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Experimental Investigation on Properties of Concrete Enhanced by Replacement of Cement with Rice Husk Ash as an Admixture

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Abstract: ***With rapid increase in urbanisation the infrastructure developments have risen exponentially in the recent times. And the usage of cement in concrete production has risen ,the increased usage of cement creates environmental pollution due to emission of harmful gases during its manufacture. Rice husk Ash (RHA) is beneficial to experiment as partial replacement of cement as it is produced as bi product after use of rice husk for burning bricks and boilers. .Also RHA possesses good pozzolanic properties. This waste is converted to one of ingredient in concrete. Up to now, little research has been done to investigate the use of RHA as supplementary material in cement and concrete production. For the current study M40 grade concrete is used where in cement is partially replaced by RHA. The percentages of RHA are varied in 5, 10 and 15 for replacing the cement content. Experimental tests were carried out to measure mechanical properties (compressive strength and split tensile strength).***
Keywords: RHA, Compression, Split Tensile, Mechanical properties, Pozzolona.

I. INTRODUCTION

Pozzolana is a natural siliceous and aluminous material which reacts with calcium hydroxide in the presence of water at room temperature. In this reaction insoluble calcium silicate hydrate and calcium aluminate hydrate compounds are formed possessing cementations properties. RHA is found to be good material which fulfils the physical characteristics and chemical composition of Pozzolona as it contains around 85 % - 90% amorphous silica. In the referred journals no where there was reference of M40 grade concrete which was partially replaced by rice hush ash .Hence we have chosen this for our study. The various factors considered in this study were concrete grade of M40 and curing period of 7, 14days with replacement of cement with RHA of 5% and 10% . Rice husk is an agricultural residue widely available in major rice producing countries. The husk surrounds the paddy grain. During milling process of paddy grains about 78 % of weight is obtained as rice, broken rice and bran. Remaining 22 % of the weight of paddy is obtained as husk. This husk is used as fuel in the various mills to generate steam for the parboiling process. This husk contains about 75 % organic volatile matter and the rest 25 % of the weight of this husk is converted into ash during the firing process, this Ash is known as rice husk ash. About 500 million tons of paddies are produced in the world annually after incineration only about 20% of rice husk is transformed to RHA. Still now there is no useful application of RHA and is usually dumped into water streams or as landfills causing environmental pollution of air, water and soil. Pozzolonas improve strength because they are smaller than the cement particles, and can pack in between the cement particles and provide a finer pore structure.

RHA has two roles in concrete manufacture, as a substitute for Portland cement, reducing the cost of concrete in the production of low cost building blocks, and as an admixture in the production of high strength concrete.

The percentage replacement of cement with RHA is 5% , 10% & 15% and the percentage replacement of GF is 30% & 50%. The specimens are tested after 28 days of curing, for compression strength and split tensile strength. The RHA and GF can be utilized in concrete at 10% replacement of RHA with cement and 30% replacement of GF with fine aggregate.Addition of RHA up to 5% replacement levels and increase in tensile strength due to addition of RHA up to 10% replacement level.

II. MATERIALS

A. Materials Used

1) Cement.
2) Fine Aggregate.
3) Coarse Aggregate.
4) Water.
5) Super plasticizer.
6) Rice husk ash.

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III. EXPERIMENTATION

A. *Hardended Properties*

Mechanical Properties of concrete such as compressive strength, split tensile strength and flexural strength are tested on cubes, cylinders and beams respectively using UTM.

B. *Compressive Strength*

The compressive strength of concrete has increased gradually on increasing the fly ash percentage i.e., for 5%, replacement the compressive strength increased by 15% and for 10 % replace these was reduction in strength .The results are shown in the table1 and 2 below and the graphs are represented in figure 1 and 2 below

Table 1: Compressive Strength results

	Rice husk ash replacement percentages (N/mm^2)		
Curing period	0%	5%	10%
7 days	25.3	29.33	13.33
14 days	37.9	38.22	22.22

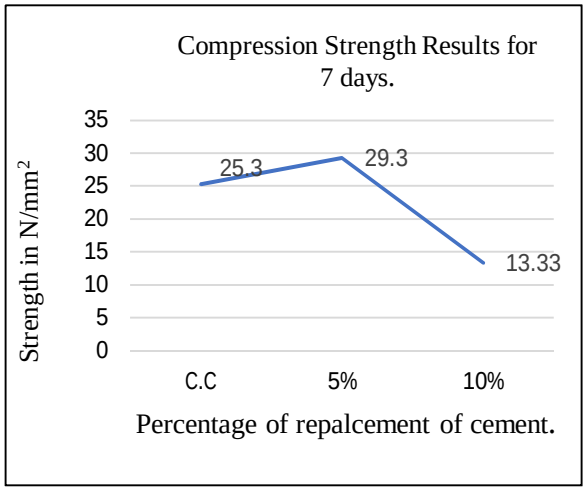

Figure 1 Compressive strength results for 7 days.

