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A Study on Compressive Strength of Cement with Rice Husk ASH

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ABSTRACT

In this Research work ,the investigation was carried to find the effect of partial substitution of cement by rice husk ash (RHA) in proportion starting from 15% mix together in concrete by substitution of cement with the moderate increase of RHA 5%, last proportion was taken 15% RHA .The test on hardened concrete were destructive in nature which includes compressive test on cube for size (150*150*150) at 3,7 and 28 days of curing done as per IS 10269 2009,the work performed in this research reports the effect on the behavior of concrete produced from cement with RHA at different proportion on the mechanical properties of concrete such as compressive strength. Investigation reported that compressive strength increases by 32% were obtained at different combinations at 5% ,10% and 15% RHA partial replacement of RHA produces the environmental effects , so this replacement is ecofriendly and improves its strength.

Keywords : Rice Husk Ash , Cement, Hardened Concrete , Compressive Test, Compressive Strength.

I. INTRODUCTION

The Earth at the end of the 20th century has just been left behind was not same to the Earth that its people left at the beginning of that century. The last half of the previous century saw marvellous technological improvements and inventions in science and engineering and in the wide range and use of materials. The construction industry has been no exception to these changes when one looks at the achievements in the design and construction of buildings.

There is no doubt that these unpredictable changes to the scientific, engineering and industrial face of the world have brought benefits in terms of wealth, good living and leisure. But, by unprecedented changes, unpredictable upheavals in world economy, uncompromising social attitudes, and unacceptable pollution and damage has brought to our environment.

In global terms, the social transformations that have roused can be categorized in terms of technological revolutions, population growth, and uncontrolled pollution.

II. METHODS AND MATERIAL

2. Experimental Procedure

2.1 Materials

- Cement
- Fine aggregate
- Coarse aggregate
- Water
- Rice husk ash

2.2 Materials Description and Their Properties

2.2.1 Cement

Cement used in the experimental work is **Ordinary Portland cement** conforming to IS: 12269-1987. The physical properties of the cement obtained on conducting appropriate tests and the requirements as per IS: 12269-1987 is given in Table.

Table 1 : Chemical Properties of Ordinary Portland cement

PARTICULARS	TEST RESULTS	REQUIREMENTS OF IS: 12269-1987
Loss on Ignition	4	5.0 Maximum
Magnesia(% by mass)	6	6.0 Maximum
Sulphuric anhydride (% by mass)	1.55	3.0 Maximum
Insoluble material (% by mass)	2	27.5 Maximum
Chloride (%)	0.011	0.1 Maximum

Table 2 : Physical properties of Ordinary Portland cement

PARTICULARS	TEST RESULTS	REQUIREMENTS OF IS: 12269-1987
Specific Gravity	3.15	
Fineness (m2/kg)	225	225m2/kg. minimum
Normal consistency	32%	
Setting time (minutes): Initial Final	 100 ± 5 210 ± 5	 30 minutes minimum 600minutes maximum
Soundness Le-Chatlier expansion Autoclave expansion	1.5 mm max 0.07%	10 mm maximum 0.8% maximum
Compressive strength (Mpa) 72+1hr (3 days) 168+2hr (7days) 672+4hr(28 days)	 40 ± 2 50 ± 2 61 ± 2	 27 Mpa minimum 37 Mpa minimum 53 Mpa minimum

2.2.2 Fine Aggregate:

Fine aggregate was purchased which satisfied the required properties of fine aggregate required for experimental work and the sand conforms to zone I as per the specifications of IS 383: 1970.

Table 3 : Properties of Sand

S.No	Property	Values
1	Specific Gravity	2.62
2	Fineness Modulus	2.8
3	Bulk Density 1.Loose State 2.Compacted State	15.75 kN/m3 17.05 kN/m3
4	Grading of Sand	Zone – I

2.2.3 Coarse Aggregate:

Crushed granite of 20 mm maximum size has been used as coarse aggregate. The sieve analysis of combined aggregates confirms to the specifications of IS 383: 1970 for graded aggregates.

Table 4: Properties of Coarse Aggregate

S.No	TEST	RESULT
1	Specific gravity	2.6
2	Fineness Modulus	3.44
3	Shape	Angular

2.2.4 Rice Husk Ash:

Rice Husk Ash used in the present experimental study was obtained from Tirupati.

Specifications, Physical Properties and Chemical Composition of this RHA as follows:

Table 5 : Specifications of Rice Husk Ash

Silica	90% minimum
Humidity	2% maximum
Mean Particle Size	25 microns
Colour	Grey
Loss on ignition at 8000 C	4% maximum

Table 6 : Physical Properties of Rice Husk Ash

Physical State	Solid – Non Hazardous
Appearance	Very fine powder
Particle size	25 microns – mean
Colour	Grey
Odour	Odourless
Specific Gravity	2.3

Table 7 : Chemical Properties of Rice Husk Ash

SiO2	93.80%
Al2O3	0.74%
Fe2O3	0.30%

TiO2	0.10%
CaO	0.89%
MgO	0.32%
Na2O	0.28%
K2O	0.12%

III. RESULTS AND DISCUSSION

3.1 Compressive Strength Test Results

The below table represents the variation of compressive strength with age for M25 grade RHA concrete, in each figure, variation of compressive strength with age is depicted separately for each replacement level of RHA considered namely 5%, 7.5%, 10%, 12.5% and 15%. Along with the variations shown for each replacement, for comparison similar variations is also shown for control concrete i.e., for 0% replacement. In each of these variations, it can be clearly seen that, as the age advances, the compressive strength also increases. The highest strength obtained at a particular age for different replacement levels with RHA is reported in table 13 for the ages of 3 days, 7 days, 28 days.

Table 8 : Highest Compressive strength obtained at different ages

Age in days	0%	5% RHA	10% RHA	15% RHA
3	14	13.2	12.5	12.3
7	27.2	26	24.8	24
28	36.1	35.2	33.2	33.6

IV. CONCLUSION

Based on the limited study carried out on the strength behaviour of Rice Husk ash, the following conclusions are drawn:

- ✓ At all the cement replacement levels of Rice husk ash; there is gradual increase in compressive strength from 3 days to 7 days. However there is significant increase in compressive strength from 7 days to 28 days followed by gradual increase from 28 days to 56 days.
- ✓ At the initial ages, with the increase in the percentage replacement of both Rice husk ash, the flexural strength of Rice husk ash concrete is found to be decrease gradually till 7.5% replacement. However as the age advances, there is a significant decrease in the flexural strength of Rice Husk ash concrete.

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