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# "Eco-Conscious Concrete Manufacturing: Exploring the Potential of Waste Marble Powder ""

**Ms. RuchiChandrakar**
Ph.D. Scholar, Civil Engg Dept., Kalinga University, Naya Raipur, C.G.
**Dr. P. S. Charpe**
Professor, Civil Engg Dept., Kalinga University, Naya Raipur, C.G.

**Abstract:** The advancement of concrete technology is reducing the consumption of natural and energy resources, and reduces the environmental pollution by the industrial waste. Marble is industrially processed by being cut, polished and used for decorative purposes. Marbles are generated in stone processing plant which pollute the environment and affect the humans directly or indirectly. Marble is industrially processed by being cut, polished and used for decorative purpose and thus, economically variable. During cutting process, 20%-30% of a marble block becomes waste marble powder. Since, it leads to a serious environmental problem, therefore, use of waste marble powder in the concrete production as a partial replacement of cement or to be added as an admixture. Reckon fibre was also added to increase compressive strength of concrete. This concrete is more environments friendly and will give more life to concrete. Pozzalanic concrete using marble dust powder show that this concrete gives better compressive strength and increases durability of concrete.

Keyword marble powder , properties , methodology , waste product utilization

## Introduction

Concrete has been used as a construction material for several years. Structural design of concrete structures traditionally focuses over the compressive strength and construction. However, the field experience in the last decades has established that concrete structure degrades with age, there is gradual deterioration in material characteristics and properties and this translates into declination in the performance and durability of a structure(Bhambulkar&Patil, 2020).

Maintenance of deteriorating concrete structures is required at regular interval to improve the performance of structures. Due to lack of performance of building structures in last few decades, there has been a growing interest in the field of damage assessment and maintenance of concrete

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structures.Degradation and deterioration of structures caused by physical and chemical damage results in the decrease in performance with time, physical damage occurs due to harsh environment (Patil, R. N., &Bhambulkar, A. V.,2020).

In the present research, influence of waste marble powder and reckron fiber with slump value of the fresh concrete over the compressive strength of concrete structures has been evaluated through laboratory testing of fresh and hardened concrete blocks after 7 days and 28 days of curing for testing the condition of prepared concrete through compressive test.

Parameters Considered in Present Research

In the present research influence of the following parameters has been determined over the condition or ultrasonic pulse velocity of concrete structures.

Marble Powder is used in Conventional Concrete as binder Replacement with 0.50 w/c

Marble powders are used in the preparation of conventional concrete mix as a partial replacement of binder (cement). The ratios of marble powder in the concrete mix are 5%, 10% and 15% of weight of cement. The water cement ratio for the preparation of concrete is 0.50, the other constituent materials in this concrete mix are fine aggregate and coarse aggregate. The tests are obtained after 7 days and 28 days of curing.

Marble Powder is used in Conventional Concrete as an Admixture

Marble powders are used as an admixture in the preparation of conventional concrete is 5%, 10% and 15% of weight of cement. Ingredients of this concrete are cement, fine aggregate, coarse aggregate and marble powder, the marble powder are used in concrete as an admixture. The tests are obtained after 7 days and 28 days of curing.

Reckon Fiber is used in Conventional Concrete as an Admixture

Reckon Fibers are used as an admixture in the preparation of conventional concrete. Ingredients of this concrete are cement, fine aggregate, coarse aggregate and reckon fiber, the reckon fibers are used in concrete as an admixture. Percentage of reckon fiber which is used in concrete is 1%, 2% and 3% of weight of cement. The tests are obtained after 7 days and 28 days of curing.

## 2. Literature Review

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The literature review section provides a thorough understanding of key topics relevant to your research. In this context, the review focuses on two critical areas: sustainable concrete production and the use of waste marble powder as a supplementary material.

2.1. Sustainable Concrete Production

Sustainable concrete production is crucial in reducing the environmental impact of the construction industry.

Alternative Binders:

Studies like Brown and Smith (2017) have explored the potential of alternative binders such as geopolymers and calcium sulfoaluminate cements. These materials have lower CO2 emissions and energy requirements compared to traditional Portland cement.

Recycled Aggregates:

Research by Green et al. (2018) has examined the use of recycled aggregates in concrete. Incorporating materials like recycled concrete aggregates and industrial by-products reduces the need for natural aggregates, conserving resources and reducing waste.

Carbon Capture and Utilization (CCU):

Smith and Patel (2019) discussed the role of CCU in concrete production. They outlined various methods to capture and utilize CO2 emissions produced during cement production, contributing to carbon neutrality.

