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DETERMINATION OF MECHANICAL PROPERTIES OF RICE HUSK ASH CONCRETE

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Abstract: Since the development of urbanization in the world. The construction has increased rapidly. The increase in demand of construction leads to the production of Co^2 in the environment. About 7% of the environmental pollution is due to cement manufacturing industries. Thus to lower the amount of objective to do this in concrete is as the dumping of rice husk has been a problem where it leads to problem in land cover and its nature of light weight made this to produce the polluted particles into environment. Also, the husk ash contains silicon which is a major constrain that material strong and fineness equal to cement. Here in, we had a problem as rice husk don't have the properties of the binding when mixed with water. So, as a concern there placement is limited to 5%, 10% and 15%. Thus mixed concrete is allowed to curing after passing its fresh stage tests. After curing the major mechanical property, compression, tensile and flexure test, where as these are the major test that defines the quality of the concrete. The final aim of the project is produce a concrete that is environmentally free and structurally strengthen concrete.
Key Words: *Light weight concrete, Rice husk ash Concrete, Compression, Environmental free Concrete.*

I INTRODUCTION

India is a major developing country where it fosters its infrastructure to greater level as to satisfy its population and to make them live comfortably. To accommodate the increasing population in India leads in increasing demand for construction which finally resulted in increasing in demand for the materials ingredients for concrete. But from the environmental perspective the waste and by-products from industries and as well from agricultural practices has been a severe problem to the society where the hug dumping of these materials resulted in land loss for the living. The materials like coconut shell, Rice-Husk, Sawdust, Fly-ash etc., are creating problem of disposal thus in process of researching eliminating this problem researches found an alternative for concrete the partial or full replacement of disposed materials to concrete ingredients, in rapid process of experimentation some materials found an alternative, in them coconut shell as a course aggregate fly-ash and marble dust as a cement, Rice husk ash as cement and many more. In the present project work the use of rice-husk ash as a partial replacement to cement in terms of volume replacement. The percentages are as 5, 10, 15 done according to the mix M20. The tests that are performed here in, are compressive strength test, tensile test and flexural test. Thus obtained results are analyzed and compared to the controlled concrete to check whether the RHA concrete is better suited or not.

II MATERIAL DESCRIPTION

In this research paper, the materials used for determining the characteristic properties of rice husk ash concrete are OPC 53 grade cement with a specific gravity of 2.93 and fineness modulus of 220 m2/kg. The river sand passing 4.75 mm sieve with a fineness modulus 2.90 and a specific gravity of 2.50 is used as the fine aggregate. The fine aggregate has opted from the grading zone II. The crushed granite of size less than 20mm is used as the coarse aggregate. The bulk density of the coarse aggregate is 1450 kg/m3 with a specific gravity of 2.83.

2.1 Mineral admixture

Regarding concrete performance the strength of the concrete is dependent on water-binder ratio and cement-water ratio. When the cement content is added in excess, the strength of the concrete is escalated. Whereas, when there is an increase in water content, the workability property of the concrete is increased. Hence, for the increase in the strength of the concrete either the cement content must be added in excess or the water content is reduced. When the excess amount of cement content is added there are several complex issues raised such as environmental degradation, less cost-effectiveness, excess amount of heat generated during the period of hydration, and leads to the internal cracks in the concrete. Keeping these issues in mind the replacement methods come forward as a solution. The replacement of mineral admixture with the cement content allows the quantitative reduction of cement content in the concrete mixture and increases in the final strength of the concrete without an excess amount of decrease in the adding water content. The mineral admixture used in the concrete is of different purposes. They contribute to the strength, durability, and workability properties of concrete. There are several admixtures used the concrete to deal with different types of properties in the concrete such as silica fume, rice husk ash, ground granulated blast furnace, fly ash, etc. In this paper, we analyse the concrete properties using the rice husk ash as the mineral admixture with the replacement of cement content. The replacement of 10% of cement content with rice husk ash is observed that there is a significant increase in the chloride penetration resistance. It also improves the resistance against acid attack due to the presence of silica content, where it reacts with the Ca(OH)2 to form calcium silicate hydrate gel known as C-S-H gel which contributes to the strength criteria of the concrete. The rice husk ash also shows an increase in the strength for some replacement amounts with cement. Further to decrease some of the problems such as high water absorption and coarseness of particles, the rice husk ash is grounded finely into a particle size of 8 - 10µm. The replacement of rice husk ash with the cement content leads to the occurrence of pozzolanic activity in the concrete. This implies that the pozzolanic materials react with Ca(OH)2 which forms as one of the by-products of bogus reactions that occurred during the hydration process of the concrete. This reaction of pozzolanic material with Ca(OH)2 finally leads to the formation of calcium silicate hydrate by-product which contributes to the increase of strength criteria in the concrete.

