

Substitution of Cement by Marble Dust in Concrete

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Abstract—The waste produced from the industries cause ecological issues. Consequently the re use of the waste material can be under line. Marble Dust Powder (MDP) is a creating composite material that will permit the concrete industry to upgrade material utilize, produce financial advantages and construct structures that will solid, strong and delicate to environment. MDP is result gotten amid the quarrying procedure from the parent marble rock; which contains high calcium oxide substations of over half the potential utilization of MDP can be a perfect decision for substitution in a cementitious binder as the reactivity effectiveness increments because of the nearness of lime. In this research work, the waste MDP passing through 90 microns IS sieve, has utilize for exploring of solidified solid properties. Besides, the impact of various at substitution of MDP on the compressive strength and flexural strength has been watched. In this exploring examination the impact of MDP in concrete on quality is exhibited. Five concrete mixtures containing 0%, 10%, 15%, 20%, 25% MDP as cement substitution by weight premise has been readied. Water cement ratio (0.512) was kept consistent, in all the concrete mix. Compressive strength, split tensile strength and flexural strength of the concrete mix has been acquired at 7 and 28 days.

Keywords—Marble Dust Powder (MDP), Cement, Compressive Strength, Split Tensile Strength, Flexural Strength.

I. INTRODUCTION

Concrete is a broadly utilized crucial material in the development world. Delivering concrete in enormous sum in production lines straight for wardly impacts the greenhouse gases discharge. Decrease in getting great quality lime stone straight for wardly influence the creation of good quality cement higher cement sub stains of high strength concrete fundamentally influences the strength at the solidified state because of shrinkage and grater evaluations of heat of hydration. The cost of development likewise gets heightened and further more leaving the waste materials to nature.

Mixed concrete in light of the incomplete substitution of Portland cement clinker (PC) by wastage have been the subject of numerous investigation as of late. The progression of concrete technology can diminish the

utilization of natural resources and energy sources decrease the weight of contaminations on environment. The utilization of substitution material offer cost lessening, energy saving, apparently predominant items and less dangers in the environment.

1.1 Objectives of research

Goal of research in this task our principal objectives is to think about the impact of half way supplanting of cement with MDP. The compressive strength, tensile strength and flexural strength of normal M25 grade of concrete are gotten. So also compressive strength, tensile strength and flexural strength were acquired for 10%, 15%, 20% and 25% replacement of cement with MDP by weight. The water cement ratio (0.512) kept consistent all through the examination of this task work.

- To consider the physical properties of marble dust powder
- To describe the molecule size of Marble dust powder
- MDP as a substitution of concrete material.
- To think about the impact of MDP incorporation on the properties of cement.

II. LITERATURE REVIEW

The point of this research is to grow high quality concrete with the usage of a waste item MDP. MDP has great pozzolanic activity and is a decent material for the creation of concrete. Also now a days beginnings of the considerable uses of MDP is in different basic fields as in R.C.C which is picking up popularity due to its constructive outcome on different properties of cement.

- Saboya et al. (2007) studied the use of the marble powder by product to enhance the properties of brick ceramic. In general, the ornamental stone industries have fine rock powder as by product that might be suitable to be used in civil engineering construction purposes. Therefore, this work intents to discuss about technical aspects concerning the use of this material, which derives from sawing of operation of marble rocks, the study has been carried out using clayey soils from the municipal district of campus in rio de janeiro, brazil, where

more than 130 ceramic industries are settled, which are potential consumers such a waste.[1]

- Hanifi binici et al. (2008) investigated the durability of concrete made with granite and marble as recycled aggregate. The ornamental stone industries in turkey produces vast amount of by product rock waste (marble, granite) that could be used in concrete production suitable for construction purposes. This work was highlighted the durability of concrete made with granite and marble as coarse aggregate. River sand and ground blast furnace slag (GBFS) were used as fine aggregate. The result were compared with those of conventional concrete.[2]
- Kursat esat alyamac and ragip ince (2009) investigated the preliminary concrete design for self compacting concrete (SCC) with marble powders. The marble has been commonly used as a building material since ancient time. Disposal of the waste material in the marble industry, consisting of very fine powder, is one of the environmental problems worldwide today. However, these waste materials can be successfully and economically utilized to improve sum properties of fresh and hardened concrete.[3]

III. PHYSICAL PROPERTIES OF MATERIAL

3.1 Cement

In the mix the ordinary Portland cement was used. The ordinary Portland cement with confirming to BIS (IS: 8112-1983) was used in the entire research study detail of physical property of cement is given in table no 1. This cement are used with marble dust powder.

