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Experimental Study on Cellular Lightweight Concrete using Rice Husk Ash

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Abstract:- **This paper represents an effort taken to produce light weight concrete by 10%, 20%, 30% & 40% of rice husk ash(RHA) replacement with fine aggregate to achieve strength of M25 and compared with conventional concrete. The cylinder specimen of size 150 x 300, beam size 150 x 150 x700 and cube size of 150 x 150. The curing period of the specimen is 7, 14 and 28 days. Compressive strength is achieved for all mixes especially with 10% RHA replacement is giving more compressive strength comparing to other mixes.**

Keywords:- *Cellular light weight concrete, Cement, Rice Husk Ash, Coarse Aggregate, Fine Aggregate.*

I. INTRODUCTION

The origin of the CLWC is difficult to assess, it would not be an exaggeration to say that its roots are from the ancient period. With the increase in the demand of CLWC and the unavailability of the aggregates, technology for producing lightweight aggregates has been developed. RHA is a by-product of the rice milling industry. During milling, about 78% of weight is received as rice, broken rice and bran and rest of the 22% is received as husk. This husk contains about 75% organic volatile matter and the balance 25% of the weight is converted in to ash, known as RHA during the burning process. This RHA acts as a partial replacement material for fine aggregate as it contains around 85% - 90% amorphous silica. Rice husk ash is obtained by burning rice husk in a controlled manner without causing environmental pollution.

II. OBJECTIVES OF PROJECT

- Investigation of basic properties of cement, RHA and aggregate.
- To prepare mix design of M25 grade of concrete and casting of cube, cylinder and beam with addition of rice husk ash.
- Using lightweight concrete to reduce dead load of building.
- To cast cube and cylinder specimens of 10 %, 20 %, 30 % and 40 % of RHA by replacement method.
- To perform test on compressive strength of cube and cylinder specimens.
- To compare strength and density of LWC with conventional concrete.

III. EXPERIMENTAL MATERIALS USED

A. Rice Husk Ash (RHA)
The Rice Husk used was obtained from Astra Chemicals, Chennai.

B. Cement
The cement used was Ordinary Portland Cement. The grade of the cement is 53.

C. Coarse Aggregate
The coarse aggregate used for this research work was 10 mm size. It was sourced from stone crusher from Narhe in Pune.

D. Fine Aggregate
The fine aggregates used for this research work was sourced from stone crusher in Narhe in Pune.

E. Water
Casting and curing of specimens were done with the potable water that is available in the college premises. The water used is free from any visible impurities.

IV. MIX DESIGN

The mix was designed for M25 grade as per IS: 10262:2009at ratio of 1:1.5:2.72. Table:1 shows various percentage replacement and Table:2 shows mix design proportion for $1m^3$ of concrete.

Batch No.	% Replacement of FA (RHA)
1	10%
2	20%
3	30%
4	40%

Table 1. % of Replacement

%	Cement (kg)	RHA (kg)	FA (kg)	CA (kg)	W/C
10	37	3	27	55	0.44
20	37	6	24	55	0.44
30	37	9	21	55	0.44
40	37	12	18	55	0.44

Table 2. Mix Proportions

V. METHODOLOGY

- Selection of Materials.
- Basic Tests performed on cement and aggregate.
- Prepare mix design for M25 grade of concrete.
- Prepare conventional concrete sample for cylinder, cube and beam.
- Curing of specimen.
- Testing of conventional concrete specimen.
- Result of conventional concrete.
- Replacement of RHA with FA in proportion of 10%, 20%, 30%, 40%.
- Curing and testing process of RHA concrete.
- Result for RHA concrete.

- Comparison between Conventional concrete and RHa concrete.

VI. EXPERIMENTAL INVESTIGATION

A. Flexural strength test:

Universal Testing Machine is used for Flexural Strength Test. Beam size of 150 x 150 x 700 mm was used. Three Beams of each batch were tested.

Fig 1:- Flexural Strength Test

B. Compressive strength test:

Compression Testing Machine is used forCompressive strength test. Cube size of 150 x150x 150 mmwas used. Three cubes of each batch were tested.

Fig 2:- Compressive Strength Test

C. Split tensile test:

Split tensile test was carried out on Compression TestingMachine. Cylinder specimen of 150 mmdiameter and height 300mm are used. Three cylinder of eachbatch were tested.

Fig 3:- Tensile Strength Test

VII. RESULTS

Tests were conducted at the ages of 7, 14, &28 days. A comparative study was made on concretewith replacement of Fineaggregate by RHA in 10%, 20%, 30% and 40%. The testsresults are reported in Tables below for the conventional concrete andRHA concrete.