This formed (CSH) gel contributes to the increase in compressive strength of concrete, electrical resistivity, reduction in permeability of concrete, prevention of allowance of chloride attack on the concrete. This also increases the denseness in the concrete body by the construction of concrete elements in the interface of transition zones between the coarse aggregate and cement paste, which removes the gap/transition lines which also prevents the flow of excess water through the transition lines.

Patnaikuni et al. investigated the temperature. During the investigation he found that, when the rice husk ash concrete is burnt at a temperature below 5000°C, there is an increase in the strength property found in the concrete. Whereas, when the temperature exceeds the temperature between 5000°C to 10000°C there is a declination of the temperature observed.

Omotola conducted some research work on the instrumental analysis of rice husk ash, he conducted some tests on the concrete elements such as XRD, XRF, INAA. The XRD test determines the components present in the rice husk ash. Whereas the XRF and INAA are conducted to identify the impurities present in the rice husk ash. From the results obtained from XRD test, he concluded that there is a presence of 90 to 93% of silica content and from the analysis of XRF & INAA tests he found that there is very less amount of impurities present in the rice husk ash with a purity level of 88.4%.

2.2 *Super plasticizer*

Conoplast super plasticizer is used based on sulphated naphthalene polymers, which is supplied as a brown liquid that immediately gets dispersed in the water. The water reduction is occurred up to 25% without compromising the workability and maintaining high-quality concrete. This helps in obtaining a high amount of strength parameters in the concrete.

III EXPERIMENTAL INVESTIGATION

3.1 *Compressive strength test:*

The compressive strength test for the concrete cubes is done in the compression-testing machine. For the test, the concrete cubes are cast with the dimensions of 150mm3 casting mould which is made of steel plates. The concrete mix is prepared with the calculated mix design as recommended by the code IS 456:2000 & IS 10262:2009. The mixed concrete is filled in the moulds which are fixed rigidly without allowing the concrete fluid to pass through it. The prepared mould is kept undisturbed for 24 hours, then it is removed from the moulds. The cubes are placed in curing tanks for a period of 7 and 28 days to gain strength. After the curing period, the cubes are removed from the curing tank and prepared for the crushing test. The cubes are taken to the compressive strength testing machine and placed in the machine with their faces made contact with the pattern in the compressive testing machine. According to the statement given in BS 1881:1970, the loading rate is done by 125N/mm2 the rate of loading increased in a progressive manner until the failure is approached.

Table 1 Compressive test Results

Compressive strength MPa				
S.No	**Mix**	**Day-7**	**Day-14**	**Day-28**
1	RHA 0	19.25	30.56	34.27
2	RHA 5	18.16	28.35	33.15
3	RHA 10	20.89	29.07	34.86
4	RHA 15	21.25	31.01	36.29
5	RHA 20	17.81	26.59	31.35