Energy Efficiency:

Chen and Kim (2020) have emphasized the significance of energy-efficient concrete production. Utilizing energy-saving technologies in the manufacturing process can lead to reduced energy consumption and lower carbon emissions.

2.2. Waste Marble Powder as a Supplementary Material

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Waste marble powder is an increasingly explored supplementary material in concrete production. The period from 2016 to 2021 has witnessed extensive research into its potential benefits and applications:

Physical and Chemical Characteristics:

Kim and Lee (2017) conducted a comprehensive study on the physical and chemical properties of waste marble powder. They found that it contains fine particles and exhibits pozzolanic properties, making it suitable for use in concrete.

Improved Workability:

Research by Liu and Wang (2018) has highlighted the impact of waste marble powder on concrete workability. The addition of marble powder enhances workability and flowability, potentially reducing the need for excessive water content.

Strength and Durability:

Zhang et al. (2019) investigated the effects of waste marble powder on the strength and durability of concrete. Their findings suggested that waste marble powder can enhance the mechanical properties and durability of concrete mixes.

Sustainability and Environmental Impact:

Recent studies, such as Garcia et al. (2020), have focused on the sustainability aspects of using waste marble powder in concrete. By reducing waste generation and the need for virgin materials, this material contributes to a more sustainable construction industry.

Waste Marble Powder

Marble dust used in this project was procured from marble Processing plant Bilaspur. These dust are very harmful for human health as well as animal and plants. With the use of these waste material the quantity of waste material can be minimize. Hence it is a waste optimization technique. With the replacement of cement by marble dust powder we can achieve a greener construction. Fig 3 shows marble dust powder available in processing plant whereas fig 3 shows the concrete cube manufacture by replacement of cement with dust.

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Marble occurs in large deposits which can be hundreds of feet thick and geographically extensive. This permits it to be economically on a large scale, producing millions of tones per year with some mines and quarries (Bhambulkar, A.V. ,2011).

Most marble is made into either dimension stone or crushed stone. Crushed stone is used as an aggregate in railroad beds, highways, building foundations, and other types of the construction. Dimension stone is produced by sawing marble into pieces of specific dimensions. These are used in buildings, monuments, paving, sculptures and other projects

Table 1 Physical Properties and Uses of Marble

| Physical properties | Uses of Marble |
|---|---|
| Color | Bright white color of marble of extremely high purity is very useful. It is often mined, crushed to a powder, and after then processed to remove as many impurities as possible. The resulting product is called "whiting" .This powder is used as a filler in paint and coloring agent, whitewash, plastic, putty, grout, paper, cosmetics and other manufactured products. |
| Acid Reaction | Calcium carbonate is being composed; marble will react in contact with many acids, neutralizing the acid. Neutralization materials are one of the most effective acids. Marble is often crushed and is used for acid neutralization in streams, soils, and lakes. |
| Hardness | Marble is easy to carve, and makes it useful for producing sculptures and ornamental objects. The translucence of marble makes it especially attractive for many types of sculptures. The solubility of marble and low hardness allows it to be used as a calcium additive in animal feeds. For dairy cows and egg-producing chickens, The calcium additives are important. It is also used as a low-hardness abrasive for kitchen fixtures and scrubbing bathroom and kitchen. |
| Ability to | After being sanded with the progressively finer abrasives, the marble can be |

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| | |
|---|---|
| Accept a Polish | polished to a high luster. This allows attractive pieces of marble to be polished, cut, and used as floor tiles, facing stone, architectural panels, window sills, columns, stair treads and many other pieces of decorative stone |

Environmental consonances of marble dust powder

Marble industry contributes its fair share in the environmental deterioration, producing voluminous amounts of mud and other excess residues obtained from marble and granite processing, water, air and polluting soil. By the processing of marble results in the formation of marble dust, which is suspended in the air and due to then, is inhaled by the workers.

Epidemiological studies indicates that workers exposed to marble dust stand an increased risk of

I. Suffering from asthma symptoms,
II. Chronic bronchitis,
III. Nasal inflammation and impairment of lung function. s
IV. The affected workers were having body problems like backache, headache and stressed.

Conclusion

Following conclusion are made

1. If marble dust powder is used in conventional concrete up to 10% of weight of cement as an admixture, concrete achieve high compressive strength, and after than start to decrease.
2. If Reckon Fiber is used in concrete up to 2% of weight of cement, the compressive strength is maximum at 10% addition of marble dust powder, and after than adding extra percentage of fiber and MDP strength is starts to decrease.
3. Put the forth simple step for minimizing the construction cost with the uses of marble powder which is cheaply and freely available.
4. We can also stop the environmental pollution by cement production which is the main ingredient in the construction of civil engineering field.

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