Experimental study on the effect of rice husk ash on the compressive strength and water absorption of cellular light weight concrete block

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Abstract*— CLC block is made by using the cement, sand, fine aggregate, fly ash and foaming agent. CLC block is also thermal resistant, sound insulated, light in weight. Under this study, we examining the impact of RHA on the compressive strength and water absorption of the CLC block. To study this, we make a three different kind of mix and make an 8 block in each kind of mix. The size of each block is 300×150×200 mm. Then we place them in the water for the curing process. After 28 days we perform a 3 test on them, Block density test, Compressive strength test and Water absorption test. The results revealed that, the compressive strength of that block is maximum, the density of which is maximum out of three. Water absorption of that block is maximum, the density of which is lowest. When we compare the compressive strength of these blocks with the standard block, we see that the compressive strength of these blocks is higher in comparison with the blocks which not have RHA. Which means the RHA helps in gaining the strength of the CLC block.

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Index Terms— ***Agricultural waste, Cellular light weight concrete, Fly Ash, Foaming agent, Red Clay Brick, Rice Husk Ash.***

I. INTRODUCTION

The use of red clay brick in the construction industry was very ancient and popular method in the past. But use of them was not environment friendly, because to make them requires a large amount of fertile soil, which affect the agriculture and during the baking process of them they emit a huge amount of CO^2 and greenhouse gases, which was also harm-full for the environment.

As time passes, and people become more sincere about the environment of the earth, they promote the use of eco-friendly things. In this direction construction industry, replace the use of the brick by the foamed concrete blocks. They are of two types, AAC Block & CLC Blocks. The both work on same principle, by entrap the air inside it the reduce the density and weight. This paper is focused on the CLC block. CLC block have more environmental benefits in comparison with the red clay brick. They are more thermal and fire resistant, they not require fertile soil, they not produce any kind of gases during the production, they promote the use of other waste material and they are also cheaper than red clay brick.

This paper studied the effect of use of Rice husk ash on the various properties of it. The rice husk ash is the agricultural waste which is generated by burning the rice husk. The burning temperature of rice husk should be maintained between 500 to 900. On burning the rice husk within this temperature range, the crystalline silica is generated in it and because of which when it is mixed with the concrete, the strength of the concrete increase.

II. MATERIAL USED

A. Cement

Under the study 53 Grade ordinary Portland cement conforming to IS 12269, is used. The compressive strength of which is 53N/mm2, fineness 370m2/kg, soundness 0.8 to 10 mm and specific gravity of 3.15.

B. Fly ash

When Fly ash conforming to IS 3812 (Part 1) may be used, class F fly ash taken from Ghatampur power plant. Specific gravity of it is 2.2 to 2.8.

C. Rice husk ash

As rice husk is taken from the Lohiya industry situated in Chaubeypur near Kanpur. This Rice husk is formed by burning the Rice husk at the temperature 650^0C. specific gravity of which is 2.3, bulk density is 96-100 kg/m^3, carbon percentage is 35%, hydrogen is 4-5%, and 65% finer when passes through the 75 micron IS sieve.

D. Foaming agent

The foaming agent should meet the requirement of 9 of IS 9103 and the foam produced shall be stable for duration beyond the final setting time of Portland cements. The Protein based foaming agent is used in this project.

III. METHOD

Under this study, we make a 3 kind of mixes by adding the cement, sand, RHA, fly ash, water and foaming agent in a definite amount of all of these. the size of the block selected

for the study is 300*150*200mm2. we make 8 blocks of each mix, which means we make a total 24 blocks. the proportion of all of these are given in table below.

Table 1: material used to produce $1m^3$

Material	Mix A	Mix B	Mix C
Cement	250 kg	300 kg	425 kg
Fly Ash	750 kg	600 kg	425 kg
Rice husk ash	250 kg	300 kg	225 kg
Water	250 L	300 L	425 L
Foam Agent	1.2L in 40 L of water	1.2L in 40 L of water	1.2L in 40 L of water

the constructed blocks were subjected to the 3 kinds of the testing in the HBTU laboratory.

A. Block Density

After the 28 days, taken out the sample from the curing tank. then dried it on the room temperature for 48 hours to completely eliminate the excess moisture. then, weighed it and determine the volume of it by measuring the dimensions it. then by using the formula we calculate the block density.

$$\text{Density} = \frac{Mass\ of\ the\ block\ in\ kg}{Volume\ of\ specimen\ in\ cm^3} \times 10^6\ kg/m^3$$

The average of the densities for the three blocks shall be taken as the average density.

B. Compressive Strength

Compressive strength of the body is defined as the, resistance provided by the body against the force to reduce the volume of body. the compressive strength test is done by using the CTM. to determine the compressive strength of the cube, first break the cube by applying the load on cube by using CTM. Then divide that load by the area of the cube.

the following formula is applied for determination of compressive strength. under this study, we done this test after 28 days.

$$\text{Compressive Strength}(N/mm^2) = \frac{Load}{Area}$$

The average of the Compressive Strength for the eight blocks shall be taken as the average Compressive Strength.

C. Water absorption test

to perform this test, we take a 3 sample from each mix, and take the weight of each sample. Then put these samples underwater for 24 hours. after 24 hours, by removing the extra surface water present on the sample, weight the sample. then apply the following formula.

$$\text{Water Absorption} = \frac{A-B}{B} \times 100$$

Where A is wet mass of the sample and B is the dry mass of the sample.

