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Study on the Influence of Iron Tailings Powder on the Performance of Brick-concrete Recycled Concrete

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Abstract

With the development of urbanization and the advancement of urban renewal, the amount of construction waste generated in our country is increasing, and the consumption of concrete has also been greatly increased, resulting in a large consumption of natural sand and gravel. At the same time, the urban space is compressed in a large area, and the city appearance is also affected threatened. In order to avoid the deterioration of this situation, this paper uses the demolition waste of brick-concrete structures as raw materials to conduct research on brick-concrete recycled aggregate concrete. This experiment adopted a method of combining literature analysis and experimental research, and designed the replacement rate of recycled coarse aggregate to be 20%, 40%, 60%, and 80% as a group of recycled concrete. A group of recycled concrete mixed with waste brick aggregate and mineral powder at a ratio of 1:1 and the mixing amount is 10%, 20%, 30%, and 40%. And a set of ordinary concrete. Taking the amount of mineral powder and the replacement rate of recycled coarse aggregate as the influencing factors, the compressive strength of the specimens cured for 7d and 28d of mineral powder was tested.

Keywords

Brick-concrete recycled aggregate concrete; Construction rubbish, Mix ratio; Compressive strength.

1. Introduction

With the continuous enhancement of my country's economic strength, the scale of cities and towns is also expanding, and many areas are gradually entering the peak period of construction. The transformation of old communities, the demolition of households, the construction of roads, the expansion of commercial buildings, etc., have caused the amount of construction waste to increase year by year, and the consumption of concrete has also increased. If materials that can replace concrete cannot be found as soon as possible, my country's ecological environment will be unbalanced due to the massive consumption of natural sand and gravel, which will seriously affect the implementation of sustainable development strategies. Brick-concrete construction waste recycled aggregate refers to the recycled aggregate made from the demolition of brick-concrete structure buildings after sorting, crushing, and screening. The main components are crushed concrete particles, crushed clay brick particles, and natural crushed materials. Sand, gravel, muck, etc. Therefore, researchers began to try to turn waste into treasure and use construction waste to develop new types of renewable concrete.

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2. Development Significance of Brick-concrete Recycled Aggregate Concrete

2.1. Definition of Brick-concrete Recycled Aggregate Concrete

Brick-concrete recycled concrete refers to the renewable type of concrete formed by replacing natural sand and gravel with brick-concrete construction waste recycled aggregate and mixing it into concrete in a certain proportion.

2.2. Development Significance of brick-concrete Recycled Aggregate Concrete

The accompanying product of the increase in economic strength is urban expansion, which in turn will trigger the rise of construction trends, which will generate a large amount of construction waste, and in the process of national economic development, the amount of construction waste will only increase and not decrease.

Unfortunately, my country is currently at this stage, and the annual output of construction waste is close to 2.5 billion tons. What's more serious is that my country's urban renewal progress has just begun. Nearly half of the buildings are built in the last century, and the building materials are clay bricks. This means that my country's construction waste output will still see a significant increase.

Up to now, our country's annual concrete consumption has exceeded one billion cubic meters, ranking first in the world. Although our country is vast and rich in geography and landforms, according to this consumption capacity, our country's natural sand and gravel reserves are still exhausted.

Therefore, my country has only carried out the research and development of brick-concrete recycled concrete, which can not only turn waste into treasure, expand the available space of the city, regularize the city appearance, but also reduce the consumption of natural sand and gravel. This is currently the most sustainable urbanization policy.

3. Performance Test of Brick-concrete Recycled Aggregate Concrete

3.1. Test Raw Materials and Program Design

Raw materials: Common specification concrete, tap water, brick-concrete construction waste, recycled coarse aggregate, mineral powder.

Test plan design: Three groups of experimental subjects were set up in this experiment. Among them, the replacement rate of recycled coarse aggregate was 20%, 40%, 60%, 80% of brick-concrete recycled concrete, and brick-concrete recycled coarse aggregate and mineral powder were compounded in a ratio of 1:1. Brick-concrete recycled concrete mixed with 10%, 20%, 30%, and 40% were the experimental group, and ordinary concrete without brick-concrete construction waste recycled aggregate was the control group. The variable factors in this experiment are the amount of mineral powder added and the replacement rate of brick-concrete recycled coarse aggregate.