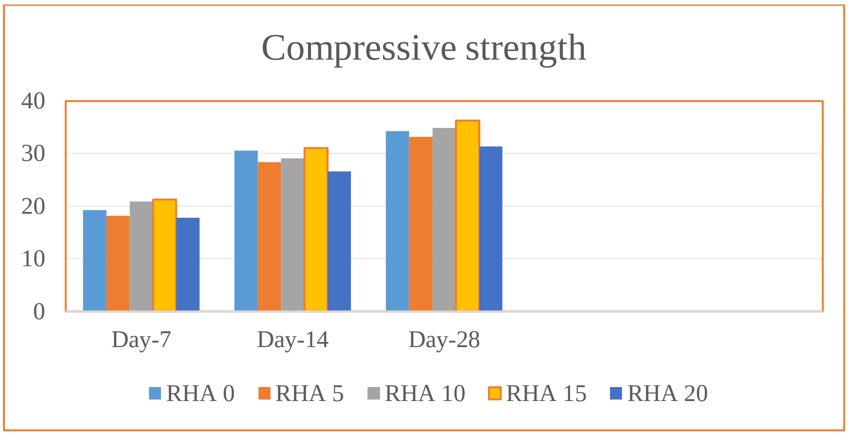

Figure 1 Graphical representation of Compression Test values

The above results are obtained by testing the Cube specimens of size 150mm under Compressive testing machine(CTM), it is observed that when compared to the grade of concrete each and every replacement proportion have given satisfied values. But, if we observe that from 5 to 15 of RHA has given increasing value of compressive strength thereafter at 20% RHA the concrete has decreased its value to the lower of all the above mix proportions. Compressive strength test shows the resistance offered by the internal particles of the specimen towards failure. As we all knew that concrete is strong in compression and weak in tension, this is why everywhere throughout the world the first and foremost test performed will be compression strength.

3.2 *Splitting tensile strength test:*

This test is done to determine the indirect tensile strength of the concrete specimen. In this method, the concrete specimen is tested as in a similar way to the compressive strength of concrete, but the test specimen varies in the dimension. Here the concrete cylinder is used as the test specimen, which has the dimensions of 150mm diameter and 300mm length. 150mm

Figure 2 Split tensile Loading Procedure

The mould is prepared with the recommended dimensions and oiled before the fresh concrete is placed into it. The concrete is prepared as prescribed according to the mix design IS 456:2000 & IS 10262:2009, and the fresh concrete is poured into the cylinder moulds and kept undisturbed for 24 hours. Then the concrete specimens are removed from the moulds by demoulding it. The concrete cylinders are kept under the water for 7 days and 28 days for curing where the concrete gains its strength by the process of hydration. Then the concrete specimens are removed out of the curing tank and kept ready for the testing. This test is conducted using the compressive strength testing machine. The cylinder is placed into the testing machine with its longitudinal dimension placed perpendicular to the loading direction and the diametric face parallel to the loading direction. Now the load is applied to the specimen and the rate of loading is increased until the concrete specimen leads to the failure. The cracked specimen is removed from the testing machine and the failure load is noted.

Table 2 Split tensile Test Results

Split tensile strength MPa				
S.No	**Mix**	**Day-7**	**Day-14**	**Day-28**
1	RHA 0	2.35	3.82	4.02
2	RHA 5	2.20	2.98	3.52
3	RHA 10	2.42	3.12	3.72
4	RHA 15	2.41	3.51	3.97
5	RHA 20	2.09	2.71	3.16

