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ANALYSIS OF CEMENT CONCRETE PREPARED WITH WASTE RICE HUSK ASH

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ABSTRACT: Ordinary Portland Cement (OPC) is by far the most expensive component of the materials used in concrete making for housing and civil engineering projects in India. Therefore, the need to research into more ways of utilizing solid wastes as mineral admixtures to partially replace OPC has continued to increase. The increase in requirement forthe ingredients of concrete is obtained by fractional replacement of materials by waste materials which is obtained by means ofdifferent industries. In today's condition concrete needs special combinations of performance and uniformity requirements that cannot be always achieved by using traditional constituents and normal mixing. Concrete is weak in tension, has limited ductility and little resistance to cracking. On the other hand, Due to growing environmental awareness as well as stricter policy on managing industrial waste, the world is progressively more turning to researching properties of industrial waste and judgment of solutions on using its valuable component so that those might be used as secondary raw material in other industrial branches. The present experimental investigation is done to study theeffect of partial replacement of cement by Rice husk ash (RHA) with using in concrete. The experimental investigation carried out on up to entire fibre volume portion of 0.5%, 1%, 1.5% and 2.0 % and cement wa spartially replaced with 10%, 20%, 30% and 40% of RHA on the basis of previous research results. The mechanical properties like compressive strength, splitting tensile and flexural strength were studied for concrete prepared. All results were determined at the age of 7, 14 and 28 days of curing.

Keywords: Concrete, Rice Husk Ash (RHA), s, Environment, Mechanical Properties, Durability.

I. INTRODUCTION

Concrete is the most significant constituent for the growth of infrastructure, buildings, industrialized structures, flyovers and highways etc. In today's circumstances concrete needs extraordinary combinations of appearance and uniformitynecessities that cannot be always achieved by using conventional constituents and normal mixing. Construction industry is one of the highest increasing sectors in India. Rapid construction action and rising requirement of houses has guide to the short fall of conservative building supplies like bricks, cement, sand and wood. Requirement of good features of building supplies to replace the conservative materials and the requirement for cost effective and durable materials for low cost construction has necessitated the researchers to expand variety of new and inventive construction materials.

FIBRE REINFORCED CONCRETE (FRC)

Fibre reinforced concrete is a comparatively new construction material created through broad research and development exertion throughout the last two decades. It has been proved as a trustworthy construction material having greater performance uniqueness compared to the conventional concrete. Integration of fibres in concrete has been establish to progress numerous of its properties; cracking opposition, ductility and fatigue confrontation, crash and wear resistance.

AIM

The aim of the dissertation was to study the difference in strength distinctiveness of concrete, for this proportion of M30 grade is designed. In each mixes containing dissimilar percentages of through rice husk ash is replaced by different % in cement as compared to normal concrete, i.e. controlled The number of specimens casted for each case is as follows.

1. Workability of concrete test like slump cone test.
2. Engineering properties like Compressive, Split tensile strength and Flexural strength test.

II. RESULTS AND DISCUSSION

In order to achieve the objectives of current study, an investigational program was planned to investigate the consequence of RHA on compressive strength, split tensile and flexural strength of concrete so as to evaluate its feasibility for use in pavement. The experimental plan consists of casting, curing and testing of controlled and RHA- concrete specimen at different ages.

The experimental program includes the subsequent points:

- Testing of properties of materials used for production concrete.
- Design of mixes for reinforced concrete.
- Casting and curing of specimens.
- Tests to establish the compressive strength, Split Tensile,flexural strength of high strength reinforced concrete.