Firstly, a certain number of samples are distinguished and extracted from the three groups of concrete, and they are respectively made into cube test blocks, named RA, RB, RC, and then placed in mineral powder for natural curing for a period of time, and then subjected to compression test.

3.2. Compressive Strength Test

In this test, test samples with curing periods of 7d and 28d were selected from the three groups of test products of RA, RB, and RC, and then related tests were carried out according to the mechanical measurement methods recorded in the literature to obtain the relevant

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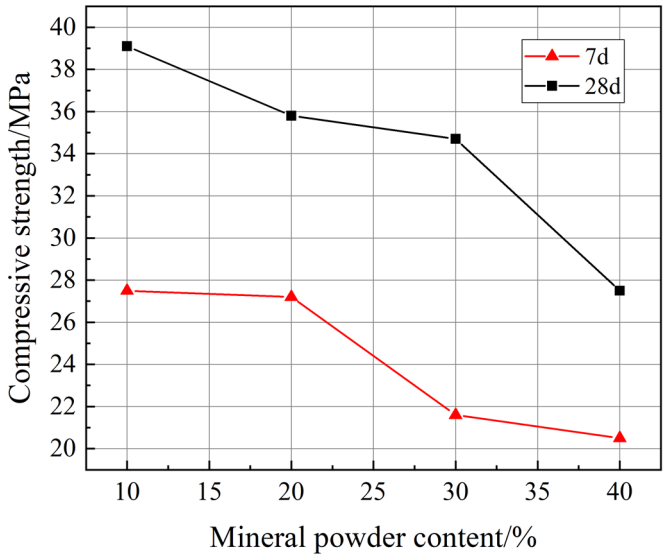
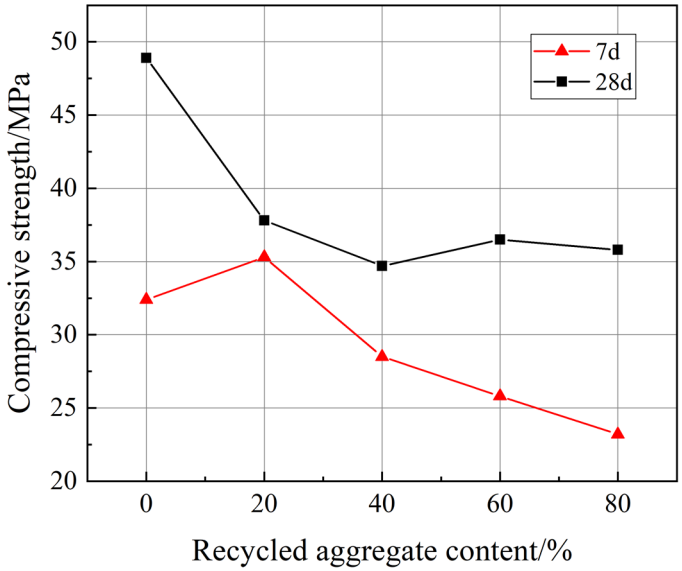
compressive strength and elastic modulus, Peak stress, peak strain, and stress-strain relationship data.

3.2.1. Relationship between Stress Resistance and Maintenance Age

According to the data shown in Figure 1, it is not difficult to see that when all variables are in the same state, the compressive strength of the sample cured for 28 days is much better than that of the sample cured for 7 days. Although it is impossible to prove that the curing time has a linear relationship with the compressive strength of the sample, one thing is certain, that is, there is a positive correlation between both of them.



(a) Relationship between mineral powder content and compressive strength



(b) Relationship between the amount of recycled aggregate and the compressive strength

Figure 1. Test results

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3.2.2. Relationship between Compressive Capacity and the Amount of Mineral Powder Mixed

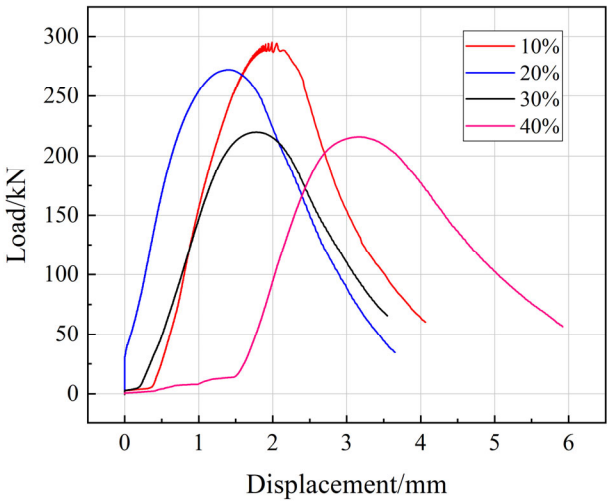

Figure 2. Relationship between load and displacement under different mineral powder content

