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Strength Properties of a bacterial concrete when Cement partially replaced with flyash and GGBS

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Abstract: ***Abstract: The objective of this research work is to reduce the cost of the construction. Now a days the industrial wastes are rapidly increasing more. To utilize such materials and reduce such type of waste in environment. The cement is replaced by the GGBS and fly ash with bacteria of 10^6 bacillus pasteurii in M40 mix. the GGBS and fly ash as taken in the proportions of 10% by weight of cement. From this research the results are much more better as compare to the convention concrete.***

Key Words: *GGBS1, flyash2, Bacullius Pasteurii3, Compressive Strength4 and Spilt Tensile strength4 etc…*

1.INTRODUCTION 1

The main problem facing now a days is the environment problem. The ordinary Portland cement is an very important material in the construction industry. However, the cement contains the pollutants the utilization of the cement will cause the pollution to the environment. The grading of cement is done by the compressive strength of the material in the time period. The grading of cement are 43 and 53. In this research 53 grade of cement is taken. Bacterial concrete is a concrete mix in which bacteria is added.

The present paper work is aims to study the strength characteristics of a bacterial concrete using GGBS and fly ash with fixed proportions. Also aims how to reduce the cost of the construction.

2. MATERIALS USED 2

2.1 Cement 1

In this experiment 43 grade ordinary Portland cement is used. The testing of cement is done as per IS …. Code the specific gravity of cement found is 3.10.

2.2 Fine Aggregates 2

In this experiment the locally available sand is used and the specific gravity of fine aggregate is done by using the IS 2720 part 3 code. The specific gravity is found 2.62. The fine aggregates used which passes through the 4.75mm sieve.

2.3 Course Aggregates 3

In this experiment the locally available aggregates are used and the specific gravity of course aggregate is done by using the IS2386 part 3 1963 code. The specific gravity is found 2.84. The course aggregates which are used of 20mm size.

2.4 Bacteria 4

In this research the bacillus pasteurii bacteria is used .Sporosarcina pasteurii formerly known as Bacillus pasteurii from older taxonomies is a bacterium with the ability to precipitate calcite and solidify sand given a calcium source and urea, through the process of microbiologically induced calcite precipitation or biological cementation. Bacillus pasteurii has been proposed to be used as an ecologically sound biological construction material.

2.5 Water 5

The least expensive but the most important ingredient of concrete is water. The water which is used for mixing concrete should be clean and free from harmful impurities such as oil, alkali, acid etc. portable water was used for mixing and curing work.

2.6 Properties of GGBS 6

Ground granulated blast furnace slag is obtained by the quenching molten iron slag from a blast furnace in water, to produce a glassy, granular product that is then dried and ground in to a fine powder. Table 1 will show the properties of GGBFS.

2.7 Properties of Fly ash 7

Flyash is a siliceous material obtained by the thermal plants, is used as the partial replacement of cement. the properties of the fly ash was analysis by the IS code 3812-1981. Table 2 will shows the properties of fly ash.

3. TESTS 3

3.1 Compressive strength 1

The test is done for 28days and the size of the cube 150x150x150mm. the concrete mix design is carried out as per IS 10262-2009 for M40 mix grade. the cubes are tested on 2000KN capacity universal testing machine. Compression test has been conducted confirming to IS 516-1959(5), on the concrete specimens in the universal testing 200MT. in this text cube is placed with the cast faces not in contact with the platens of testing machine. Load has been applied at a constant rate of stress equal to 15mpa/min according to the relevant IS code and the load at which the specimens failed has been recorded. Thus from the results, the compressive strength is obtained.

3.2 Spilt tensile strength 2

The test is done for 28days and the size of the cylinder 150x300mm and the same mix design is taken i.e., M40 as per IS 10262-2009. The test is carried out by placing a cylinder specimens. the placing of the specimen is horizontally between the loading surfaces of the compression testing machine and the load is applied until failure of the cylinder along the vertical diameter are recorded. Thus from the results, the compressive strength is obtained.