WORKABILITY

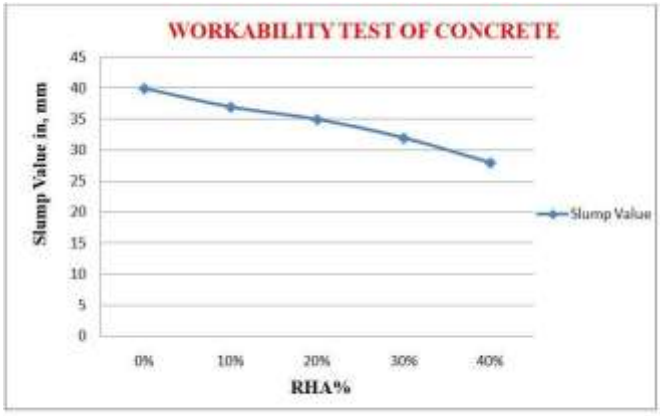
Slump cone test was conducted on all samples. Concrete mix with 30% RHA gave the highest slump with 38 mm while addition showed a slump measurement of 36 mm to 31 mm. Graph shows the reduction in slump measurement when fibre was added. This result shows that concrete mix with higher fibre content of a constant w/c ratio will give a lower workability as the stability of concrete mix with support of fibres.

TEST RESULTS

SLUMP TEST (WORKABILITY)

S.No	RHA (%)	Weight of RHA in Mix (Kg)	Slump Value, mm
1	0	00	40
2	10	43	37
3	20	86	35
4	30	129	32
5	40	172	28

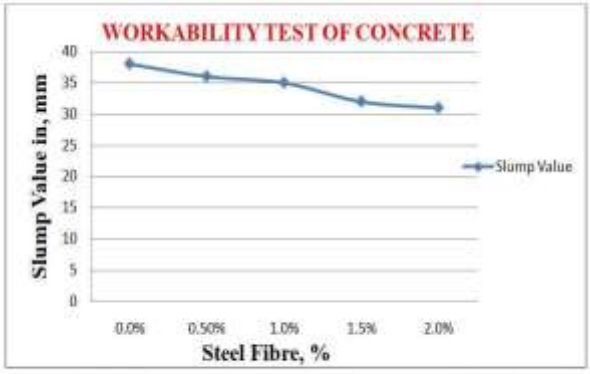
Table 1: Workability Test results of cement replaced with RHA.



Graph 1: Workability testing of concrete Mix with RHA.

S.No	RHA (30%) + Steel Fiber %	Weight of RHA in Mix (Kg/cum)	Weight of in Mix (Kg/cum)	Slump Value, mm
1	0	129	00	38
2	0.5		40	36
3	1.0		80	35
4	1.5		120	32
5	2.0		160	31

Table 2: Workability test of concrete with 30% RHA Different % of .

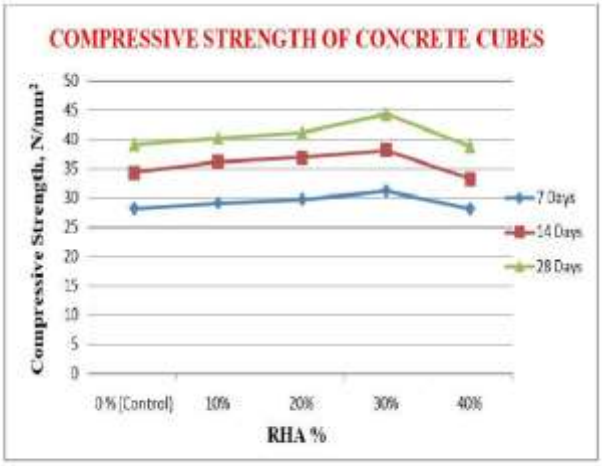


Graph 2: Workability test of concrete by slump conemethod with 30% RHA different percentage of .