The average of the water absorption for the three blocks shall be taken as the average water absorption.

IV. RESULTS

The results of each test are given below;

A. Block Density

On performing the test block density test after 28 are give below in the table 2 and figure 1.

Table 2: Average result reported for 3 sample from each mix

S. No.	Mass of the block	Volume of the block	Average dry density
Grade A	9.05	0.009	1000
Grade B	8.78	0.009	900
Grade C	7.1167	0.009	800

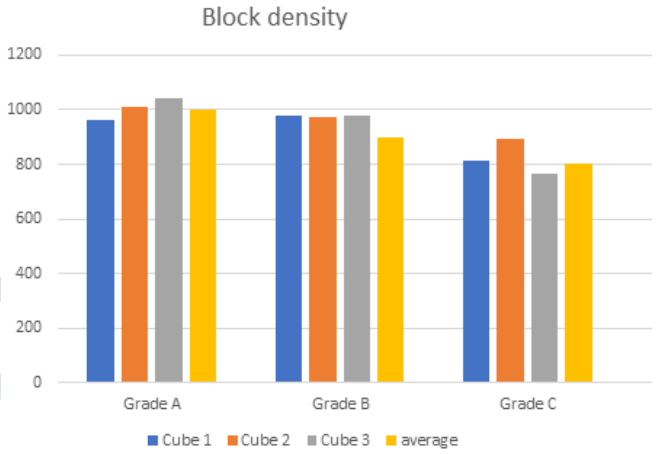

Figure 1: Figure for the block density result

B. Compressive Strength Test-

Compressive strength test performed on the 8 blocks from each sample and the result reported in table 3 and figure 2.

Table 3: Average Compressive strength of the 8 blocks from each sample

S.No.	AVERAGE COMPRESSION STRENGTH (N/mm^2)	CONVENTIONAL BLOCK COMPRESSIVE STRENGTH (N/mm^2) As per (IS 2185 part4 2008)
Grade A	3.95	3.5
Grade B	3.61	3.0
Grade C	1.90	2.5

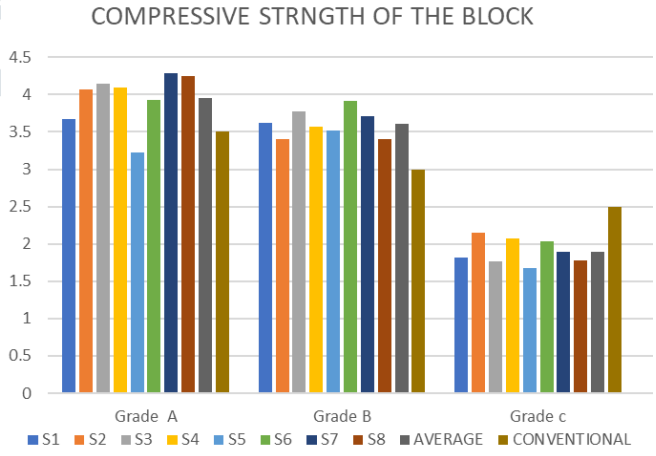

Figure 2: Compressive strength of the 8 blocks from each sample

C. Water absorption-

The water absorption test performed on 3 blocks from each sample mix. The reported result is the average of the water absorption of three samples.

Table 4: Average resulted for water absorption of 3 block from each sample

S.N	Dry	Wet	Average	Conventio

o.	weight (kg)	weight (kg)	Water Absorption %	nal block Average Water Absorption % As per (IS 2185 pat 4 2008)
Grade A	9.20	9.9	7.5	12.5
Grade B	8.9	9.68	8.7	12.5
Grade C	7.9	8.81	11.2	12.5

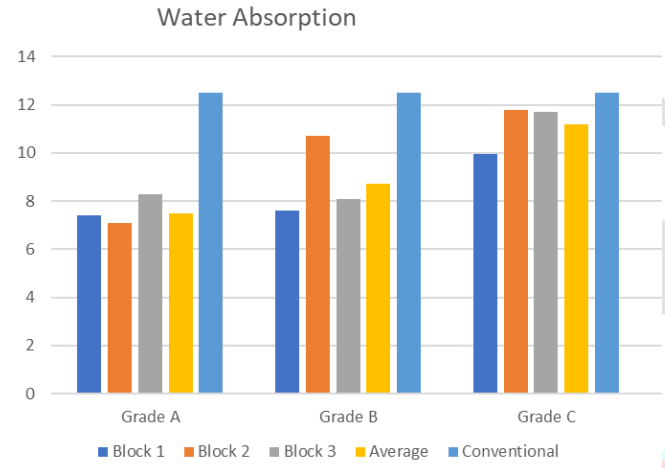

Figure 3: Water Absorption of the 3 blocks from each sample

CONCLUSION

The results reveled the following conclusions-

1. The compressive strength of the CLC block depend upon its density. As the density increases, the compressive strength is also increases.
2. The percentage of RHA, also helps in strength gaining of the CLC blocks, because of amorphous silica present in it.
3. Addition of RHA to CLC, also reduce the water absorption to some extent, but as we increase the amount of RHA in the CLC blocks, the water absorption is also increases. Which affect the durability of the concrete.

overall we can conclude that, the addition of RHA to CLC block is beneficial. it increases the strength of the block. it is also environmental friendly. it provides a way to dispose off the RHA waste. the RHA blocks are also cheaper than the red clay brick.

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