According to the data in Figure 2, when the mineral powder content is 10%, the peak stress is the strongest, followed by the mineral powder content of 20%, followed by 30%, and finally 40%, which shows the compressive strength of the brick-concrete recycled concrete The peak value is inversely proportional to the mineral powder content. In addition, the content of mineral powder is 20%, the peak strain capacity is the best, followed by the content of 40%, and the worst is the content of 10%.

In summary, when the mineral powder content is 20%, the compressive strength of recycled concrete is the most stable, the endurance is the most durable, and it is most suitable for use as a building material.

3.2.3. The Relationship Between Compressive Capacity and Replacement Rate of Brick-concrete Recycled Coarse Aggregate

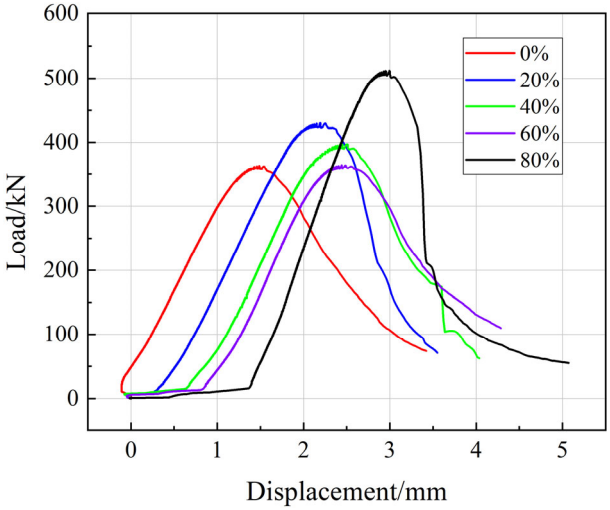

Figure 3. Relationship between load and displacement under different recycled aggregate content

From the data in Figure 3, it can be seen that when the replacement rate of the recycled coarse aggregate of brick-concrete is 20%, the peak compressive strength of recycled brick-concrete

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concrete is the highest, but even this still does not exceed the compressive peak of ordinary concrete. The compressive capacity of concrete and recycled brick-concrete concrete is close.

Furthermore, the peak strain capacity of ordinary concrete is not as good as brick-concrete recycled concrete, which shows that brick-concrete recycled concrete is superior to ordinary concrete in terms of durability.

Therefore, in a low-pressure environment, brick-concrete recycled concrete can completely replace ordinary concrete, but its resistance will be considerably improved.

4. Conclusions and Suggestions

Conclusions:

A. According to the test results of single admixture test, compared with waste aggregate, the admixture of mineral powder will have a negative impact on the strength of concrete. As part of the gelling material is replaced, the hydration process of the active admixture is delayed and the strength is reduced. However, the incorporation of waste aggregates can play a role in replacing aggregates, so both the early strength and the standard curing age strength are higher than the single-mixed mineral powder group.

B. The peak stress is the strongest when the mixing amount of mineral powder is 10% and the replacement rate of recycled aggregate is 20%, respectively, 280kN and 300kN. However, considering the relationship of deformation and displacement, 20% of mineral powder is appropriate.

Suggestions:

Compared with western developed countries, our country has less understanding of brick-concrete recycled aggregate concrete, started late, and is still in the experimental stage. It is imperative that brick-concrete recycled concrete replace ordinary concrete and become the main material of construction in my country. Because it can not only alleviate the massive consumption of natural sand and gravel, is in line with the sustainable development strategy, but also plays an important role in protecting the stability of our country's ecosystem.

Author believes that researchers will be able to break through various difficulties and improve the development process of brick-concrete recycled concrete, so that it will replace the existing ordinary concrete on the market as soon as possible and become the mainstream of the construction industry.

Acknowledgments

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