Table.1: Physical Properties of Cement

Properties	Test method	Result
Initial settings time	Vicat apparatus (IS:4031 Part-4)	75 minutes
Final setting time	Vicat apparatus (IS:4031Part-4)	255 minutes
Normal consistency	Vicat apparatus (IS:4031Part-4)	32%
Specific gravity	Specific gravity bottle (IS:4031Part-5)	3.14
Fineness	Sieve test on sieve no 9 (IS:4031PART-2)	2.83% retain on 90 micron IS sieve
soundness	Le chatlier method (IS: 4031Part-3)	Expansion 3mm

3.2 Fine aggregate and coarse aggregate

Table.2: physical properties of fine and coarse aggregate

Properties	Fine aggregate	Coarse aggregate
Size	4.75mm	20mm
Specific gravity	2.69	2.79
Water absorption (%)	4.5	2.50
Fineness modulus	1.75	6.1

3.3 Marble dust powder

One of the real waste created in the stone industries amid cutting, forming, and cleaning of marbles is the MDP. Amid this procedure around 20-25% of the procedure marble is transform into the powder. India being the third (around 10%) top most exporter of marble on the planet, consistently millions tons of marble waste frame preparing plants are discharge because of the accessibility of extensive amount of waste delivered in the marble industrial facility. The physical and synthetic properties of MDP are given in Table 3.



Fig.1: Marble dust powder

Table.3: Physical properties of marble dust powder

Properties	Results
specific gravity	2.60
Colour	White
Form	Powder
Odour	Odourless
Sieve	90 micron

IV. RESULT AND DISCUSSION

4.1 Compressive strength test

The test is performing on compression testing machine. Compressive strength tried on cube at various level of MDP is content in concrete the strength of concrete has been tested on 7 days and 28 days curing with substitution of MDP in percentage, in solid the cube tested has been 7 days led to check the pick-up in starting strength of concrete and 28 days test gives the information the definite strength of concrete at 28 days curing. Compression testing machine is utilized for testing the compressive strength test on concrete.

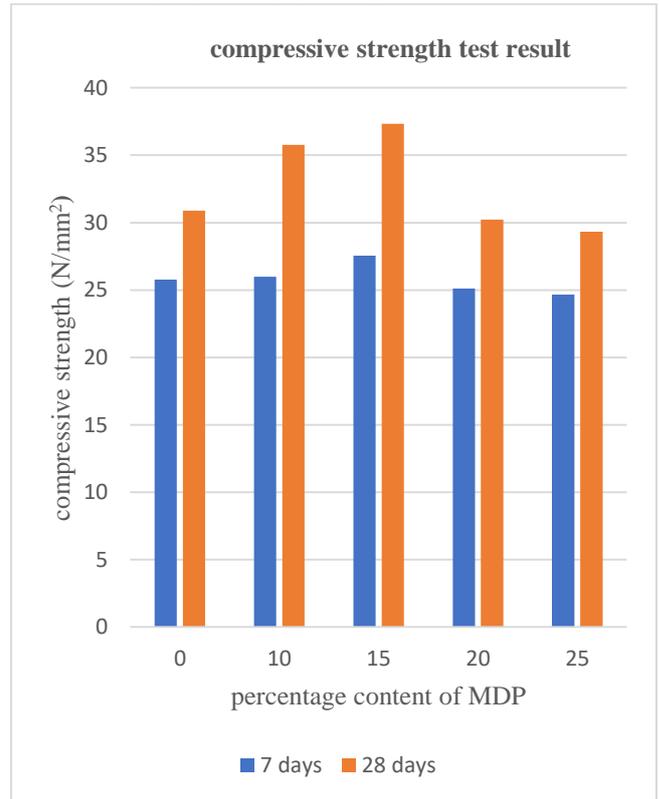


Fig. 2: Testing of cube

Table.4: compressive strength test result

Percentage of replacement	Compressive strength at 7 days (N/mm ²)	Compressive strength at 28 days (N/mm ²)
0%	25.77	30.88
10%	26	35.77
15%	27.55	37.33
20%	25.11	30.22
25%	24.66	29.33

Graph.4: Percentage content of MDP v/s Compressive strength (N/mm²) of M25 grade of concrete



4.2 Split tensile strength

The test is perform on compression testing machine. The results are written in table no. 5. The cylindrical specimen is placed horizontally between the loading surface of compression testing machine and load is applied till failure of the cylinder the plywood as a packing material for the avoid any sudden loading. The split tensile strength is computed from the following formula. [4]

$$T = \frac{2P}{\pi LD}$$

Where;

