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An Experimental Study on Carbon Cure Greener Concrete

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ABSTRACT: Concrete is a basic building material that will continue to be in demand far into the future. A world without concrete, and its dominant precursor, Ordinary Portland Cement (OPC), is hard to imagine. Manufacturing of cement creating hazardous pollution and hence green concept is important. Green concrete is a type of concrete which resembles the conventional concrete but the production or usage of such concrete requires minimum amount of energy and causes least harm to environment. Green concrete is very low energy and resource consumption, no environmental pollution and sustainable development. Green cement concrete is produced by using recycled waste materials such as fly ash, GGBS, rice husk ash etc. the other problem is scarcity of water. Hence instead of water curing we can go for other curing types. Here in this work carbon curing is adopted. In our experimental research we got maximum values for 1.5% carbon with 50% GGBS.

KEYWORDS: Compressive strength, Split tensile strength, water absorption, GGBS.

I. INTRODUCTION

Concrete is a basic building material that will continue to be in demand far into the future. A world without concrete, and its dominant precursor, Ordinary Portland Cement (OPC), is hard to imagine. Although there are different types of concrete that have been developed for use in different applications, their common virtues are familiarity, versatility, strength, durability, wide availability, fire resistance, resistance to the elements and comparatively low cost. OPC is a vital construction material and also a strategic commode .Such is our dependence on OPC that the world currently produces nearly 3.6 billion metric tonnes of the material each year with volume predicted to rise to more than 5 billion metric tonnes by 2030 Although figures vary from country to country, around half of the world's OPC is used to make around 11 billion metric tonnes of concrete annually; the rest is used in mortars, screeds, stucco, coatings, soil stabilization and other applications.

Ground Granulate Blast furnace Slag (GGBS) cement can be added to concrete in the concrete manufactures along with Portland cement, aggregates and water. The normal ratios of aggregates and water to cementitious material in mix remain unchanged. GGBS is used as a direct replacement for Portland cement, on a one to one basis by weight. Replacement levels of GGBS vary from 30% to up to 85%. Typically 40- 50% is used in most instances.

Carbon dioxide (CO_2) emissions are one of the most serious concerns among all greenhouse gas emissions.CO_2 emission can be affected by combustion of organic materials (e.g. Wood, coal, oil, and other fuels), or

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by human and animal metabolism in which oxygen is utilized and CO_2 is given off as an end product. Hence in this work curing is done by using carbon and cement is replaced by GGBS.

II. MATERIALS AND METHODOLOGY

MATERIALS USED

Cement, fine aggregate, coarse aggregate, GGBS, liquid carbon, water.

CEMENT

Cement is a vital component for soil-stabilized bricks, enhancing both strength and durability. Cement, an expensive element, can be kept down to the range of 50% of the mix without compromising performance. Ordinary Portland cement of 53 grade is used in our work.

FINE AGGREGATE

The aggregates passing through I.S. sieve 4.75 mm sizes is termed as fine aggregate. The sum of percentage of all types of deleterious materials in fine aggregate should not exceed 5%. Natural sand or crushed stone dust is the fine aggregate mainly used in concrete mix.

M-sand is used as fine aggregates.

COARSE AGGREGATE

The aggregates retained on I.S. sieve 4.75 mm size is termed as coarse aggregate. The size of the coarse aggregate used, depends upon the nature and type of work required.

GGBS

GGBS is the byproduct obtained from steel industry. In our work we have used this GGBS as a partial replacement for OPC. This GGBS is white finely powdered material and it is finer than cement.

LIQUID CARBON DIOXIDE

It is purchased through online for our project requirements because in our college we do not have any facility to liquefy the carbon dioxide gas into liquid.

WATER

Potable water has been used for casting concrete specimens.