III. COMPRESSIVE STRENGTH

Mix	Average Compressive Strength (N/mm²)		
	7 days	14 days	28 days
0 % (Control)	28.23	34.4	39.15
10%	29.14	36.23	40.27
20%	29.75	36.95	41.15
30%	31.27	38.15	44.36
40%	28.15	33.25	38.80

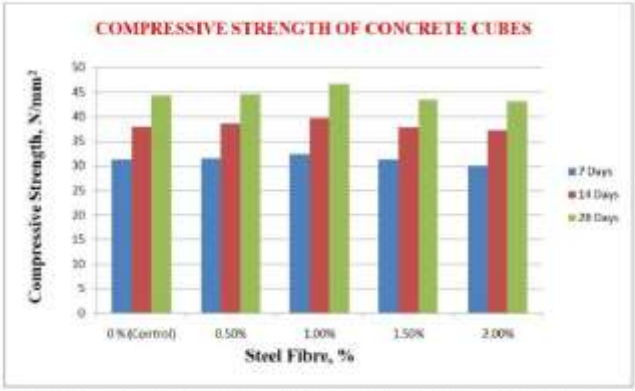
Table 3: Details of Compressive Strength test with various % of RHA.



Graph 3: Compressive Strength testing of concrete cubes with various % RHA

S.No	RHA (30%) + Steel Fiber %	Average Compressive Strength (N/mm²)		
		7 days	14 days	28 days
1	0 % (Control)	31.27	38.15	44.36
2	0.5%	31.50	38.60	44.68
3	1.0%	32.43	39.85	46.76
4	1.5%	31.25	38.00	43.50
5	2.0%	30.10	37.25	43.15

Table 4: Test results of compressive strength of dissimilar mix with different percentage of 30 % RHA & .



Graph4: Compressive Strength variation of each mix with dissimilar percentage of RHA & .

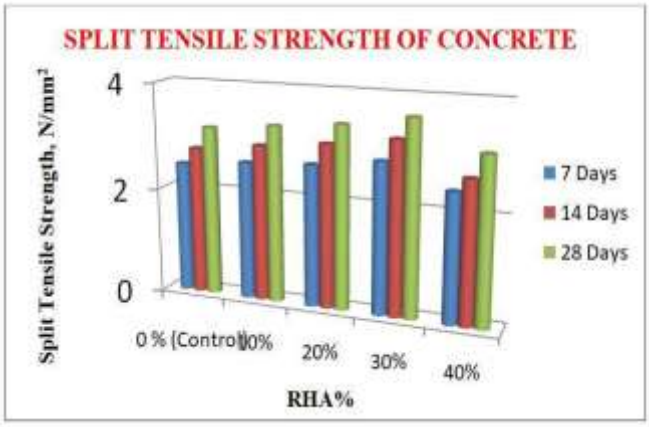
SPLIT TENSILE STRENGTH

The split tensile strength of all the mixes was determined at the ages 28 days for various replacement levels of RHA variable percentages of s in concrete mix. The 150mm × 300 mm size cylinders were casted and tested in the compression testing machine with a uniform rate of 180 kg/min. The results of split tensile strength of concrete are reported in Table 4.3 shows the gain in split tensile strength for different levels of RHA replacement with concrete and addition of at different time. The split tensile strength results of individual concrete mix are also shown graphically.

From the results, it is observed that the optimum value of split tensile strength is achieved with addition of 1% of in controlled concrete mix.

Mix	Average Split Tensile Strength (N/mm^2)		
	7 days	14 days	28 days
CM	2.46	2.77	3.18
10%	2.58	2.92	3.30
20%	2.65	3.05	3.42
30%	2.82	3.23	3.63
40%	2.40	2.65	3.10

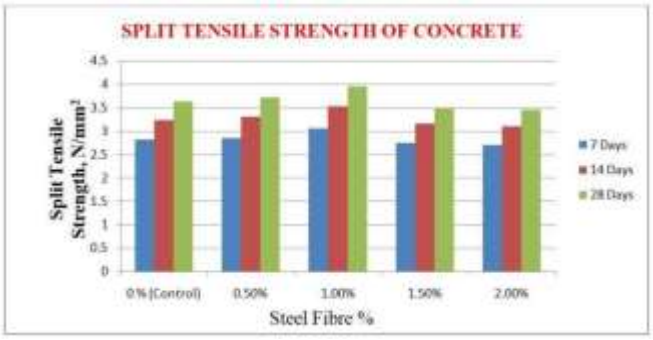
Table 5: Details of Split Tensile Strength test with different % of RHA.



