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Effect of Rice Husk Ash in Concrete as Cement and Fine Aggregate

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***Abstract*—Cement is the most expensive constituents of concrete. Over 5% of global CO_2 emission is attributed by cement production. Similarly due to the demand in the fine aggregate. In this work alternate source for cement and fine aggregate as rice hush ash is used. A comparative study on properties of concrete when cement and fine aggregate are partially replaced by rice husk ash. Percentage replacement of cement with RHA is kept as constant at 10% and fine aggregate is replaced at 0%, 5%, 10% and 15% in a mix of M20 grade of concrete. The strength such as compressive strength and split tensile strength are found out at 7 and 28 days. The strength are compared with control concrete and the optimum % of replacement of RHA is found out.**

***Keywords*— Rice Husk Ash (RHA), compressive strength, split tensile strength.**

I. INTRODUCTION

Nowadays disposing of agro waste are the major problem. One of the agro waste is Rice Husk. Every year an average of 120 million tonnes of rice husk are produced by paddy field. Majority of rice producing countries like india, the husk produced from the rice processing is either burnt or dumped as a waste. Rice husk can be used as a fuel if its burnt at high temperature and it turn into a ash. Ash obtained is porous as fine aggregate and its grinding into a fine power . RHA is a pozzolanic material contains 85% of silica content. Using Rice Husk Ash as a substitute material in concrete reduces the environmental problem.

II. OBJECTIVE OF PROJECT

1. To find the optimum percentage of RHA in concrete by partial replacement of Natural Sand.
2. To use pozzolanic material such as RHA in concrete by partial replacement of cement.
4. To find compressive strength and split tensile strength.
5. To provide economical construction material.
6. Safeguard the environment by utilizing agro waste properly.

III. EXPERIMENTAL MATERIALS USED

A. Rice Husk Ash

Rice Husk was burnt for approximately 60 hours in air under
uncontrolled burning process. The temperature at the range of 400-600^{o}C. The ash collected was porous as fine aggregate named as RHA2. Ash are grinding and sieved through IS sieve size 75µm named as RHA1.

B. Cement

Ordinary Portland cement of 53 grade was used. The specific gravity of cement is 3.17 was determined using Le Chatelier flask.

C. Fine Aggregate

Normal river sand is used as fine aggregate of zone III. Sand passing through sieve no 4.75mm is used. The specific gravity is 2.63

D. Coarse Aggregate

The coarse aggregate of maximum size 20mm is used. Its specific gravity is 2.65.

E. Water

Normal portable drinking water is used for casting and curing.

F. Superplasticizer

Conplast SP430 is used. It is a sulphonated napthalene based polymers**.** Its free from chloride and brown in colour. It is used to increases the workability of the concrete. Dosage limit is 0.6 to 1.5litres per 100 kg of cement.

IV. MIX DESIGN

The mix was designed for M20 grade as per IS: 10262-2009 at ratio of 1:2.1:3.26. The Table :1 shows various percentage replacement and Table : 2 shows mix design proportion for 1 m^3 of concrete.

Table :1 % of Replacement

Batch No	% Replacement of Cement (RHA1)	% Replacement of Fine Aggregate (RHA2)
1	0%	0%
2	10%	0%
3	10%	5%
4	10%	10%
5	10%	15%

Table : 2 Mix Proportions

Batch No	Cement (kg)	RHA1 (kg)	FA (kg)	RHA 2 (kg)	CA (kg)	W/C
1	350	0	756	0	1140	0.4
2	315	35	756	0	1140	0.4
3	315	35	718	38	1140	0.4
4	315	35	680	76	1140	0.4
5	315	35	642	114	1140	0.4

V. EXPERIMENTAL INVESIGATION

A. Slump Test:

Slump test was conducted for all batch and the slump values are as shown in Table :3 and figure no: 1.

Table :3 Slump Height

Batch No	Slump Height (mm)
1	95
2	90
3	86
4	85
5	82

Figure :1 Slump test

Total number of 30 cubes of size 150mm and 30 cylinder of diameter 150mm and 300mm height are casted and curing for 7 and 28 days.

B. Compressive strength test:

Compression Testing Machine of 2000kN is used for Compressive strength test. Cube size of 150 x150x 150 mm was used. Three cubes of each batch were tested.