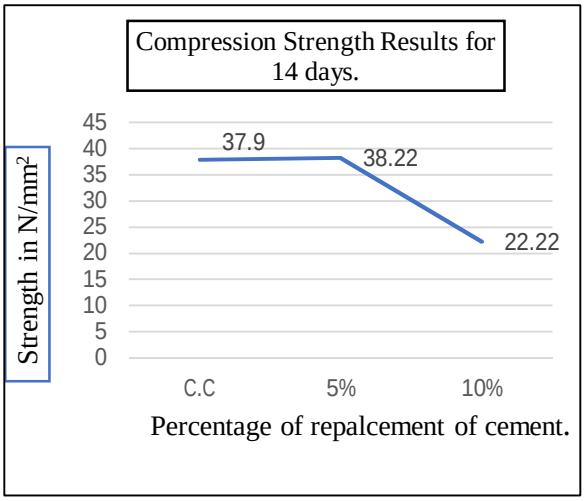

Figure2 Compressive strength results for 14 days.

C. Split Tensile Strength

The split tensile strength of concrete increased by 17.5% when replaced with 5% rice husk ash for 14 days of curing and the strength decreased when the rice husk percentage increased to 10 % .The results are shown in figure below and are tabulated in table 3 below and graphs are shown in figure 3 and 4 below

Table 3: Split Tensile Strength Results

	Rice husk ash replacement percentages (N/mm^2)		
Curing period	0%	5%	10%
7 days	1.27	1.41	0.84
14 days	1.69	1.98	1.13

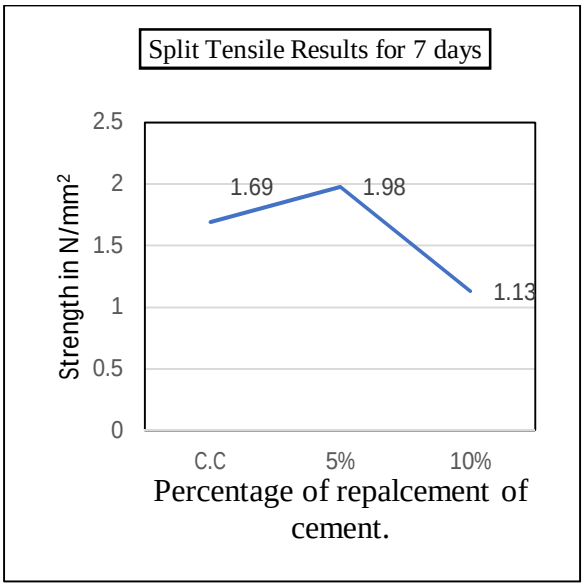

Figure 3 Split tensile strength results for 7 days

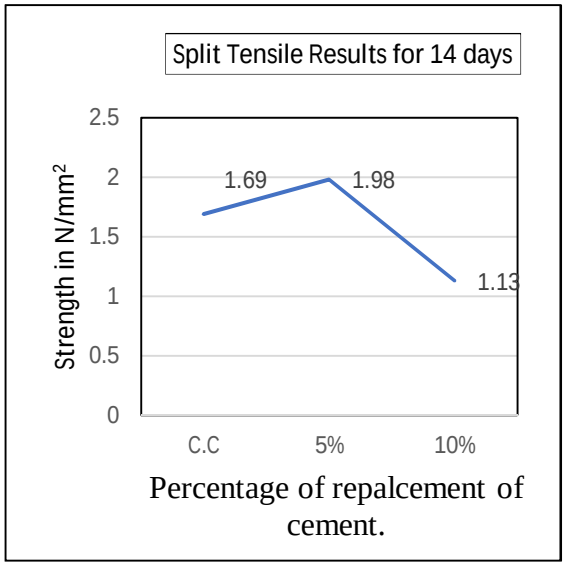

Figure 4 Split tensile strength results for 14 days

IV. CONCLUSIONS

Following are the conclusions drawn from the results studied

A. For Compression Test

1) With 5% replacement of cement with rice husk ash there is increase in strength of 15.92% for 7days and 0.84% for 14 days when compared to conventional concrete.

2) With 10% replacement of cement with rice husk ash there is decrease in strength of 47.3% for 7 days and 41.3% for 14 days when compared to conventional concrete.