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LABORATORY TEST RESULTS

Cement

Table 1: Physical properties of cement

SL NO	CHARACTERISTICS	RESULTS	SPECIFICATIONS
1	Specific gravity	3.12	IS:2720[part 3]
2	Standard consistency	29%	IS:4031[26-33%]
3	Fineness	4.5%	Not more than 10%
4	Initial setting time	35min	IS:4031[>30min]

TESTS	RESULTS	REQUIREMENTS IS:2386-1963 part-3
Specific gravity	2.46	2.5-3
Fineness modulus	3.52	2-4
Bulk density	1750kg/m3	1400-1800
Grading zone	Zone II	ZONE I-III

GGBS

Table 3: Physical properties of GGBS

SL NO	PROPERTIES	TEST RESULT
1	Specific gravity	2.82
2	% particles retained on 90µ sieve	-

Coarse aggregate

Table 4: Physical properties of Coarse aggregates

TESTS	RESULTS	REQUIREMENTS IS:2386-1963 part-3
Specific gravity	2.64	2.6-2.8
Fineness modulus	5.09	3.5-6.5
Bulk density	1630kg/m^3	1520-1680
Aggregate crushing value	20.06%	<45%
Aggregate impact value	16.01%	<30%
Water absorption	0.6%	0.1-2%
Max size of aggregate	20mm	

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III. TESTS ON CUBES

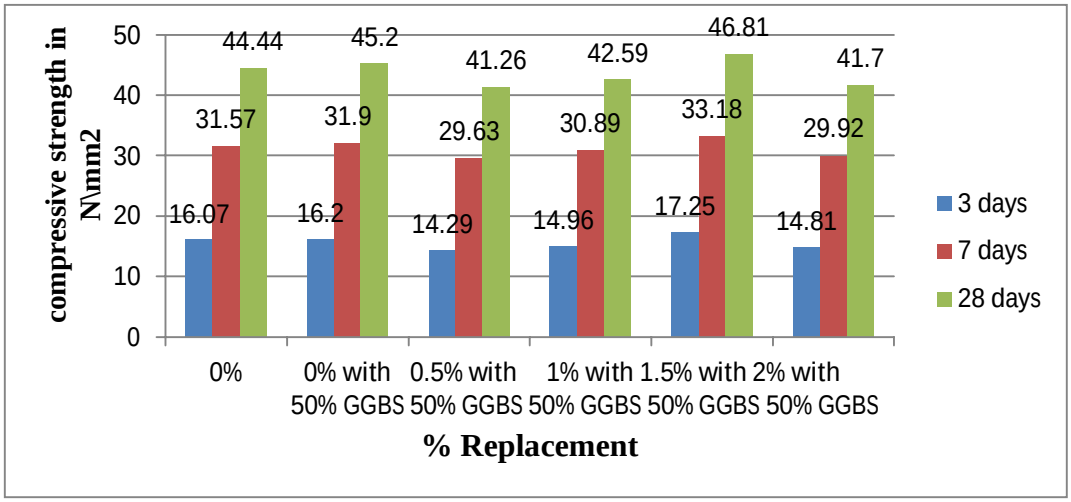
The various tests are conducted to know the performance of carbon cure concrete by partial replacement of cement by GGBS

1. Compressive strength test
2. Split tensile strength test
3. Water absorption test

COMPRESSION STRENGTH TEST RESULTS:

Table 5: Compressive strength test results

Sl no	% Replacement	Compressive strength in N/mm^2		
		3 days	7 days	28 days
1	0%	16.07	31.57	44.44
2	0% with 50% GGBS	16.20	31.90	45.20
3	0.5% with 50% GGBS	14.29	29.63	41.26
4	1% with 50% GGBS	14.96	30.89	42.59
5	1.5% with 50% GGBS	17.25	33.18	46.81
6	2% with 50% GGBS	14.81	29.92	41.70