C. Split tensile test:

Split tensile test was carried out on Compression Testing Machine of 2000kN capacity. Cylinder specimen of 150 mm diameter and height 300mm are used. Three cylinder of each batch were tested.

Figure :2 Compressive Strength Test Set up

Figure :3 Split Tensile Strength Test Set up

VI. RESULTS

Compressive strength tests were conducted at the ages of 7, 28 days. A comparative study was made on control concrete with replacement of cement by RHA1 in 10% and fine aggregate by RHA2 in 0%, 5%, 10% and 15%. The tests results are reported in Table :4 for the control concrete and RHA concrete.

Table 4: Compressive strength at 7 and 28 days

Batch No.	Compressive Strength (N/mm^2)			
	7 Days	28 Days	% Decrease in strength	
			7 Days	28 Days
1	29.1	44.15	-	-
2	27.78	41.78	0.0	0.0
3	22.52	39.41	18.93	5.67
4	26.2	37.19	5.69	10.98
5	26.85	37.33	3.34	10.65

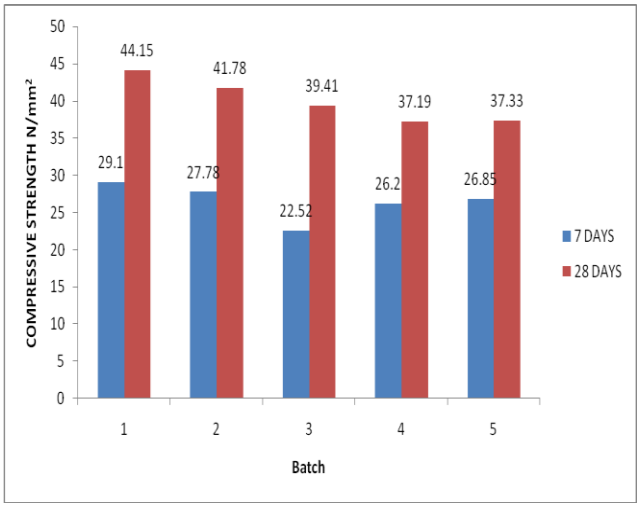

Figure:4 Compressive Strength at 7 days and 28 days

Table 4 shown below tabulates the split tensile strength at 7 and 28 days.

Table 4: Split Tensile strength at and 28 days

Batch No.	Split Tensile Strength (N/mm^2)			
	7 Days	28 Days	% Increase in strength	
			7 Days	28 Days
1	1.63	2.41	-	-
2	2.10	2.55	0.0	0.0
3	2.12	2.78	0.95	9.02
4	2.15	2.83	2.38	10.9
5	2.48	2.93	18.09	14.90

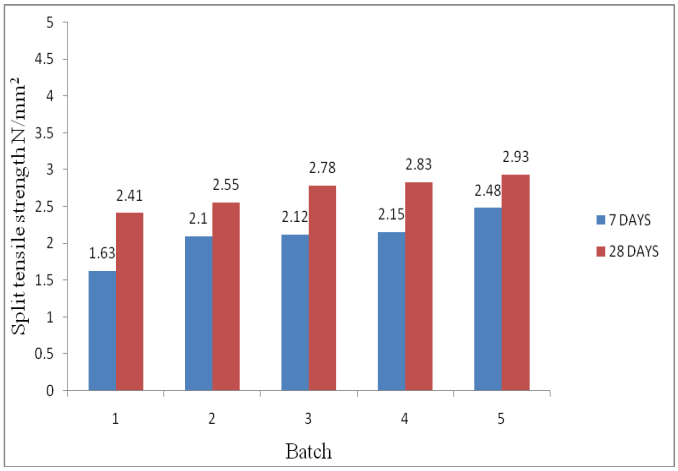

Figure :5 Split tensile strength at 7 and 28 days

VII. CONCLUSIONS

Based on above study the following observations are made on partial replacement of cement and fine aggregate by Rice Husk Ash:

(i) The gradual decrease in the compressive strength as the percentage of replacement increases at 7 and 28 days .

(ii) The gradual increases in spilt tensile strength as the percentage of replacement increases at 7 and 28 days.

(iii) The maximum compressive strength is obtained at 5% replacement of fine aggregate by RHA.

(iv) The maximum Split tensile strength is obtained at 15% of replacement of fine aggregate by RHA.

(v) The workability of RHA concretes have decreased if the percentage of replacement increases.

(vi) The problem of disposal of land filling is reduced.

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