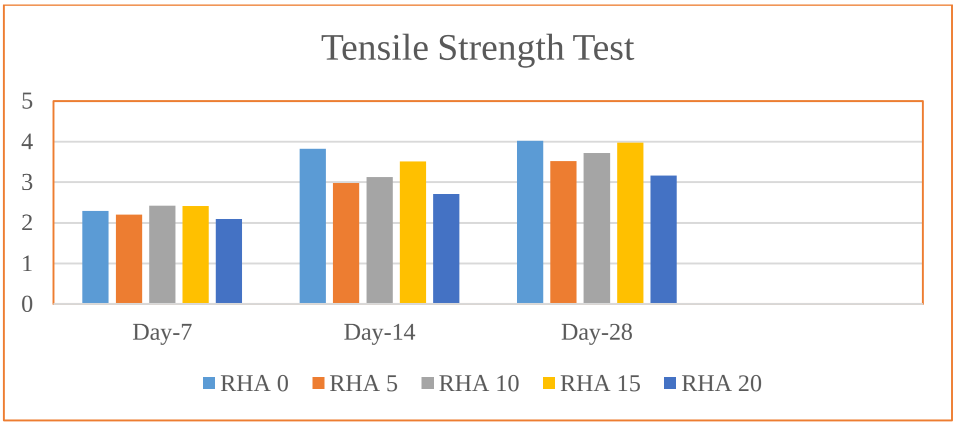

Figure 3 Graphical representation of tensile test values

It is observed from the results that replacement proportions has given better result when compared to zero replacement. But, when compared within replacement proportions, RHA 15 has given greater value with 3.97Mpa. This RHA 15 has a difference value of 0.05MPa and this can be avoided as it is not a big difference. One more thing that we noticed was the test results at 7days of curing has given higher values when compared to RHA 0 but later on when the days of curing increases there is no greater difference by increasing.

3.3 *Flexural load test*

The flexural load test is done for the concrete prisms of dimensions 150mm x 150mm x 500mm. This test is done to determine the flexural strength or the bending strength of the concrete specimen. In this test, the concrete beam is subjected to three-point loading. When this load is acted the concrete specimen is subjected to two different stresses simultaneously, the compressive stress above the neutral axis and tensile stress below the neutral axis.

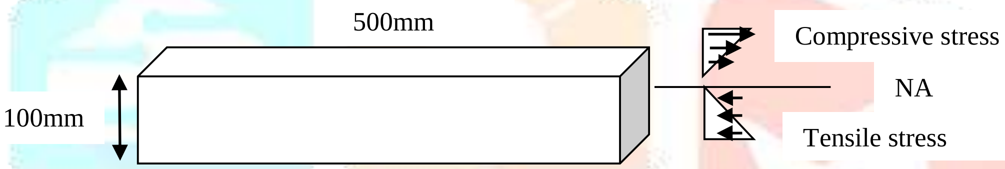

Figure 4 Loading behaviour on beam

The concrete is mixed as recommended from the IS code and the fresh concrete is placed into the prepared moulds of the above-specified dimensions. After 24 hours the concrete beams are removed from the moulds and placed inside the curing tanks for 7 days and 28 days. Then after the concrete specimens were prepared for the testing, the concrete is placed under the three-point testing machine. The load is applied to the testing sample until the failure occurs. In a three-point loading test, the initial failure occurs on the tension side of the beam. The cracks are observed until the neutral axis. Then the cracks are extended further till the top. The loading is stopped when the first crack is noticed. The values for flexural strength are calculated according to the bending formula given below.

Table 3 Flexural Strength test Values

Flexure strength MPa				
S.No	**Mix**	**Day-7**	**Day-14**	**Day-28**
1	RHA 0	2.08	3.45	4.23
4	RHA 15	2.85	4.53	5.33