B. For Split Tensile Test

1) With 5% replacement of cement with rice husk ash there is increase in strength of 11% for 7days and 17.15% for 14 when compared to conventional concrete.

2) With 10% replacement of cement with rice husk ash there is decrease in strength of 33.85% for 7days and 49.55% for 14 days when compared to conventional concrete.

3) It is observed that, absorption of moisture content increases with increase in percentage of rice husk ash.

4) Comparing all the results shows that we get optimum strength at 5% replacement of cement with rice husk ash.

V. FUTURE SCOPE

A. Similar studies are recommended for concrete beams and slab sections to ascertain the flexural behavior of lightweight concrete made with this material.

B. Durability studies of concrete cubes made with RHA as partial replacement for cement should be carried out.

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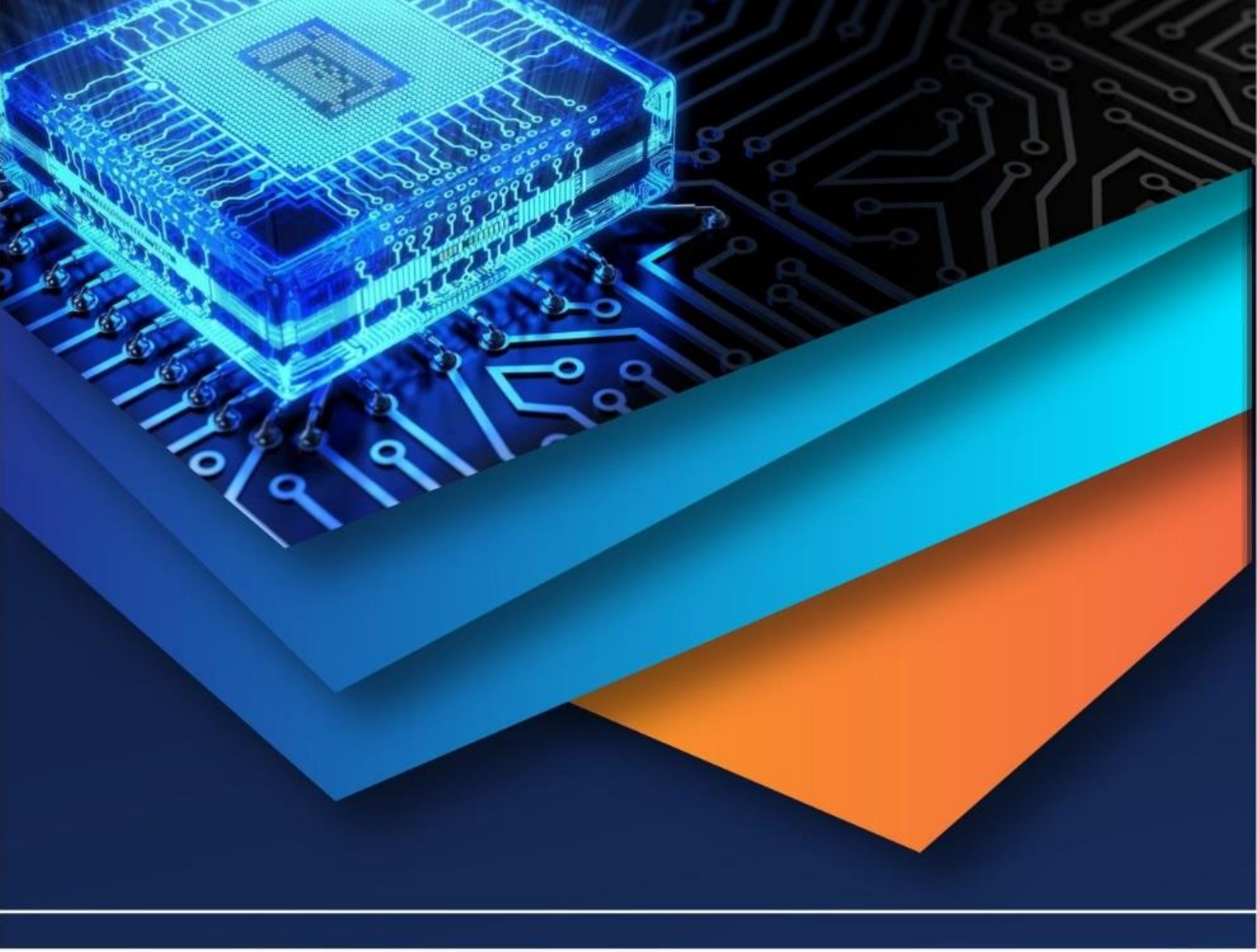

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