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Comparative study of conventional concrete and Green concrete

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Abstract; In today's modern world there has been enormous development in the field of "Concrete Technology". With this development, there has also been enormous use of concrete in our day today life. Concrete mainly comprises of cement, sand and aggregate as its main constituents, which when mixed with water in correct proportion gives a byproduct called as "Concrete". The excess use of concrete has led to the environmental impact in terms of resources utilization as well as in terms of pollution. To overcome these impacts the concept of "Green Concrete" came into existence. Green Concrete is a concrete in which one or more of its constituents are replaced by a resource saving material, which ultimately has reduced environmental impacts in terms of both, resource utilization and pollution impacts together.
The current paper is an experimental work carried out to assess the comparative study of "Green Concrete" and "Conventional Concrete" in terms of their "Compressive Strength" parameter. M25 grade of Concrete was designed to carry out this experimental test. A comparative study of "Green Concrete" with "Conventional Concrete" was made based on the curing techniques.i.e. "Water Submerged Curing" and "Steam Curing".
Keywords— Green Concrete, Conventional Concrete, Compressive Strength, Water Submerged Curing, Steam Curing.

I. INTRODUCTION

When we replace one or more constituents of conventional concrete, by environmental friendly materials or recycled materials, the concrete formed is termed as "Green Concrete". As we know the manufacturing process of cement and aggregate causes huge environmental impact, and day by day this increasing demand of concrete materials is ultimately causing impact to our environment. Thus replacing cement and aggregate (conventional constituents of concrete) can in turn help in minimizing the environmental impact caused during manufacturing process of aggregate and cement
The main objective of this research is to compare conventional concrete and green concrete in terms of compressive strength. To check the compressive strength property the "Conventional Concrete" cubes were cured by "Water Submerged Curing" method, and the "Green Concrete" cubes were cured by "Water Submerged Curing" method and another set by "Steam Curing" method. The curing of concrete cubes was carried out for 3 days, 7 days, and 28 days subsequently and cubes were tested respectively. The grade of concrete used use cast all the set of cubes was M25

II. MATERIALS

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A. Cement

Ordinary Portland cement of 53 grade available in local market.was used to prepare the cubes. The cement used was already tested for its various properties as per IS 4031-1988 and IS 12269-1987. Specific Gravity of cement was 3.09, while fineness was 2600cm2/gram.

B. Fine Aggregate

Locally available medium size crushed sand was used as fine aggregate. The fine aggregates confirmed to Zone-II of IS 383-1983. Specific Gravity of fine aggregate was 2.69 and Fineness Modulus of 3.23.

C. Coarse Aggregate

Locally available crushed angular aggregates were used as coarse aggregates. The maximum size of coarse aggregate used was 20 mm. with Specific Gravity of 2,68 and Fineness Modulus of 7.2 for conventional concrete. The maximum size of coarse aggregate

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for green concrete was 20 mm. and it was collected from the demolished sites.

D. Fly Ash

Fly ash having grade C 618 was used.

E. Alkaline Solution

Sodium Hydroxide having molecular weight of 40gm was used. The sodium silicate (Na2Sio3) to sodium hydroxide solution (NaOH) ratio used in this experiment was 1.5.

F. Water

The potable drinking water was used for the purpose of mixing concrete unifomally.

III. MIX DESIGN

Standard Mix Design for conventional concrete was carried out as per IS standards Assuming the volume of overall aggregate as 65% and alkaline liquid to fly ash ratio as 0.30, the quantities of all ingredients used in conventional and green concrete are mentioned below in TABLE I and TABLE II.

TABLE I
MIXING PROPORTIONS OF CONVENTIONAL CONCRETE

Sr. no	Constituents for M25	(Kg/m3)
1	Cement	320
2	Fine aggregate	751
3	Coarse aggregate	1356
4	Water	138
5	Water cement ratio	0.43

TABLEIII
MIXING PROPORTIONS OF GREEN CONCRETE

Sr. no	Ingredient for M25	(Kg/m3)
1	Fly ash	463.50
2	Fine aggregate	530.70
3	Coarse aggregate	1154.06
4	Sodium hydroxide solution	80
5	Sodium silicate solution	120

IV. TEST PERFORMED ON THE AGGREGATE

The various tests were performed on the aggregates included sieve analysis, flakiness and elongation index, specific gravity, impact value test and crushing of aggregates. All tests performed were confirmed to IS standards.

V. MIXING AND CASTING OF CUBES

The conventional method of mixing was used for geo-polymer concrete. At first of all ingredient were mixed in dry condition i.e. dry mix, for about 4-5 minutes. Then the combination of sodium hydroxide solution and sodium silicate solution was are added to the dry mix. The mixing was carried out in a trial mixer for about 6-8 minutes. The moulds were properly oiled and kept ready before pouring concrete into it.