Graph 5: Split Tensile Strength testing of concrete cylinders with various RHA%.

S.No	RHA (30%) + Steel Fiber %	Average Split Tensile Strength (N/mm^2)		
		7 days	14 days	28 days
1	0 % (Control)	2.82	3.23	3.63
2	0.5%	2.85	3.31	3.72
3	1.0%	3.05	3.52	3.95
4	1.5%	2.75	3.15	3.50
5	2.0%	2.70	3.10	3.45

Table 6: Split tensile strength of different mix with 30% of RHA & .



Graph6: Test results of split tensile strength of different mix with 30% of RHA & .

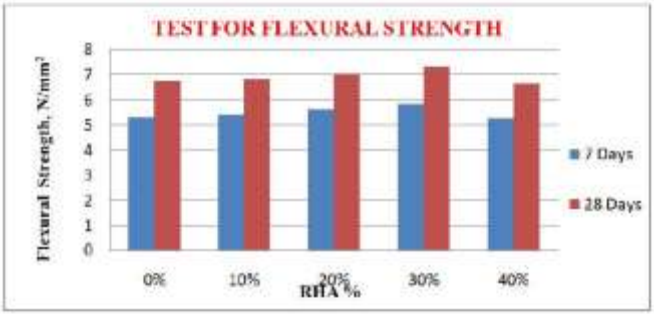
FLEXURAL STRENGTH

The most general concrete structure subjected to flexure is a highway or airway pavement and potency of concrete for pavements is usually evaluated by use of bending tests. When concrete is subjected to bending, then tensile and compressive stresses and in many cases direct shear stresses are developed. When fibre reinforced concrete and composite beams are loaded in pure bending, then the tensile strains develop. The load at first crack would increase with admiration to reinforced concrete due to crack arresting mechanism of the closely spaced fibres. After the concrete matrix cracks, the fibres continue to take higher load which is provided. Thus the ultimate flexural strength is increased.

Test specimens of beam size 100 mm×100 mm×500 mm were prepared for determining the flexural strength of reinforced concrete and substitute of cement with RHA. The beam moulds containing the test specimens were placed in moist air (at least 90% relative humidity) and a temperature of 27° ± 2 °C for 24 hours ⁄hour from the time of accumulation of water to the dry ingredients. After this the specimens were detached from the moulds and placed in clean new water at a temperature of 27°±2° C for the remaining curing period. After 28 days of curing the specimens were observedfor bending on a flexure Testing Machine. Loadswere applied at the one third points at a constant rate of 180 kg/minute. The distance between the centres of two rollers was kept 20 cm.

S.No	RHA %	7 Days strength, N/mm²	28 Days strength, N/mm²
		Average of 3 samples	
1	0	5.30	6.75
2	10	5.41	6.82
3	20	5.63	7.03
4	30	5.85	7.32
5	40	5.27	6.66

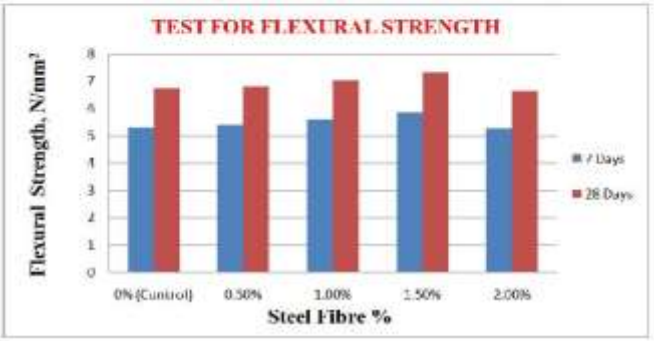
Table 7: Details of Flexural Strength test with different % of RHA.