Graph 1: Compressive strength test result

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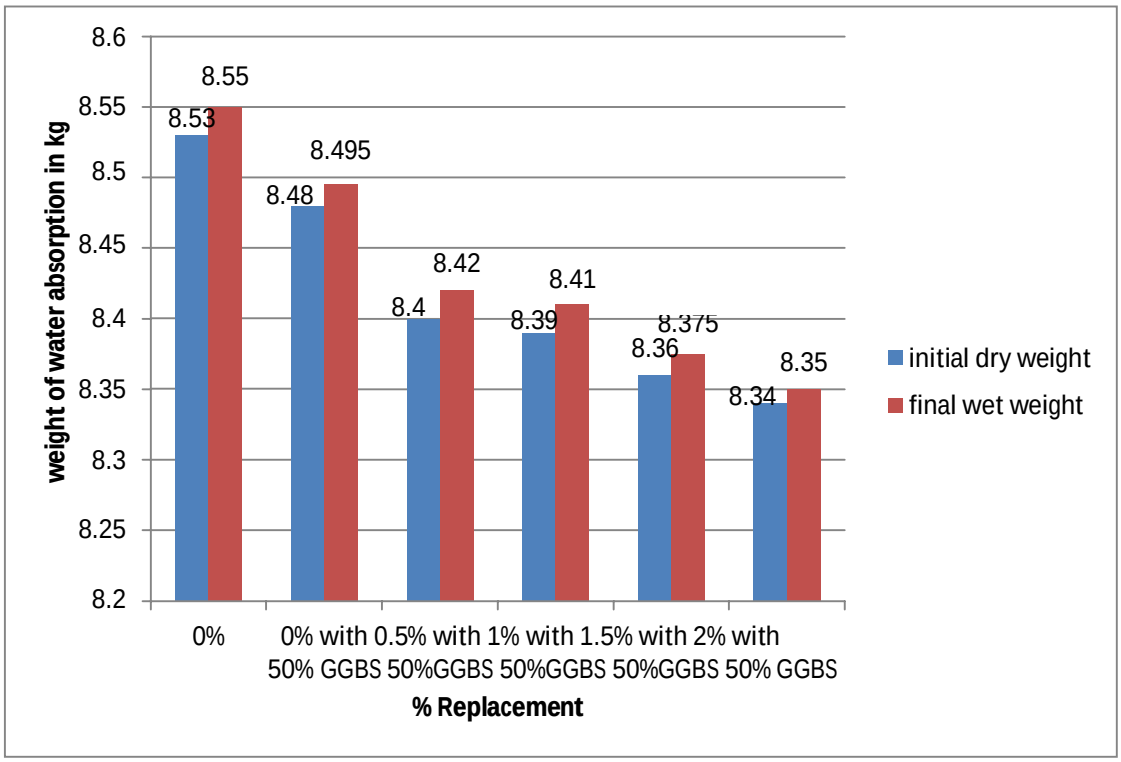
WATER ABSORPTION TEST RESULTS

Table 6: Water absorption test results

Sl no	% Replacement	Initial dry weight in kg	Wet weight in kg	% water absorption
1	0%	8.530	8.550	0.234
2	0% with 50% GGBS	8.480	8.495	0.176
3	0.5% with 50% GGBS	8.400	8.420	0.238
4	1% with 50% GGBS	8.390	8.410	0.238
5	1.5% with 50% GGBS	8.360	8.375	0.179
6	2% with 50% GGBS	8.340	8.350	0.119



