

Strength Properties of a Bacterial Concrete with Flyash and GGBS

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

Keywords—GGBS, Fly ash, Bacillus pasteurii, compressive strength, flexural strength, split tensile strength.

I. INTRODUCTION

The main problem faced by the living being, 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 for a specified time period. The grading of cement are 43 and 53. In this research 53 grade of cement is used. Bacterial concrete is a concrete mix in which bacteria is added.

The present paper is aiming to the study of strength characteristics of a bacterial concrete using GGBS and fly ash at a partial proportions. Also aims to reduce the cost of the construction.

II. MATERIALS USED

A. Cement

In this experiment 43 grade ordinary Portland cement is used. The testing of cement is done as per IS 4031-11-1988 Code the specific gravity of cement found is 3.10.

B. Fine aggregates

In this experiment the locally available sand is used and the specific gravity of fine aggregate is to be obtained 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.

C. Coarse aggregates

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 coarse aggregates which are used of 20mm size.

D. Bacteria

In this research the bacillus pasteurii bacteria is used .Sporosarcina pasteurii formerly known as Bacillus pasteurii The 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 used as an ecologically sound biological construction material.

E. Water

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

F. Properties of GGBFS

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. It is then dried and ground in to a fine powder.

G. Properties of flyash

Fly ash is a siliceous material obtained from the thermal plants, is used as the partial replacement of cement. the properties of the fly ash was analysis as per IS code 3812-1981.

III. TESTS

1. Compressive strength

The test is done on specimens cured for 28days and the size of the cube 150x150x150mm. the concrete mix design is carried out as per IS 10262-2009 of 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 machine. Test 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.

2. Split tensile strength

The test is done on specimens cured 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 cylindrical specimens horizontally between the loading surfaces of the compression testing machine and the load is applied till the cylinder failed along the vertical surface and diameters are recorded. Thus from the results, the compressive strength is obtained.

IV. RESULTS AND DISCUSSIONS

A. COMPRESSION TEST

In this study the cubes are prepared without bacteria conventional concrete. Totally 12 cubes are tested with curing period of 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 important 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 that of normal concreted. Bacterial concrete with fly ash and ggbs is decreased compared to conventional concrete. The compressive strength for both conventional and bacterial concrete in table as well as bar chart are provided.

Si. No	Type of concrete	7 days	14 days	28 days	60 days
1.	Convention concrete	32.10	39.60	45.58	51.39
2.	Concrete with bacteria	36.48	48.26	59.17	62.35
3.	Concrete with bacteria using fly ash	40.88	51.80	61.15	64.35
4.	Concrete with bacteria using GGBS	42.14	53.16	61.86	65.21
5.	Concrete with bacteria using fly ash and GGBS	36.20	41.20	46.14	50.23

Table: 1 compressive strength of conventional concrete and bacterial concrete with fly ash and ggbs.

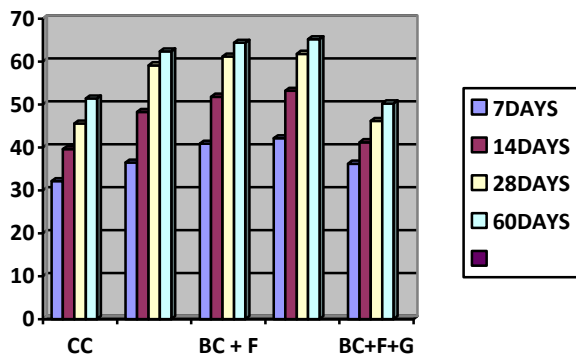


Chart : compressive strength results in bar chart.

B. SPILT TENSILE TEST

In this study the cylinders are prepared without bacteria conventional concrete. Totally 12 cylinders are tested with age period of 7days ,14 days, 28days and 60days. Concrete with bacteria for 4 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

Si. No	Type of concrete	7 days	14 Days	28 days	60 Days
1.	Convention concrete	3.2	3.9	4.2	4.53
2.	Concrete with bacteria	4.0	4.2	4.5	4.64
3.	Concrete with bacteria using fly ash	4.2	4.5	4.9	5.1
4.	Concrete with bacteria using GGBS	4.26	4.54	5.2	5.3
5.	Concrete with bacteria using fly ash and GGBS	3.6	3.8	4.3	4.5

Table:2 Spilt tensile strength of conventional concrete and bacterial concrete with fly ash and ggbs.

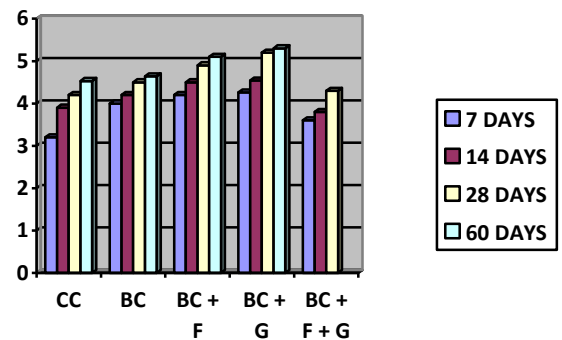


Chart : Spilt tensile strength results in bar chart

V. CONCLUSIONS

A. Based on the present experimental investigation the following conclusion are drawn

- [1] 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 workability.
- [2] The compressive strength of a bacterial concrete is increased by 10% compare to normal concrete or conventional concrete.
- [3] Addition of fly ash with bacterial concrete is also increased by 14% compare to normal or conventional concrete.
- [4] Addition of GGBS with bacterial concrete is also increased by 18% to 20% as compared to normal or conventional concrete
- [5] Addition of flyash and GGBS with bacterial concrete has given almost same compressive strength of conventional concrete.
- [6] Spilt tensile strength is increased by 22% when compared with normal concrete
- [7] Bacillus pasteruii can be produced from laboratory which is proved to be a safe and cost effective.
- [8] 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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