Graph 7: Flexural Strength testing of concrete Beam with RHA%.

S.No	RHA (30%) + Steel Fiber %	7 Days strength, N/mm²	28 Days strength, N/mm²
		Average of 3 Samples	
1	0 % (Control)	5.85	7.32
2	0.5%	5.92	7.43
3	1.0%	6.25	7.85
4	1.5%	5.75	7.25
5	2.0%	5.66	7.20

Table 8: Flexural strength test results of each mix with 30 % of RHA & .



Graph8: Flexural Strength variation of each mix with 30 % RHA & .

IV. CONCLUSIONS

The current study was undertaken to investigate the compressive strength, split tensile and flexure strength, of concrete with substitute of cement with RHA addition of in concrete mix. Cement was moderately replaced by RHA is added in concrete mix at different percentage i.e. 0%, 0.5%, 1%, 1.5% and 2.0%. On the origin of this experimental work done in the laboratory, following conclusion can be drawn.

WORKABILITY

- It is observed that the workability of reinforced concrete gets reduced at constat water cement ratio as the proportion of s increases.
- Rice husk ash (RHA) is a suitable material for use as a pozzolana, since it satisfied the requirement for such a material.

STRENGTH CHARACTERISTICS

- The satisfactory development in various strengths is determined with the insertion of RHA in the plain concrete. However, greatest gain in strength of concrete is originated to depend upon the amount of fibre content.
- Concrete mixes when reinforced by 1% shows an increased compressive strength when compared to nominal mix.
- The split tensile strength also tends to increase with 1% increase percentages of s in the mix.
- The flexure strength also tends to increase through the increase percentages of s, a trend similar to enhance in split tensile strength and compressive strength.
- Maximum strength (compressive, split tensile as well as flexure) of concrete incorporating RHA s, both, is achieved for 30% RHA replacement and 1% s. Though, if the content is increased, the increase is not very significant.
- From the percentage increase graph, it can be concluded that due to the addition of Steel fiber concrete resist more tensile stresses when compared to compressive stresses.
- Although testing the specimens, the plain cement concrete specimens have shown a characteristic crack dissemination outline which tends into splitting of beam in two piece geometry. But due to addition of s in concrete cracks gets ceased which results into the ductile behavior of s inclusion.
- The results represents that 30 % of RHA 1.0 % of shows a greater combination for preparing a durable concrete which may help to solve environmental problems and gives long lasting economical concrete. By this enhancement of strength results in reduction of pavement thickness.

REFERENCES

[1] ―IS: 8112-1989‖. Specifications for 43-Grade Portland cement, Bureau of Indian Standards, and New Delhi, India.