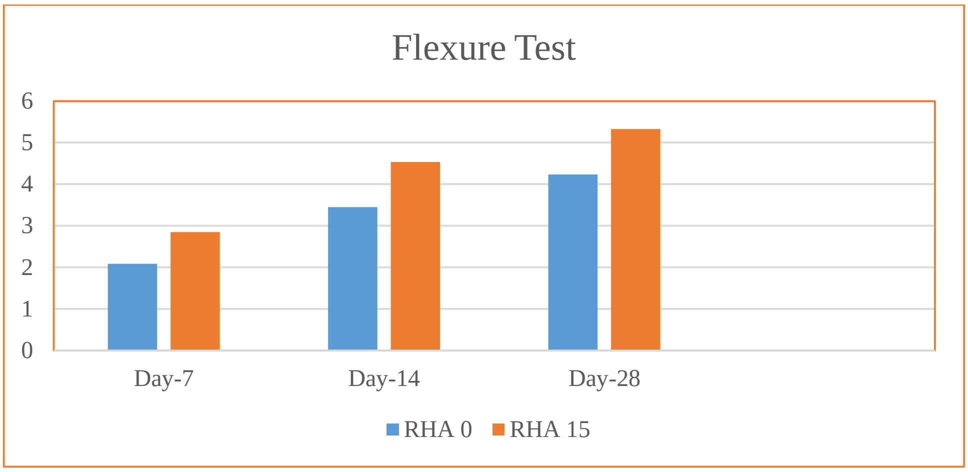

Figure 5 Graphical Representation of Flexural test values

The test performed to know the bending and cracking resistance of the concrete on Beams. Here we have taken the optimum percentage value at which the concrete specimens have given better results while testing. And, it was at 15% replacement of RHA the flexural resistance was observed like 5.33MPa.

CONCLUSION:

1. The compressive strength of RHA 15 was identified to be as 36.29MPa where the maximum of all the replacement proportions.
2. The Split tensile strength is also looks maximum at 3.92MPa.
3. The flexure test values for RHA 15 was 5.33MPa. Here, the flexure test was performed only on one replacement proportion as an optimum replacement.
   The values thus observed from the test results shows that replacement of RHA can be used as an alternative to cement not fully but partially.

REFERENCES:

[1] Alefiya Kachwala[1],Arti Pamnani[2],Amit Raval[3],volume : 02 issue :05 aug-2015,Effect of rice husk ash as a partial replacement of ordinary Portland cement in concrete,refera from International Research Journal of Engineering and Technology.

[2] Deepa G Nair,K. Sivaraman ,and Job Thomas ,e-ISSN:2220-0847 p-ISSN:2320-0936 volume-3 pp-14-19,Mechanical properties of rice husk –high strength concrete, refers from American journal of engineering research.

[3] Godwin. Akeke, Maurice E.Ephraim, Akobo,I.Z.S and Joseph O.ukpata, Structural properties of rice husk ash concrete may 2013,vol.3,no.3

[4] Harshit Varshney, Utilization of Rice Husk Ash in concrete as cement replacement. Journal of mechanical and civil engineering:e-ISSN: 2278-1684,p-ISSN:2320-34X

[5] S.I.Khassaf ,A.T.Jasim,F.K.Mahdi,volume3,issue 4, april 2014,Investigation the properties of concrete containing rice husk ash to reduction the seepage in canals, refers from International journal of scientific & technology research.

[6] Dr. G. Prabhakaran1, Chinnakotti Sasidhar2, Volume 3, Issue 2, pp. 312315, 2018,Experimental investigation on strength properties of rice husk and silica fumes as admixtures for vermiculate concrete, refers from International research journal of advanced engineering and sciences.

[7] Sayed AlirezaZareei[a], FarshadAmeri[b], FarzanDorostkar[c], MojtabaAhmadi 2017, Rice husk ash as a partial replacement of cement in high strength concrete containing micro silica:Evaluating durability and mechanical properties,Case study in construction.

[8] Sayed AlirezaZareei[a], FarshadAmeri[b], FarzanDorostkar[c], MojtabaAhmadi 2017, Investigation of rice husk ash as supplement in cement for building applications,Research Article volume 6-Issue –july 2018.

[9] Satish H. Sathawane[a*], Vikrant S. Vairagade[b] and Kavita S kene[c] 51(2013)35-44,Combine effect of rice husk ash and fly ash on concrete

[10] Swami Nathen. A.N, [2]Robert Ravi,Indian rice husk ash-improving the mechanical properties of concrete,ISSN; 2248-9622,VOL7,ISSUE1(part-1) January 2017,pp.76-79,Journal of engineering research and application.

[11] R. B. Y. B. Uduwweriya[1], C. Subash[1], lM. M. A. Sulfy[1] and Sudhira De Silva[2] December 2010 december 13-14,Investigation of compressive strength of concrete containing rice husk ash,International conference on sustainable built environment (ICSBE-2010).