

AN EXPERIMENTAL INVESTIGATION OF REPLACEMENT OF CEMENT WITH MARBLE DUST

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ABSTRACT: The concrete basically consists of a mixture of ordinary Portland cement, Aggregates (coarse, fine) and water. Depending upon the mix ratio of cement, fine aggregates, coarse aggregates the concrete is divided into many grades like as M10, M15, M20 etc, here 'M' represents the mix and the number denotes the compressive strength in N/mm² of cube after 28 days. In this study some of the cement content in concrete is replaced by the waste product coming from the industry. Here in this study the waste product used is marble dust. As the large amount of marble dust waste product is coming from the industries, it is not easy to dump such huge amount of marble dust waste product and as a result of this environmental problems occurs. In this study the 5%, 10%, 15% cement is replaced by the marble dust and the cubes are formed in the laboratory, then these cubes are tested for compressive strength. In this study it was found that the quantity of marble dust used should be limited and maximum upto 10% where the compressive strength is maximum for 28 days curing period.

The main purpose of this study is that the waste product coming from the industries like marble dust is being used in concrete and we can protect our environment from these waste deposits.

Key words: Marble dust, environment problems, concrete grades and compressive strength.

I. INTRODUCTION

As we know the large amount of waste products are coming out from the various industries. Among these waste products the marble dust powder is one of them which results the pollution in the environment and effect the human's life. This marble dust powder can be used in concrete formation with partial replacement of cement. Total 10 cubes were casted in this study by partial replacement of cement in percentage of 5%, 10%, 15% and 20% and the compressive strength of these cubes were tested by compression test machine after 7 days and 28 days.

1.1 Ingredients

As we know the main ingredients used in concrete formation are ordinary Portland cement, coarse aggregates, fine aggregates and water. The angular coarse aggregates has been used of size 20mm and of specific gravity of 2.66. Marble dust powder (As shown in Fig 1.1) used as a replacement of cement was collected from zirakpur Punjab. The quantity of water used as per indian standard code.



Fig 1.1, Marble Dust Powder

1.2 Method of mixing

All the ingredients are mixed as per IS 456 2000 and the mixing was done by manually. The cement was then replaced by marble dust powder by 5%, 10%, 15% and 20%. The method should be done in such a way that there is no segregation and bleeding.

II. LITERATURE REVIEW

Marble dust is crushed or ground marble particles that can still be formed to make a solid object. Waste marble powder is generated as a by-product during cutting of marble. The waste is approximately in the range of 20% of the total marble handled. The amount of waste marble powder generated at the study site every year is very substantial being in the range of 250-400 tones. The dust is used in many more instances than marble itself because of its lower cost and versatility. Marble dust is typically mixed with cement or resins to make cultured marble, which looks similar to true marble. The marble cutting plants are dumping the powder in any nearby pit or vacant spaces, near their unit although notified areas have been marked for dumping. This leads to serious environmental and dust pollution and occupation of vast area of land especially after the powder dries up. This also may leads to contamination of the underground water reserves.

III. TEST ON INGREDIENT

Cement:- The physical properties of cement as well as on the replacement of cement with marble dust powder were determined by doing the consistency test, initial and final setting time. The Vicat's apparatus was used to conduct these tests

Table 1: Consistency test

S. NO.	% of cement replaced with marble dust powder.	Consistency(%)
1	0%	30%
2	5%	33%
3	10%	35%
4	15%	38%
5	20%	41%

Table 2: Initial setting time

S. NO.	% of cement replacement with marble dust powder	Time (in minutes)
1	0%	31min
2	5%	34min
3	10%	38min
4	15%	41min
5	20%	45min

Table 3: Final setting time

S.NO.	% replacement of cement with marble dust powder	Final setting time(in minutes)
1	0%	9h 20min
2	5%	8h 20min
3	10%	7h 25min
4	15%	7h 10min
5	20%	6h 53 min

IV. TEST ON CUBES

Total of 10 cubes were casted in which the first two cubes were casted without any replacement of cement. The remaining 8 cubes were casted with replacement of cement with marble dust powder by 5%, 10%,15% and 20%. The grade of concrete used was M20 i.e. of ratio 1:1.5:3. The compressive strength of cube of size 150mm x 150mm x 150mm were determined after 7 days and 28 days curing by compressive testing machine(As shown in Fig 3.1). The table 4 shows the test result on cube after 7 days and 28 days curing period.



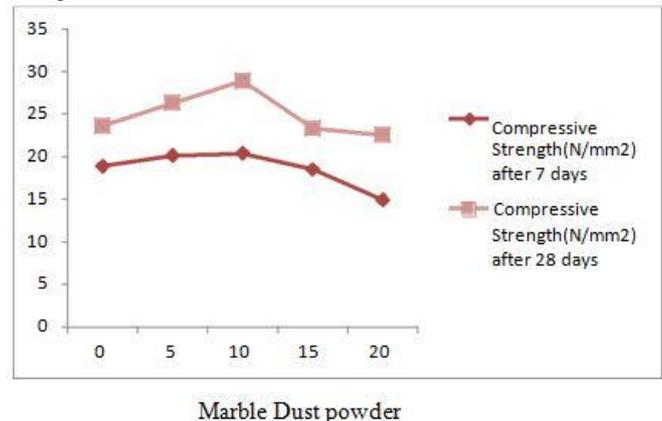
Fig 3.1, Compressive Testing Machine`

Table 4: Compressive strength after 7 days and 28 days

S NO.	%replacement of cement with marble dust powder	Compressive strength after 7 days (in N/mm ²)	Compressive strength after 28 days (in N/mm ²)
1	0%	18.90	23.63
2	5%	20.16	26.30
3	10%	20.42	28.92
4	15%	18.53	23.34
5	20%	14.95	22.56

Graph

The graph shown below shows the variation of compressive strength versus the replacement of cement with marble dust powder. The variation shows increase in the compressive strength upto 10% of replacement of cement with marble dust powder beyond the dosage of 10%, the compressive strength decreases.



Marble Dust powder

V. CONCLUSION

- With the replacement of cement with marble dust powder, the environment will remain protected from pollution.
- The consistency of a cement with partial addition of marble dust powder is increased. Due to this increase in consistency the water consumption in concrete also increases which can produce bleeding of concrete.
- With the replacement of cement by marble dust powder upto 10%, the initial setting of cement increased while the final setting time of cement will decrease. As a result of this the concrete will take much more time in strength gaining.
- The compressive strength of concrete is increased by replacing cement with marble dust powder, but it was found that upto 10% replacement of cement with marble dust powder the compressive strength of concrete is maximum and if replacement is more than 10% then the compressive strength of concrete will decrease.
- The use of marble dust powder in concrete for construction might be cost effective because this waste is available free of cost.

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