4. RESULTS 4

4.1 Compression Test 1

In this study the cubes are prepared without bacteria conventional concrete totally 12 cubes those are tested for 7days,14 days, 28days and 60days. Concrete with bacteria for 4 different age periods for every age period 3 cubes are casted. Bacterial concrete with fly ash and ggbs also casted. the size of cube is 150mmX150mmX150mm. the most and useful parameters is compressive strength because it is a desirable characteristic of concrete properties and also quantitatively related to compressive strength. The bacterial concrete strength is increased when compared to normal concreted. Bacterial concrete with flyash and ggb is decreased to conventional concrete. The compressive strength for both conventional and bacterial concrete is in table as well as bar charts.

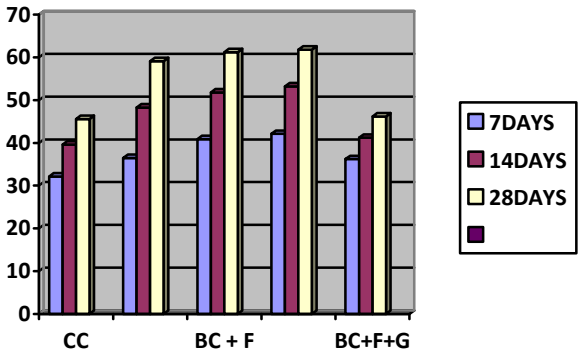

Chart -1: Compressive Strength Results

Table -1: Compressive Strength of a conventional and bacterial concrete of different age periods.

Si. No	Type of concrete (KN/mm^2)	7 days	14 days	28 days
1.	Convention concrete	32.10	39.60	45.58
2.	Concrete with bacteria	36.48	48.26	59.17
3.	Concrete with bacteria using fly ash	40.88	51.80	61.15
4	Concrete with bacteria using GGBS	42.14	53.16	61.86
5	Concrete with bacteria using fly ash and GGBS	36.20	41.20	46.14

4.2 Spilt Tensile Test2

In this study the cylinders are prepared with out bacteria conventional concrete totally 9 cubes without bacteria those are tested for 7days and 14 days. Concrete with bacteria for 2 age periods are casted. Bacterial concrete with fly ash and ggbs also casted. The size of cylinder is 150mmX300mm. The spilt tensile strength is obtained by indirect cylinder spilt tensile test. This is also a useful parameter for desirable characteristics of concrete. The spilt tensile for both normal and bacterial concretes are shown in table as well as bar chats

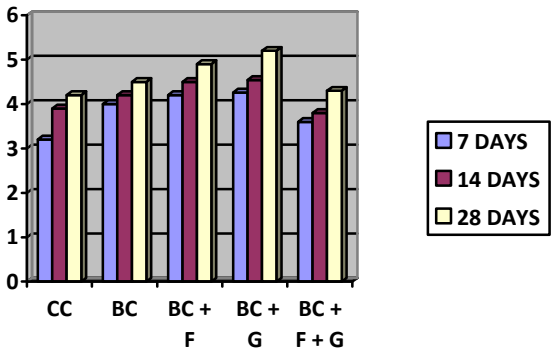

Chart -2: Spilt Tensile Strength Results

Table -2: Spilt Tensile Strength of a conventional and bacterial concrete of different age periods.

Si. No	Type of concrete	7 days	14 days	28 days
1.	Convention concrete	3.2	3.9	4.2
2.	Concrete with bacteria	4.0	4.2	4.5
3.	Concrete with bacteria using fly ash	4.2	4.5	4.9
4	Concrete with bacteria using GGBS	4.26	4.54	5.2
5	Concrete with bacteria using fly ash and GGBS	3.6	3.8	4.3

5. CONCLUSIONS 5

Based on the present experimental investigation the following conclusion are drawn

- Addition of bacillus pasteruii doesn't affect the workability aspects of concrete. Bacillus pasteruii with flyash, GGBS, and fly ash and ggbs was affected the workalikty.
- The compressive strength of a bacterial concrete is increased by 10% compare to normal concrete or conventional concrete.
- Addition of fly ash with bacterial concrete is also increased by 14% compare to normal or conventional concrete.
- Addition of GGBS with bacterial concrete is also increased by 18% to 20% as compared to normal or conventional concrete
- Addition of flyash and GGBS with bacterial concrete has given almost same compressive strength of conventional concrete.
- Spilt tensile strength is increased by 22% when compared with normal concrete
- Bacillus pasteruii can be produced from laboratory which is proved to be a safe and cost effective.
- From the above it can be also concluded that the Bacillus pasteruii with fly ash can be easily cultured and safely used in improving the performance characteristics of concrete.

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