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A Review on Mechanical Characterization Using Rice Husk Ash in Concrete

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Abstract: -- The main objective is to study the mechanical properties of a high strength concrete by using Rice Husk Ash (RHA) instead of different replacement in levels of an Ordinary Portland Cement (OPC). The standard cylinders (300mm height x 150mm dia), prisms (100mm X 100mm X500mm) and cubes (150mm X 150mm X 150mm) were casted. In all specimens having M50 and M40 grade mix are casted and tested. The comparison is done between the RHA of both grades with high strength concrete of various amount replacement of the cement viz i.e, 15%, 10% ,5%, 0% and along with high strength concrete without RHA. The compressive test is done for various number of days. A interesting and quite encouraging results are obtained of mechanical properties of RHA for a particular number of days. By increasing the Rice Husk Ash fineness, enhanced strength of the blended concrete are compared to coarser Rice Husk Ash and control OPC mixture. Increase in water demand in concrete by incorporation of the Rice Husk Ash. Up to 20% of cement can be replaced by RHA without adversely affecting in the strength and it shows excellent improvement in the strength.

Keywords: Rice Husk Ash (RHA), Tensile Strength Test, Compressive test, Mechanical characterization, Cement.

I. INTRODUCTION

Ravande kishore et. al.[3] said that, Rice husk is the one of waste material found in rice growing region. This is not only to make purposeful utilization of agricultural waste, but also to reduce the energy consumption used in production of the cement. Rice husk is a agricultural based product, which can also be used a subtitle of the cement without sacrificing the durability and strength.Rice husk were used for cooking purposes too but now it's replaced by LPG. Rice husk has a negligible protein contents, and it's not useful for feeding of animals. RHA is obtained by burning of rice-husk, i.e, the by-product of the rice.

Syed Mehdi et. al. [1] estimated that 200 kg of the rice husk was produced by 1000 kg of the rice grain and from that 200 kg of rice husk only 20% of rice husk or only 40 kg of RHA was produced.

Shridharmurthy et. al. [8] performed mixed mode fracture tests on brittle material.

Ghassan abood habeeb et. al.[5] showed that, Chemical composition of the rice husk are found by varying from one another due to difference in type of crop year, geographical condition, paddy and climate. Rice husk are burnt under control temperature about 8000c, this can produce a ash with a silica mainly in the amorphous form. Syed mehdi abbas et. al.[1] said that, Pozzolanic activities of RHA depends on (1) silica crystallization phase, (2) Surface area and size of the ash particles, (3) Silica content. In addition, a small amount of carbon should be present in the ash.It is reported that Rice Husk Ash has good pozzolan for numerous researches. During a mass concrete, compared to the OPC concrete, Rice Husk Ash has more effective in reducing the temperatures of the mass concrete. This summarizes the use of RHA as a partial replacement of OPC in concrete. P. K. Mehta et. al.[9] proved that, The cement containing RHA posses excellent resistances to the dilute mineral or organic acid. Water demand for the normal consistency to increasing the ash content of blended cements. This can be overcome by using the application of certain water reducing mixture. The reaction that take place in preparation of the RHA concrete are, silicon is burnt in presence of the oxygen that gives silica.

$Si + O_2 \text{-------} \rightarrow SiO_2$

C_3S (cement) + H2O-----→ CSH + $Ca(OH)_2$

$SiO_2 + Ca(OH)_2$ -------→ CSH + SiO_2

II. MATERIALS

A.Rice Husk Ash (RHA)

Godwin A Akeke et. al.[4] said that, Rice husk is burnt under control temperature under 8000c, (or) rice husk should be burnt for approximately 48 hours in a open air and by uncontrolled burning process and the temperature should be in the range of 4000 to 6000c. The ash's BS standard sieve size should be 45micrometer and its color should be grey.

Makarand suresh kulkarni et. al. [2] gave the physical properties of RHA that are to be replaced in the concrete (Table1).

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Sl No.	Particulars	Properties
1	Colour	Gray
2	Shape Texture	Irregular
3	Mineralogy	Non Crystalline
4	Particle size	< 45 micron
5	Odour	Odourless
6	Specific gravity	2.3
7	Appearance	Very fine

Cement:
Ghassan Abood Habeeb et. al.[5] studied that, OPC are used in composites and properties are in compliance with a standard organization, defined by ASTM standard i.e, C150 type of cement for a concrete production .

Water:
Godwin A Akeke et. al.[4] studied that, water plays a important role in the concrete production in that, it start reaction between the cement and aggregates. It helps in hydration of mix. In this water used are pipe–borne water and the water free from the contaminations.

