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WASTE VALORIZATION IN CONSTRUCTION: A REVIEW ON EXAMINING THE ROLE OF MARBLE POWDER IN GREEN CONCRETE

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Abstract
The construction industry is a significant contributor to environmental degradation, and find sustainable alternatives for traditional construction materials is imperative. This research paper explores the potential of incorporating waste marble powder as a partial replacement for cement in concrete production. Marble processing industries generate a substantial amount of WMP as a byproduct, leading to environmental challenges if not managed effectively. This study investigates the physical and mechanical properties of concrete mixes with varying proportions of WMP, aiming to assess its impact on strength, durability, and workability. The research contributes to the growing body of knowledge on sustainable construction materials and provides insights into the potential of WMP as a valuable resource in reducing the environmental impact of the construction industry. The outcomes of this study can inform construction practices, promote waste minimization, and contribute to the development of eco-friendly construction materials.

Keywords:
WMP, sustainability, workability, durability.

Introduction

Construction is essential, but it often leads to a lot of waste and environmental concerns. In the world of construction, waste and environmental impact are big challenges. This study explores a solution by using waste marble powder in making concrete, a common building material. Marble factories create a lot of this powder, and instead of letting waste, the study is investigating if it can be used to make our building better. If we can replace a part of cement in concrete with waste marble powder and still get the same strength, it could be a game-changer. This research aims to find out if this approach is not only good for the environment but also practical for construction. By tuning waste into a useful resource, the study hopes to contribute to more sustainable and eco-friendly building practices.

Aim and objectives of the study

The aim of this research is to investigate the feasibility and effectiveness of utilizing waste marble powder as a partial replacement for cement in concrete, with the overarching goal of promoting sustainable practices in the construction industry. The objectives of the study are as follows:

1. Conduct a comprehensive analysis of the physical and chemical properties of waste marble powder generated by marble processing industries to understand its composition and potential impact on concrete properties.
2. Determine the optimal percentage of WMP replacement for cement on concrete mixes through a systemic series of experiments, considering factors such as compressive strength, durability, and workability.
3. Conduct compressive strength test on concrete specimens containing varying proportions of WMP to assess the mechanical performance of the modified concrete compared to conventional concrete.
4. Investigate the impact of WMP incorporation on the durability of concrete, including resistance to water absorption, Chloride penetration, and other factors affecting long-term performance.

5. Evaluate the workability and rheological properties of fresh concrete mixes with WMP to ensure that the modified concrete remains practical and easy to handle during construction.
6. Assess the environmental benefits and drawbacks associated with the use of WMP in concrete, considering factors such as reduced carbon footprint, energy consumption, and overall sustainability.
7. Analyse the economic aspect of incorporating WMP in concrete production, considering the potential cost savings or additional expenses associated with its use.
8. Based on the study findings, offer practical recommendations for the implementation of waste marble powder in concrete mixes, addressing challenges and suggesting guidelines for sustainable construction practices.

Literature review

The effects of crushed stone dust, which includes marble dust, on various properties of concrete were studied in the research. The influence of these dusts on workability, compressive strength, and durability was discussed, laying the foundation for understanding the impact of marble powder on concrete [1]. The use of waste marble aggregates in concrete was explored in the study. The mechanical and durability properties of concrete mixes incorporating marble aggregates were investigated, providing insights into the potential benefits of using larger marble particles in the concrete matrix [2]. The effect of using marble powder as a fine aggregate in concrete was investigated by the authors. The compressive strength, flexural strength, and workability of concrete mixes were evaluated in the study, shedding light on the potential benefits and challenges associated with this specific application [3]. An overview of the existing research on the use of waste marble powder in concrete was provided by this review. Various methods of incorporating marble powder, the effects on concrete properties, and gaps in current knowledge were discussed, paving the way for further investigations [4]. The influence of marble powder on the properties of mortar and concrete mixes was explored in this research. The focus of the study was on the mechanical properties, durability, and microstructure of the modified mixes, providing valuable information on the performance of marble powder in compositions [5]. The properties of concrete containing waste marble sludge powder and concrete dust were investigated in the study. The potential benefits and challenges associated with these waste materials were explored, offering insights into their impact on concrete characteristics [6].

Benefits of using waste marble powder in concrete

The study attempts to promote the adoption of environmentally friendly and economically viable practices in the construction sector, contributing to the overall sustainability of the built environment. The following are the various benefits of using waste marble powder in concrete:
1. Utilizing WMP as a partial replacement for cement in concrete contributes to the reduction of waste generated by the marble processing industry, promoting sustainable waste management practices.
2. The incorporation of WMP may lead to a decrease in the carbon footprint associated with concrete production, as it reduces the demand for traditional cement, which is a significant source of carbon dioxide emissions.
3. By repurposing waste marble powder, the study promotes the efficient utilization of natural resources, transforming a byproduct into a valuable material for construction.
4. The optimal proportions of WMP in concrete can enhance certain mechanical and durability properties of concrete, potentially leading to more robust and durable structures.
5. The use of WMP can contribute to the reduction of water absorption and chloride penetration, thereby improving the concrete's resistance to environmental factors.
6. The study explores the economic implications of using WMP in concrete production, potentially identifying cost-effective solution for the construction industry by utilizing a waste material as a partial cement replacement.

7. The outcomes of the research can provide valuable guidelines for the construction industry, encouraging the adoption of sustainable practices and the integration of alternative materials in concrete production.
8. The use of WMP can ensure that the modified concrete maintains adequate workability and practicality during construction activities, thus facilitating its use in real-world applications.
9. The study may contribute to the academic understanding of sustainable construction materials by providing insights into the performance of concrete mixes incorporating waste marble powder.
10. The findings may serve as a basis for the development of new construction standards, codes or practices, potentially leading to the wider adoption of waste marble powder in concrete industry.

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