T=tensile strength

P=maxi. Load in newton applied to the specimen

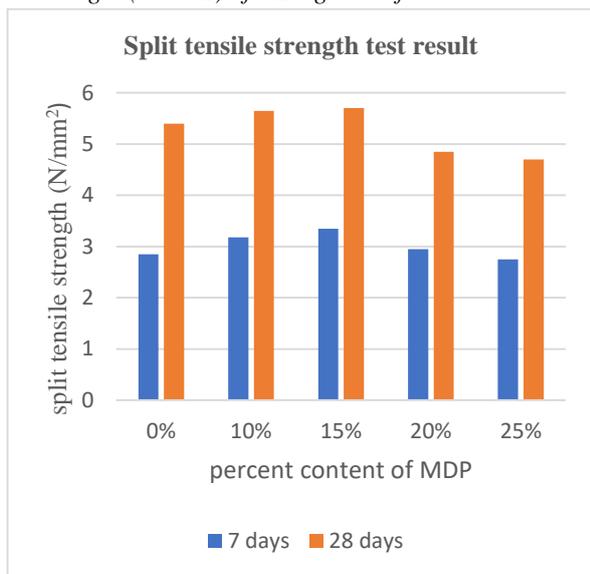
L=length of specimen in mm

D=dimension of the specimen in mm

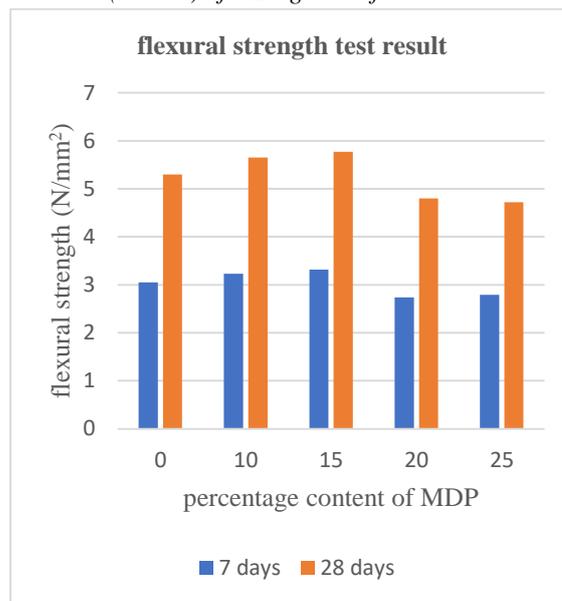
Table.5: split tensile strength result

Percentage of replacement	Split tensile strength at 7 days (N/mm ²)	Split tensile strength at 28 days (N/mm ²)
0%	2.85	5.40
10%	3.18	5.65
15%	3.35	5.70
20%	2.95	4.85
25%	2.75	4.70

Graph.5: Percentage content of MDP v/s Split tensile strength (N/mm²) of M25 grade of concrete



Graph.6: Percentage content of MDP v/s Flexural strength (N/mm²) of M25 grade of concrete



4.3 flexural strength test

The flexural strength test is done according to the IS: 516-1959. The outcomes demonstrate that flexural strength of marble mix concrete increment with expansion of the waste marble proportion in these mix. This pattern can again be credited to the way that marble dust has solidifying properties.

Table.6: flexural strength test result

Percentage of replacement	Flexural strength at 7 days (N/mm ²)	Flexural strength at 28 days (N/mm ²)
0%	3.05	5.30
10%	3.23	5.65
15%	3.32	5.77
20%	2.74	4.80
25%	2.79	4.72

V. CONCLUSION

- The compressive strength are increased with addition of waste marble dust 15% replacement by weight of cement.
- The split tensile strength of concrete in increases up to 15% replacement of cement by marble dust.
- The flexural strength increases up to 15% replacement of cement by marble dust.
- The any addition of marble dust the compressive strength, split tensile strength, flexural strength are decreases.
- It is concluded that the marble dust use as a replacement material of cement and 10% of addition of marble dust in cement are gives an excellent result in strength as compared to normal concrete.
- Result of this research that the marble could be used in making good quality concrete and use of marble dust are in construction is very beneficial for saving environment.

VI. SCOPE OF THE FUTURE WORK

This task was for the most part centred around the partial replacement of ordinary Portland cement bond with marble dust powder at various rate on different properties and employments of marble dust powder sooner rather than later to make this a valuable building material to enhance the nature of building development industry. Different kind of study that can be in incorporated with marble dust powder may be listed below.

- Marble dust is a brilliant material for concrete in building structure.

- The characteristics strength of concrete can be studied with marble dust and other type of by product.
- Earthquake effect on marble dust concrete structure.
- Further study on durability of marble dust concrete and Study of marble dust concrete varying water cement ratio.

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