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Specimen	7Days (N/mm^2)	14Days (N/mm^2)	28Days(N/mm^2)
Cylinder	11.34	14.98	18.63
Beam	8.16	10.78	13.41
Cube	14.2	18.75	23.3

Table 3. Result for Conventional Concrete

Specimen	10%	20%	30%	40%
Cylinder	16.26	14.71	13.58	11.31
Beam	16.59	14.51	12.44	9.33
Cube	15.11	12.88	9.33	7.55

Table 4. Result for RHA (7 Days)

Specimen	10%	20%	30%	40%
Cylinder	18.40	16.98	14.86	12.03
Beam	20.74	16.59	13.48	10.37
Cube	20	15.32	12.17	8.45

Table 5. Result for RHA (14 Days)

Specimen	10%	20%	30%	40%
Cylinder	22.64	20.23	18.81	16.69
Beam	22.40	21.15	19.49	17.62
Cube	26.67	17.78	15.55	12.45

Table 6. Result for RHA (28 Days)

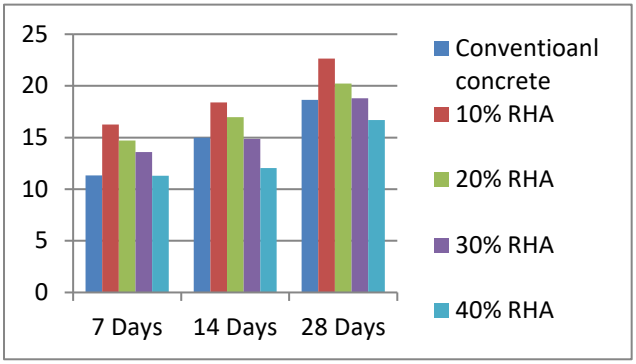

Fig 4:- Bar chart for Cylinder

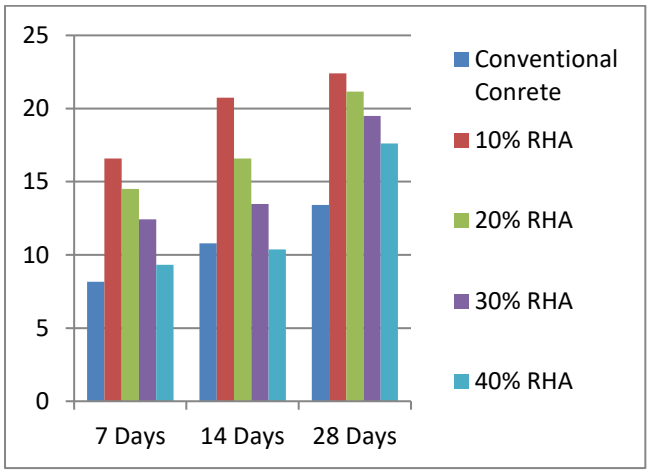

Fig 5:- Bar chart for Beam

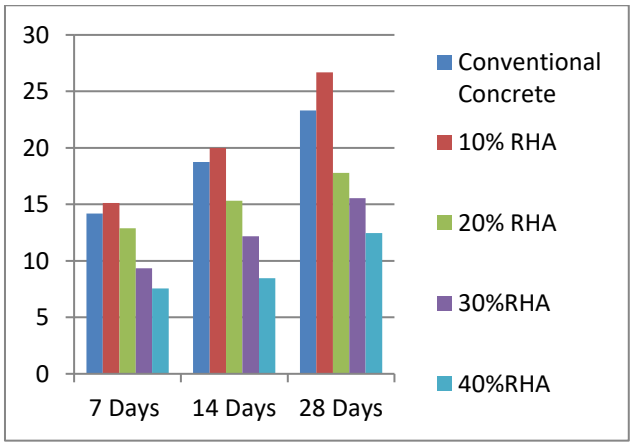

Fig 6:- Bar chart for Cube

VIII. CONCLUSION

Based on experiments and test results on fresh and hardened concrete the following conclusions are drawn:-Due to addition of RHA it is observed that early strength gain is slightly increasing with addition of 10%, 20%, 30%, 40% RHA in normal concrete at 14 days. But in 28 days test result it is found that with addition of 10% RHA in normal concrete the strength is running parallel or more than of normal concrete. Thus 10% RHA is the optimum content for getting nearly equal strength at 28 days. As the replacement of fine aggregate by RHA in concrete the Dead Load of specimen decreases.

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