III. EXPERIMENTAL PROGRAMME

Akobo et. al.[5] proved that, Concrete is an mixture of cement, water, admixture and aggregate. Ravande kishore et. al.[3] proved that, Experimental programs are designed for determining mechanical properties like tensile strength, compressive strength and flexural strength. This program consists of a testing and casting of a particular number of specimen (144). For the testing of all specimens universal testing machine i.e, UTM of 200 tons are used. In the first series specimens of M50 and M40 grade are casted with a different replacement in levels of the cement as 15%, 10% ,5%, & 0%. Ghassan Aboob habeeb et. al.[5] said that, Total time for the mixing is 5 minutes and then the samples are casted and allow it 24 hours for drying compressive strength are investigated at age of 1, 3, 7 & 28 days. The specimen is left in casting room for an 24hours and then, it is moved into water and curing until the testing time. By variation of the compressive strength with a age are depicted separately for each of the replacement in levels of RHA are considered namely 0, 5, 10, & 15%. By each of the verification, it is clear that age of advances, increase in compressive strength can be observed.

A. Testing Methodology

Tensile strength test:-
Ravande kishore et. al.[3] shows an experimental procedure and testing diagram in fig 1. Cylinder specimen are placed in horizontal position in centering with loading pieces (wooden strips) packing skip are carefully placed along with the bottom and the top of the plane of loading the specimen. The loads were applied without stock and are increased continuously at normal rate within the range of 1.2 to 2.4 N/mm2 /min till the failure of the specimen. At failure, the maximum load that was applied is recorded. After the investigation on 28 days, the tensile strength results are similar at all the replacement percentage.

Figure 1 :- Test for Tensile Strength.

Compressive strength test:
Ravande kishore et. al.[3] showed that, Cube specimen are placed in machine of 200 tonnes capacity. The load is applied approximately at the rate of 140kg/cm2/min till the resistance of the specimen to increasing loads can be sustained.
Ghassan Aboob habeeb et. al.[5] studied that, Concrete with the coarser RHA exhibited lesser strength than fine rice husk ash concrete. As the age of the specimen is more, the strength achieved are higher values. Ravande kishore et. al.[3] showed that experimental setup in fig 2.

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Figure 2 :- Test for Compressive strength.

Flexural strength test

Ravande kishore et. al.[3] studied that, The specimen are place in a machine in such a way that load should be applied to upper most surface as cast in mould, and along with two line spaced i.e. 13.33 cm apart. The axis of specimen should be carefully aligned with the axis of loading device. The loads are applied through the two similar rollers of steel, diameter is 38 mm and are mounted at 3rd point of supporting span which are spaced at 13.33 cm from center to center.
Maurice Ephram et. al. [4] proved and gave the equation that, the load are applied without stock and are continuously increased at rate of 180kg/min till the specimen fails.

$F_{cf}= FL/(d_1+d_2)^2$

F = Breaking load (n).

d_1 & d_2 = lateral dimension of cross section.

L = Distance between supporting rollers

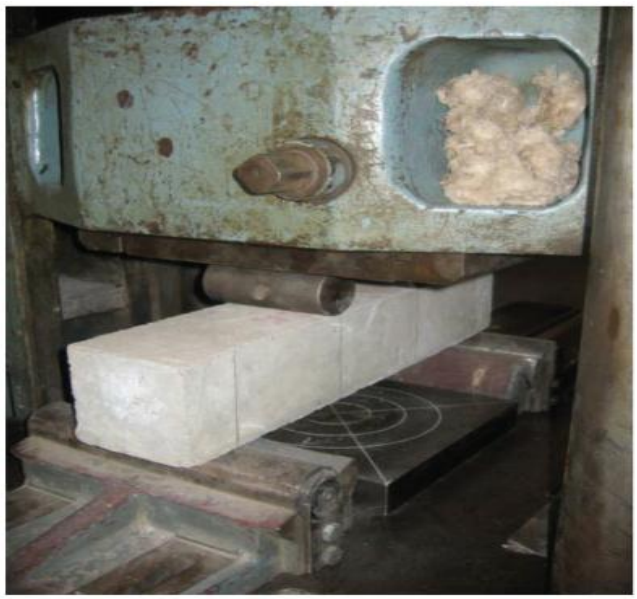

Figure 3 :- Test for Flexural Strength.

IV. DISCUSSION

A, Tensile strength of concrete

Ravande kishore et. al.[3] proved that, After the curing of 28 days, in both M50 and M40 grades of concrete, as replacement level increase there will be decrease in tensile strength for 5% to 10%. 4.19 Mpa and 3.98 Mpa is splitting tensile strength for M50 and M40 grade of concrete. At 15% of replacement there is decrease in 9.1 to 5.1 % of tensile strength for both M50 and M40 grade of concrete. Ravande kishore et. al.[3] as given the results for both the grade of concrete for 28 days (table2).