[2] ―I.S: 516-1959‖. Method of test for strength of concrete, Bureau of Indian Standards, New Delhi, 1959.
[3] ―I.S:2386 (Part I, IV, VI)-1988‖. Indian standard Method of test for aggregate for concrte, Bureau of Indian Standards, Reaffirmed, New Delhi, 2000.
[4] IS: 1199-1959‖. Indian Standards Methods of Sampling and Analysis of Concrete, Bureau of Indian Standards, New Delhi, India.
[5] I.S: 10262-198‖. Recommended guidelines for concrete mix design, Bureau of Indian Standards, reaffirmed, New Delhi 1999 and IS: 456:2000 Indian standard recommended guidelines for concrete mix design.
[6] IS: 383- 1970,Indian standard of specification for coarse and fine aggregates from natural sources for concrete(second revision).
[7] ACI committee 544, 3R-08, 2008. ―Guide for specifying, proportioning, and production of fibre reinforced concrete.‖ American concrete institute, Farmington hills, USA.
[8] Gunduz,L and I.Ugur (2004), The effects of different fine and coarse pumice aggregate/cement ratios on the structural Concrete properties without using any admixtures, Cement Concrete Res,35;pp:1859-1864.
[9] Obilade,I.O.(2014), Experimental Study On Rice Husk As Fine Aggregates In Concrete;The International Journal of Engineering and Science(IJES),Vol.3;pp:09-14.
[10] C.B. Sisman,E. Gezer and I. Kocaman(2001),Effects of Organic Waste (Rice Husk) On The Concrete Properties For Farm Buildings;Bulgarian Journal of Agricultural Science,17(No. 1);pp: 40- 48.
[11] H. Premalal,H. Ismail and A. Baharin(2002),Comparison of the Mechanical Properties of Rice Husk Powder Filled Polypropylene Composites With Talc Filled Polypropylene Composites,Poly-mer Testing,Vol.21(No.7);pp:833-839.
[12] Singh Smita (Research Scholar) & Mr. Kumar Dilip (Asst. Prof.) (2014),Alternate and Low Cost Material-Rice Husk Ash(RHA),International Journal of Innovative Research in Advance Engineering,Vol.1;pp:214-218.
[13] Patnaikuni I et al (2014) ―performance of rice husk ash concrete exposed to sea water‖ 6 th SASTech 2014, Malaysia, Kuala Lumpur. 24-25 March, 2014. Organized by Khavaran Institute of Higher Education.
[14] Maurice E et al. (2015) ―Compressive strength of concrete with rice husk ash as partial replacement of ordinary Portland cement‖. Department of Civil Engineering, Rivers State University of Science and Technology Port Harcourt, Nigeria. Scholarly Journal of Engineering Research Vol. 1(2), pp. 32-36, May 2015, ISSN 2276-8955 ©2015 Scholarly-Journals.
[15] Marthong C (2015) ―Effect of Rice Husk Ash (RHA) as Partial Replacement of Cement on Concrete Properties‖. Civil Engineering Department, Shillong Polytechnic, Shillong, Meghalaya, India, 793008, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181, Vol. 1 Issue 6, August – 2015
[16] Huang S, Jing S, Wang JF, Wang ZW and Jin Y. Silica white obtained from rice husk in a fluidized bed. Powder Technology (Lausanne), 2001; 117:232-238.
[17] Ephraim et. al, (2015): Compressive Strength of Concrete with RHA as partial replacement of ordinary Portland cement. Scholarly Journal of Engineering Research Vol. 1(2) pp 32-36.
[18] Kalyan Kumar Moulick - ―Replacement of Ordinary Portland Cement by Rice Husk Ash to produce Concrete of Grade M20, M25 and M30‖ - 2013 Asian Conference on Civil, Material and Environmental Sciences (ACCMES'2013) – 15th to 17th March, 2013; Tokyo, Japan.
[19] Alireza Naji Givi, Suraya Abdul Rashid, Farah Nora A. Aziz and Mohamad Amran Mohd Salleh, ―Contribution of Rice Husk Ash to the Properties of Mortar and Concrete: Review‖, Journal of American Science, December -2010, pp. 157-165.
[20] P.C. Kumar and N. V. S. Venugopal, ―X-Ray Diffraction Studies of Rice Husk Ash—An EcofriendlycConcrete at Different Temperatures‖, American Journal of Analytical Chemistry, August 2013, pp. 368-372.
[21] R. Kishore, V. Bhishma Hikshma and P. Jeevana Prakash, ―Study on Strength Characteristics of High Strength Rice Husk Ash Concrete‖, Procedia Engineering, 14 (2011), 2666–2672.
[22] A.L.G. Gastaldini, M.P. Da Silva, F.B. Zamberlan and C.Z. Mostardeiro neto, ―Total shrinkage, chloride penetration, and compressive strength of concretes that contain clear-colored rice husk ash‖, Construction and Building Materials, January 2014, pp. 369-377.
[23] B. Chatveera and P. Lertwattanaruk, ―Evaluation of nitric and acetic acid resistance of cement mortars containing high-volume black rice husk ash‖, Journal of Environmental Management/ January 2014 pp. 365-373.

