the design made by myself using waste materials in the renovation of waste factories, and clarifies the cultural connotation of waste materials in landscape design. An Xiaoguang (2018) analyzed the types, sources, and application methods of recycled materials in landscape construction, and summarized the principles of the application of recycled materials: ecological principles, functional principles, artistic principles, economic principles, as well as the process of the application of recycled materials in landscape, including the formation of construction teams, site research, selection of recycled materials, design and construction of applied recycled material landscapes, and specific application pathways, Subsequently, evaluate the application of recycled materials in landscape, such as their value, problems and risks faced.

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Waste polymer materials are widely used in our daily lives, and various plastic products, rubber products, and fiber products are all processed and made from polymer materials. In the development process of social technology, the application of advanced science and technology in the application of polymer materials has become a development trend.[1] Facing the emergence of waste polymer materials, incorporating them into the application of building materials will have certain development value.

2 Method

The dry shrinkage is an important indicator in the utilization of waste concrete, and the dry shrinkage of recycled cement concrete increases by about 45% to 80% compared to general concrete. The basic characteristics of concrete and the quality of basic materials, combined with the proportion of recycled concrete materials, determine the value of the dry shrinkage rate of concrete. If there is more cement slurry in recycled concrete, the dry shrinkage rate of recycled concrete will become relatively large. The elasticity standard of recycled concrete is usually about 75% of that of conventional concrete. However, after adding plasticizing catalysts, recycled concrete will improve its elasticity index. According to the experimental results, the optimal amount of elasticity index increases correspondingly when the expansion agent is added, from (8%~11%) to (10%~12%).[2]

Due to the initial fragmentation treatment of waste concrete, hardened cement slurry will be mixed in these fragments in an independent manner, and there will be a small amount of naturally formed concrete surface. This makes the surface of recycled concrete uneven and rough, and the material density is not high, making it easy to absorb and retain water, without strong adhesion, The above factors are the fundamental reason why recycled concrete is inferior to natural base material concrete. In terms of concrete properties, the difference between the two is very obvious (see Table 1 for details):

Table 1. Physical properties of natural and recycled base materials

Aggregate type	10% crushing index (kg)	Apparent density (kg/m3)	Water absorption rate (%)		moisture content (%)	
			10mm	20mm	10mm	20mm
Natural granite	161.6	2601	1.24	1.22	0.50	0.62
Recycled NC aggregate	103.9	2351	8.63	7.80	3.72	3.61
Recycled HPC aggregate	122.7	2401	6.88	5.99	5.33	2.87

The process of recycling and utilizing waste concrete mainly includes: fragmentation, screening and separation, and cleaning and washing. After simple processing, it can be used as a raw material for preparing new concrete. Firstly, it can be reinforced with concrete, and secondly, it can be used for processing ground paving and relatively lightweight bricks; In addition, it can be directly used as a cushion layer in building construction and road construction, or as a foundation material for road base after screening.[3]

During the initial disassembly and splitting process of waste concrete, the strength of recycled foundation materials is affected by the presence of fragmented areas inside. Therefore, according to the different classification of recycled foundation materials for waste concrete, they are used in different levels of road and infrastructure engineering. There are some lightweight, low strength, and high impurity content waste concrete that can be used as road foundation bedding; After screening, the recycled foundation material of waste concrete can be mixed with other road construction materials to serve as the road base layer; A well configured recycled base material can be used to prepare pavement concrete.[4]

3 Results

By using the above technical means to scale up the treatment of abandoned concrete and provide materials for construction projects, the adopted technical means, facilities, equipment, and process flow are relatively simple, and the cost of the project is relatively low. It can also reduce the current cost of construction waste treatment, waste transportation costs, and the cost of purchasing materials again. In the later stage, it can also generate certain profits, which is economically and technically feasible. More importantly, in terms of environmental protection and resource conservation, it reflects the three major advantages of building concrete waste, namely resource intensification, harmless process, and product recycling. At present, the utilization of concrete waste in China is still in its early stage, and the key reason is the slow updating of construction concepts and social concepts that have been around for a long time. When conducting research on such technologies, relevant national institutions and urban planning and construction staff should provide assistance, guidance, and participate in the design of such research. At the same time, they should promote public opinion, formulate relevant assistance policies, and update technologies. It is necessary to quickly apply this technology to relevant fields as much as possible.[5]