After proper mixing of material, the concrete was poured into 150 mm X 150 mm X 150 mm size cube mould. For proper compaction of concrete was ensured by poured it in three layers and each layer was tamped 25 times. These cubes were demoulded after 24 hours. The cubes were then transferred for curing p

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VI. CURING OF CUBES

Water Submerged Curing" method was adopted for conventional concrete cubes for 3days, 7days, and 28 days subsequently, and the cubes were submerged into a rectangular tank filled with water.

"Water Submerged Curing" method was also adopted for one set of green concrete cubes. The another set of green concrete was cured by "Steam Curing" method.

After demoulding, the cubes were placed in steam curing unit for 24 hours initially and then followed by water submerged curing

VII. TEST RESULTS

The results of compressive strength test conducted on both conventional and green concrete after a span of 3 days, 7 days and 28 days are reflected in TABLE III, TABLE IV and TABLE V

TABLE IIIII
COMPRESSIVE STRENGTH TEST RESULTS OF CONVENTIONAL CONCRETE

Sr. no	Curing / Days / Cubes	Conventional Concrete (Mpa)		
		3 Days	7 Days	28 Days
1	Cube 1	9.5	15.3	24.6
2	Cube 2	10.3	14.9	25.3
3	Cube 3	10.6	15.2	24.9
Average Strength		10.13	15.13	24.93

TABLE IVV
MIXING PROPORTIONS OF GREEN CONCRETE (WATER SUBMERGED CURING)

Sr. no.	Curing / Days / Cubes	Green Concrete (Water Submerged Curing) (Mpa)		
		3 Days	7 Days	28 Days
1	Cube 1	4.97	8.46	13.43
2	Cube 2	4.37	8.23	12.88
3	Cube 3	4.56	8.51	13.1
Average Strength		4.63	8.4	13.13

TABLE V
MIXING PROPORTIONS OF GREEN CONCRETE (STEAM CURING)

Sr. no	Curing / Days / Cubes	Green Concrete (Steam curing) (Mpa)		
		3 Days	7 Days	28 Days
1	Cube 1	15.8	22.5	27.5
2	Cube 2	15.6	22.8	27.6
3	Cube 3	15.4	22.5	27.5
Average Strength		15.6	22.6	27.53

Fig 1, Fig 2 and Fig 3 below reflects the comparison of compressive strength of conventional concrete and green concrete after 3 days, 7 days and 28 days subsequently.

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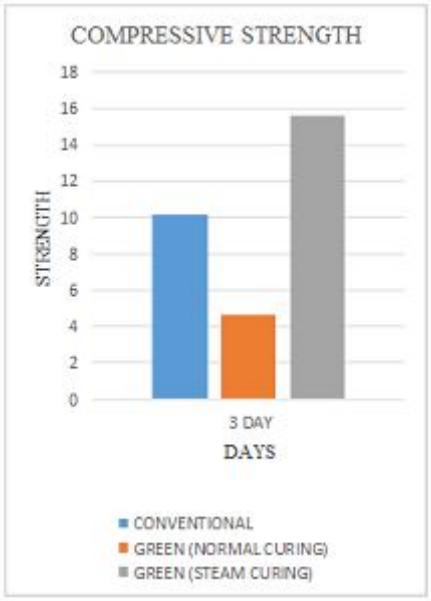


Fig. 1 Analysis of compressive strength test results after 3 days

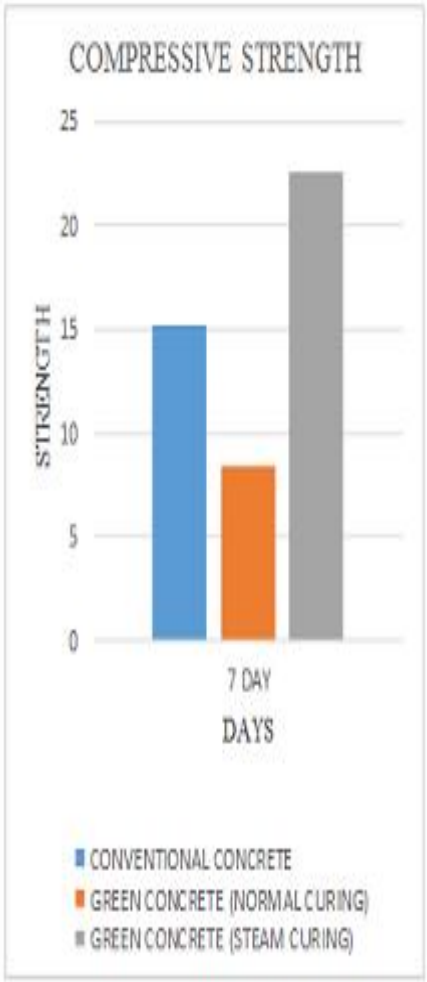


Fig. 2 Analysis of compressive strength test results after 7 days

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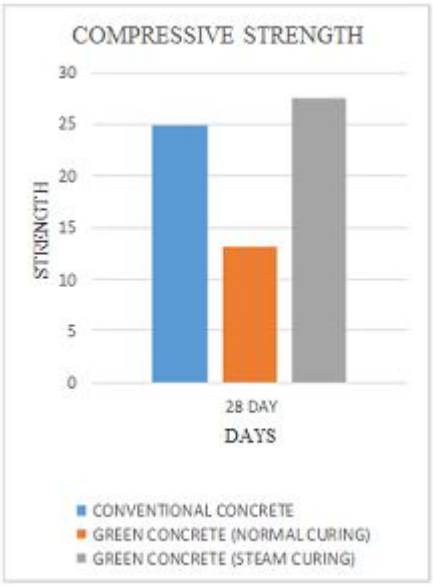