Rice husk ash %	Tensile strength (MPa)	
	M40	M50
0	4.19	4.19
5	4.05	4.60
10	4.05	4.26
15	3.98	4.19

Table 2 :- 28days tensile strength of concrete.

B. Compression strength of concrete:-

Ravande kishore et. al.[3] proved that, For M40 grade of concrete from 7 to 28 days for 15% replacement, 42% of strength increase was observed. It is clear that as the

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number of days or ages increases its compressive strength also increases.

Ravande kishore et. al.[3] as given the results for both the grade of concrete for 7 and 28 days (table3 and 4).

Rice husk ash %	Compressive strength (MPa)	
	7days	28 days
0	37.20	50.80
5	35.34	48.26
10	34.12	44.72
15	30.36	43.18

Table 3 :- compressive strength for M40 grade RHA concrete.

Rice husk ash %	Compressive strength (MPa)	
	7 days	28 days
0	48.31	59.43
5	42.00	56.43
10	38.40	53.43
15	37.37	50.46

Table 4 :- compressive strength for M50 grade RHA concrete

C. Flexural strength of concrete:-

Ravande kishore et. al.[3] proved that, At 15% replacement of RHA with cement it was observed that there is a decrease in flexural Strength for both the grades of concrete, but the target strength was obtained by 10% of replacement. Ravande kishore et. al.[3] as given the results for both the grade of concrete for 28 days (table5).

Rice husk ask %	Flexural strength (MPa)	
	M40	M50
0	4.87	5.36
5	4.40	4.87
10	4.34	4.76
15	4.17	4.72

Table 5 :- 28 days flexural strength of concrete

V. CONCLUSION

1) Workability of concretes are decreased to 27% of slump and 9% of compaction factor by replacement of the cement by rice husk ash in the concrete increases [3].

2) The workability and compressive strength test suggest that the rice husk ash can be substituted For OPC till the practical percentage [4].

3) By the addition of the rice husk ash there is no improvement i.e. no increase in tensile strength are observed [5].

4) RHA concrete has a good number of qualities that, they are durable and as good structural concrete for long and short term consideration [7].

5) At 10% replacement level they are good for structural concrete and there is decrease in Compressive strength and improved workability [6].

6) Water content required for desired strength and workability in case of the RHA concrete then the normal concrete [1].

7) The optimum replacement levels of RHA are found to be 10% for M50 and M40 grade of concrete [3]

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As the increase in age of the concrete are good for replacement level.

REFERENCE

[1] Syed Mehdi Abbas, Dada Patil, Sanjeev Raje (2015). “Use of Rice Husk Ash in Concrete”. IJOSER, Vol 6, Issue 12, December 2015, PP 276-278.

[2] Makarand Suresh kulkarni, Paresh Govind Mirgal, Prajyot Prakash Bodhale, S.N. Tande. (2014). “Effect of Rice Husk Ash on properties of concrete”. JOCEET, Vol 1, August 2014, PP 26-29.

[3] Ravande Kishore, V. Bhikshma, P. Jeevana Prakash. (2011). “Study on Strength Characteristics of

High strength Rice Husk Ash Concrete". Procedia Engg 14 (2011), 2666-2672.

[4] Godwin A. Akeke, Maurice E. Ephraim, Akobo, I.Z.S and Joseph O. Ukpata. (2013). "Structural Properties of Rice Husk Ash Concrete". IJEAS, Vol 3, No 3, May 2013, PP 57-61.

[5] Ghassan Abood Habeeb, Hilmi Bin Mahmud. (2010). "Study on Properties of Rice Husk Ash and its use as cement replacement material". Mar. Res. Vol 13. No 2, Apr/ June 2010.

[6] P.Padma Rao, A. Pradhan Kumar, B.Bhaskar Singh. (2014). "A Study on use of Rice Husk Ash in concrete". IJEAR, Issue spl-2, Jan-June 2014, pp 75-81.

[7] Hwang Chao-Lung, Bui Le Anh-Tuan, Chen Chun-Tsun. (2011). "Effect of Rice Husk Ash on the Strength and Durability characteristics of concrete". Construction and building materials 25, 2011, PP 3768-3772.0

[8] Shridharmurthy H N, H K Srinivas, Shashidhara L C, Madhusudhan T.(2016). "A Review on investigation of mixed mode Fracture in Brittle materials". IJRET, Vol 5, spl issue 09, may 2016, pp 24-29.

[9] P.K. Mehta, "Properties of blended cements made from Rice Husk Ash". ACI journal/September 1977, pp 440-442.