Graph 2: Water absorption test result

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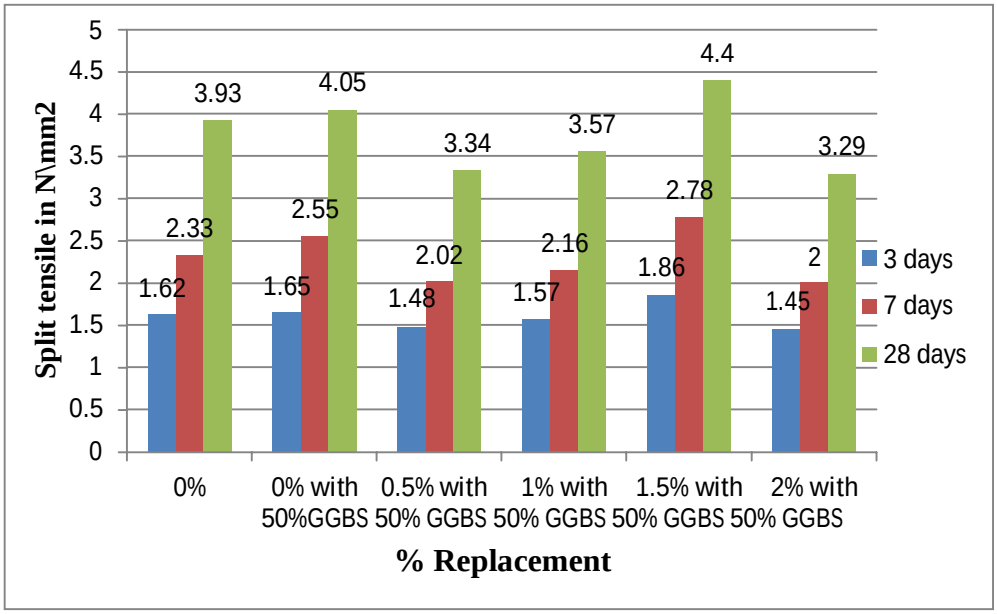
SPLIT TENSILE STRENGTH TEST

Table 8: Split tensile strength test results

Sl no	% Replacement	Compressive strength in N/mm^2		
		3 days	7 days	28 days
1	0%	1.62	2.33	3.93
2	0% with 50% GGBS	1.65	2.55	4.05
3	0.5% with 50% GGBS	1.48	2.02	3.34
4	1% with 50% GGBS	1.57	2.16	3.57
5	1.5% with 50% GGBS	1.86	2.78	4.40
6	2% with 50% GGBS	1.45	2.00	3.29



Graph 3: Split tensile strength test result

IV. CONCLUSION

Following broad conclusions can be made from the experimental study on carbon cube greener concrete:

- Compressive strength of the carbon cure greener concrete is more compared to 28days normal water curing.
- Compressive strength is more for 1.5% carbon with 50% GGBS replaced concrete compared to normal concrete.

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- Split tensile strength is more for 1.5% carbon with 50% GGBS replaced concrete compared to normal concrete.
- With the addition of carbon and GGBS to the concrete, the slump value goes on decrease.
- Compressive strength and split tensile strength for 2% carbon with 50% GGBS decreases.

REFERENCES

[1] Proposal from Environmental Protection Agency, "Astrengthened product - effect approach. An introduction to a debate", Ministry of Environment and Energy. Environmental Protection Agency, 1997.
[2] "Selection of areas to develop cleaner technologies with respect to different political scenarios WP5 ", Cleaner Technology Solutions in the Life Cycle of Concrete Products - TESCOP, Brite Euram Project No. BE 3858/BRPR - CT97 - 0385, Draft version 1998.
[3] Haugaard, M. and Glavind, M.: "Cleaner Technology Solutions in the Life Cycle of Concrete Products (TESCOP)". Accepted for publication in Proceedings from conference on Euro Environment, Sep. 1998.
[4] BPS Centre DTI, "Handbook in environmentally correct design" ("Håndbog i miljørigtig projektering") Volume 1 and 2, Publication /2/, 1997.
[5] "Industry Analysis, Concrete - Cleaner Technology in Concrete Production", Environmental Project No.350, Ministry of Environment and Energy, Danish Environmental Protection Agency, 1997.
[6] Damtoft, J. S.: "Use of Fly Ash and Other Waste Materials as Raw Feed and Energy Source in the Danish Cement Industry" Proceedings from CANMET/ACI International Symposium on Sustainable Development of the Cement and Concrete Industry, Canada, Oct. 1998.