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An Experimental Work on Bacterial Concrete Using Marble Powder

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ABSTRACT:

Because concrete is used all around the world, how its ingredients are used greatly influences how healthy it is. The globe is developing quickly, as we all know, and building construction plays a crucial part in this development. If we examine concrete usage closely, we will see that it raises the need for natural resource storage. This common sand asset is deteriorating as a result of the growing demand for concrete. One of the most significant building materials since antiquity is fine aggregate, which can be substituted for marble powder to the extent of 0%,5%,10%,15%,20%, and 25%. For M30 grade of concrete, adding bacteria at 0%, 5%, 10%, and 15% worked well in terms of durability to boost the concrete's split tensile and compression strengths. The tests were looked at for 7 and 28 days.

Key Points: *marble powder,* bacterial concrete, compression strength and split tensile strength of concrete.

1. Introduction

One essential building ingredient is concrete. Despite its versatility in construction, concrete is known to have some draw backs. Marble powder is used to replace the fine total in a trial evaluation to evaluate the behavior of cement. It has a particular test to determine whether adding marble powder significantly improves the product's quality. The specific blend extent has completed the midway replacement of fine total with marble powder to obtain excellent strength in concrete. The benefits of bacterial concrete, like its self-healing ability, higher durability, enhanced strength, etc. Numerous factors are anticipated to affect the activity of living creatures incorporated into cementitious materials. Another name for it is self-healing concrete. Because the mineral precipitation caused by microbial activity is pollution-free and natural, it is very desired. It can be used to effectively repair concrete fractures.

2. Objectives

1. To maximise the percentage of marble powder used as a partial replacement of fine aggregate.

2. To determine the ideal bacterial dosage needed to make bacterial concrete.

3. To examine the split tensile and compressive strengths of concrete.

3. Materials:

Cement, fine aggregate, coarse aggregate, marble powder, bacterial concrete, and water are the raw materials needed for the concreting activities of the current project.

3.1 Cement:

In building, cement serves as a binder—a material that binds other materials together by setting, hardening, and adhering to them. Cement is primarily used to bond materials, like as sand, together. It is rarely used alone.

3.2 Fine Aggregate:

Fine aggregates are essentially natural sand particles that are extracted from the ground during the mining process. They can be any size of crushed stone particle that is ¼" or smaller.

3.3 Coarse Aggregate:

In the current investigation, 20 mm coarse aggregate that complies with IS: 383-1970 is used. Using a pycnometer test, aggregate specific gravity is evaluated. The material that was kept on a 4.75 mm sieve after passing through a 20 mm sieve was employed for the study, and sieve analysis was performed to determine the aggregate fineness modulus.

3.4 Water:

For mixing and curing, fresh potable water is used.

3.5 Marble Powder:

The strength of concrete can be improved by adding marble powder to the mixture. It is a solid waste product that is produced during the manufacturing of marble. It will be coloured white.

3.6 Bacterial concrete:

When concrete hardens, bacterial reactions in the concrete help to fill up the fractures that have formed in the structure. We talk about the different kinds of bacteria, how they work, and how to make bacterial concrete. The employment of technology in the modern era has raised the bar for construction standards.

4. EXPERIMENTAL INVESTIGAATION

4.1 COMPRESSIVE STRENGTH TEST

The results of the compressive strength test performed on the cast and cured specimen in the compressive testing machine are provided in the table below.

Table 1: compressive strength of % Of Marble Powder With Partial Replacement Of Fine Aggregate.

S. No	% of Marble Powder	Compressive strength (N/mm^2)	
		7 days	28 days
1	0	27.65	39.51
2	5	28.71	41.05
3	10	29.34	42.53
4	15	31.39	44.72
5	20	29.51	42.86
6	25	27.84	40.77

Table 2: : Compressive Strength Of % Of Bacillus Subtilis With Cement.

Sl.no	% of Bacillus subtilis	Compressive strength (N/mm^2)	
		7 days	28 days
1	0	27.65	39.51
2	5	31.27	44.68
3	10	32.41	46.23
4	15	28.59	41.29

Table 3: Combined Compressive Strength Of 15 % Of Marble Powder With Partial Replacement Of Fine Aggregate+10 % Of Bacillus Subtilis With Cement.

Sl.no	% of MP+% of BS	Compressive strength (N/mm^2)	
		7 days	28 days
1	0	27.65	39.51
2	10 % of BS + 15 % MB	48.01	68.59

4.2 SPLIT TENSILE STRENGTH TEST

The results of the split tensile strength test that was performed on the cast and cured specimens .

Table 4: Split tensile strength of % Of Marble Powder With Partial Replacement Of Fine Aggregate.

Sl.no	% of Marble Powder	Split tensile strength (N/mm^2)	
		7 days	28 days
1	0	2.75	3.94
2	5	2.89	4.13
3	10	2.93	4.24
4	15	3.12	4.46
5	20	2.99	4.29
6	25	2.81	4.02

Table 5: Split tensile strength Of % Of Bacillus Subtilis With Cement.

Sl.no	% of Bacillus subtilis	Split tensile strength (N/mm^2)	
		7 days	28 days
1	0	2.75	3.94
2	5	3.14	4.48
3	10	3.62	5.17
4	15	2.76	4.03

Table 6: Split tensile strength Of 15 % Of Marble Powder With Partial Replacement Of Fine Aggregate+10 % Of Bacillus Subtilis With Cement.

Sl.no	% of MP+% of BS	Split tensile strength (N/mm^2)	
		7 days	28 days
1	0	2.75	3.94
2	10 % of BS + 15 % MB	5.17	7.41

5. CONCLUSION

- The Normal Concrete of Compressive Strength results for 7 and 28 days is 27.65 N/mm^2 and 39.51 N/mm^2 .
- At 15% replacement of fine aggregate by Marble powder the compressive strength of concrete is for 7 and 28 days 31.39 N/mm^2 and 44.72 N/mm^2 .
- At 10% of Bacillus subtilis with cement the compressive strength of concrete for 7 and 28 days are 32.41 N/mm^2 and 46.23 N/mm^2 .

- Combined replacement of compressive strength of concrete with 15% of Marble powder and 10 % of Bacillus subtilis for 7 and 28 days are 48.01 N/mm^2 and 68.59 N/mm^2 .
- The Normal Concrete of Split tensile Strength results is for 7 and 28 days is 2.75 N/mm^2 and 3.94 N/mm^2 .
- At 15% replacement of fine aggregate by Marble powder the Split tensile strength of concrete is for 7 and 28 days 3.12 N/mm^2 and 4.46 N/mm^2.
- At 10% Bacillus subtilis with cement the Split tensile strength of concrete for 7 and 28 days are 3.62 N/mm^2 and 5.17 N/mm^2 .
- Combined replacement of Split tensile strength of concrete with 15% of Marble powder and 10 % of Bacillus subtilis for 7 and 28 days are 5.17 N/mm^2 and 7.41 N/mm^2 .

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