4 Discuss

4.1 Using Waste Polymer Materials to Produce Building Wall Materials

The current national policy leans towards the development of new wall materials, including a series of measures that explicitly prohibit solid clay bricks, prompting the search for new material applications to develop new wall materials. In the experiment of exploring new composite materials, the application of waste polymer materials in

composite new wall materials has received certain attention. At present, the material composite technology using waste polymer materials is relatively mature and has been put into practical applications Plastic and glass composite bricks. This type of sample brick is a composite material sample brick produced through material composite technology using plastic and glass materials, and has been widely used in practical applications in construction engineering. The plastic composition types that form this composite material are mainly olefins and plastic materials composed of olefin and benzene compounds. In the material composite process, a glass composite material is used to achieve a material composite process where the particle shape of plastic remains unchanged, and the narrow size range and size distribution are relatively similar. This type of sample brick is fired at 235 ℃ under high pressure during the firing process of clay bricks. The glass percentage ratio is 15%, 30%, and 45%, and the resistance to fracture is tested when compared with ordinary clay bricks under a temperature change of about 50 ℃. It has a better resistance to fracture than ordinary clay bricks with a strength of 187%. When selecting the plastic raw materials required for this composite material, there is no need for the plastic material to have special requirements for thermoplastic and thermosetting properties, so the range of waste polymer plastic materials that can be recycled is wide Metal rubber composite concrete. Metal rubber composite concrete is actually produced by adding different strength metal materials, waste rubber materials, plastic materials, and other building materials and admixtures during the manufacturing process. Moreover, the combination of the aforementioned materials can achieve outstanding building performance, making it widely used in current construction. This material can solve wall cracking, cracks, sound insulation problems, and impact resistance defects in practical construction applications, demonstrating outstanding performance advantages. Therefore, this composite material is mainly used in road and bridge construction Composite concrete insulation blocks. Polystyrene plastic, which is currently used in large quantities and is often abandoned after use, is commonly known as plastic foam. It can be used in the processing of concrete thermal insulation blocks in the application of building materials to promote and enhance the compression resistance, sound insulation and thermal insulation functions of concrete thermal insulation blocks. It is widely used in wall materials in current construction. At present, polystyrene plastic is mainly added in the production process of concrete insulation blocks, and through this application, it plays a certain auxiliary role in improving the surface appearance density, compressive strength, and insulation of wall materials. [6]Due to the lightweight nature of polystyrene materials, adding polystyrene materials to insulation bricks will significantly improve the building utilization value of insulation blocks, resulting in relatively good application effects.

4.2 Using Waste Polymer Materials to Produce Building Decoration Materials

① Plastic decorative sheet. In the processing of decorative panels, it is often necessary to use special building materials that can meet the characteristics of indoor and outdoor building decoration. Therefore, building materials need to be selected according to different construction application environments. However, waste polymer materials,

due to their own characteristics, can often find a certain development and application space in the application of decorative panels in construction projects. Due to the strong plasticity of waste polymer materials, especially plastic materials, and their strong coloring advantages, plastic materials are often used for the molding process of decorative panels under certain requirements to produce decorative panels High flame retardant building decoration. Some plastic materials have strong flame retardancy after being mixed with additives, so this type of waste polymer material is often used to make high flame retardant door and window materials and high flame retardant building decoration materials after reasonable additive blending. In the selection of flame-retardant building materials, they have been widely used due to their obvious flame-retardant properties and lightweight advantages.

4.3 Production of other building materials from waste polymer materials

① Fly ash and waste polystyrene foam plastic particles are used to produce waterproof materials. According to the analysis of waterproof performance and mode data of waterproof materials currently used, if fly ash and waste polystyrene foam materials are mixed to form a new waterproof material, and quicklime gel and other materials with waterproof characteristics are added, a waterproof material with higher waterproof coefficient under specific pressure can be produced. After testing, it was found that the new waterproof material not only has higher insulation and waterproof performance, but also does not leak under a water pressure of 0.2MPa for half an hour. This is related to the low density, high strength, and other characteristics of this waterproof mixture material itself. It is a new waterproof product that is more environmentally friendly and meets waterproof standards Utilize waste hydrocarbon resin to produce plastic flooring. According to the processing process and standards of the floor, materials such as waste polyethylene were added to form a better plastic floor. According to the current market requirements for floor performance, plastic flooring produced from waste polyethylene has better adapted to the needs of different scenarios. Waste materials can also be used as processing raw materials for building materials such as plastic greenhouse films or pipes, Very versatile Pan. Because this type of plastic contains a special halide inside, its value will be limited during processing and recycling. With the continuous development and upgrading of processing technology, more environmentally friendly and harmful production processes have emerged. This processing method can effectively control production costs and achieve targeted treatment of waste polyolefin resins, avoiding various limitations in the material processing process Question. ③ Utilize recycled agricultural film and wood chips to composite into plastic wood. Due to the rapid development of China's agricultural economy, more agricultural production processes use agricultural film. At this time, recycled agricultural film and wood chips are mixed to form plastic wood, forming a better building material. Compared with natural wood, this material has more stable physical properties, as well as higher moisture and corrosion resistance, making it less susceptible to being eaten by insects such as aphids. It ensures a longer lifespan while reducing processing costs.

5 Conclusion

In the process of recycling different waste polymer materials, it is necessary to fully consider the physical and chemical characteristics of different polymer materials, reduce environmental pollution, and effectively control production and processing costs, ultimately forming special materials that are more suitable for use in the construction field. Continuously optimizing and improving the utilization range and approaches of polymer materials can enable the construction industry to obtain more new materials. This method ensures the efficient recycling of limited resources, maintains a stable economic development trend, ensures a balanced ecological environment, effectively controls the current economic development trend, and allows the construction industry to have broader development space and prospects.

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