Fig. 3 Analysis of compressive strength test results after 28 days

VIII. CONCLUSIONS

The experimental result concludes that, the rate at which the compressive strength is gained by the green concrete (under water submerged curing) is less compared to the compressive strength of the conventional concrete (under water submerged curing). However, the compressive strength of the Green Concrete (under steam curing) is very high compared to the other methods of cube curing carried out. It can be concluded that the strength gained by the green concrete cubes under steam curing is 10% higher compared to the tests conducted on cubes in water submerged curing condition

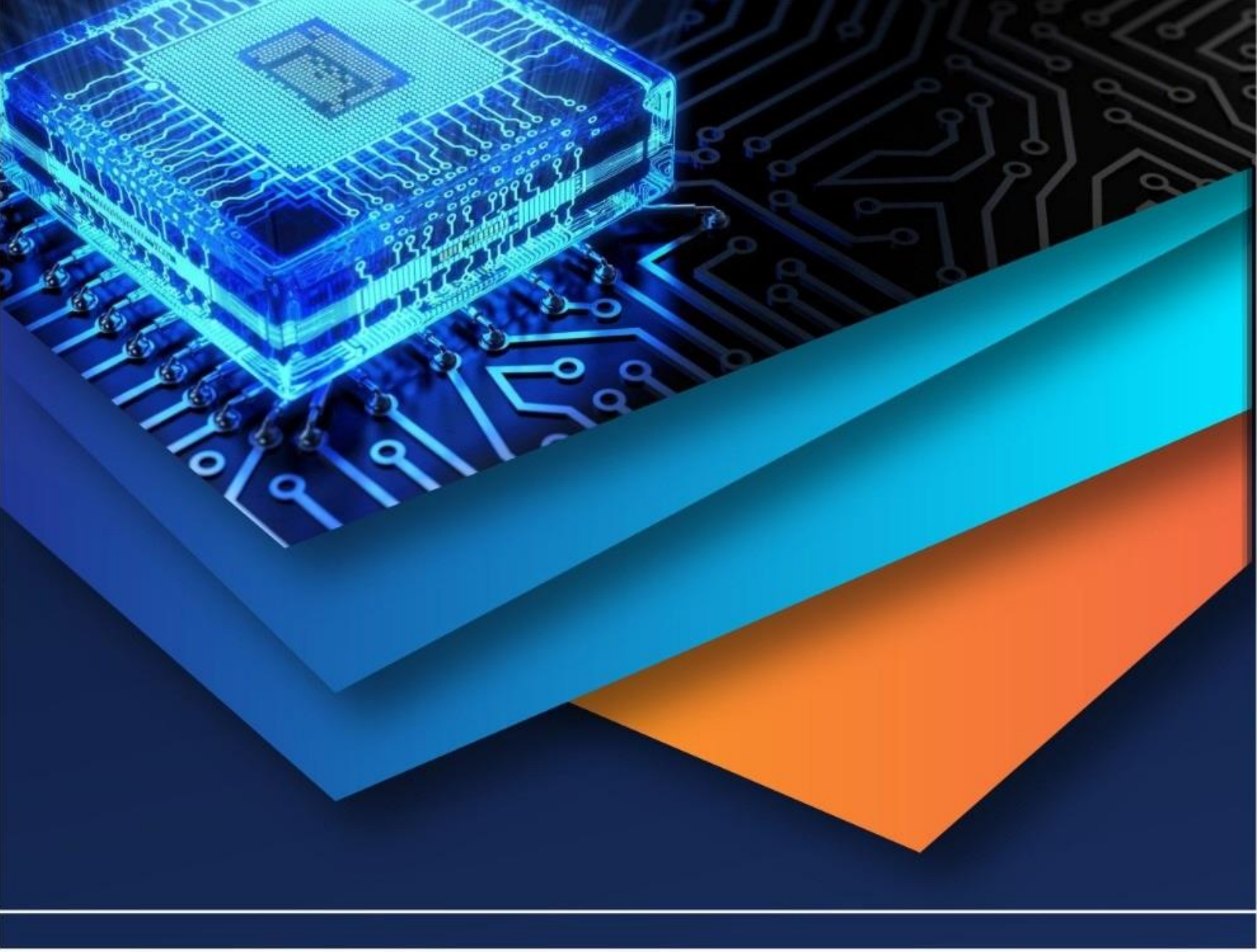
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