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A Literature Review On Use Of Rice Husk Ash As Cementation Material

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Abstract: ***The cement has been the major building material in today's construction because of its binding and high compressive strength properties. Beside this, it also causes release of greenhouse gas carbon dioxide which causes global warming and other environmental issues. Researches were done to decrease the carbon footprint and use of waste material to be used in construction. The rice husk ash is waste materials which have shown promising results if replaced with cement in production of concrete. Previous researches done by researcher's shows that it enhances the corrosion resistance capability of produced concrete with RHA and some increase in compressive strength. In this literature review is related to increase in strength of concrete depending on age of concrete & percentage of RHA addition. Keywords: Rice Husk ash, Waste materials, Concrete, Cementation material, RHA, compressive strength***

I. INTRODUCTION

Concrete is widely and globally used throughout the history of humankind. Concrete is a mixture of sand and coarse aggregate combined together by a hardened paste of cement and water. The increased use of concrete is going to grow the demand for its ingredients' resources (cement, sand, and gravel). The high rate of concrete constituents is increasing rapidly and hence there is a requirement for an unconventional material that is low-cost and readily presented that will also give a similar or greater strength when used for concrete. Cement is one of the constituents of concrete which is costly and its production releases large amounts of CO_2 during its manufacturing. Manufacturing one tonne of cement releases about one tonne of CO_2 in the atmosphere while 1.6 tonnes of natural resources are required to produce about one tonne of cement. In many studies the cement is partially replaced by agricultural/industrial waste such as glass powder, sugar cane bagasse ash, rice husk ash (RHA), blast furnace slag, maize cob ash, millet husk ash, fly ash etc. in order to reduce cost, waste and CO_2 emissions while these resources are easily available.

II. OBJECTIVE

The main objective of this paper is to study Rice Husk Ash (RHA), it's property and potential to be used as a replacement of cement in concrete production

III. LITERATURE REVIEW

Following are the critical literature reviews on various papers based on experimental research work on use of Rice Husk Ash.D.V.

A. Reddy, Ph. D, P.E. and Marcelina Alvarez, B.SFourth LACCEI International Latin American and Caribbean Conference for Engineering and Technology (2006)

Detailed, the use of RHA will not only concrete production of better quality and low cost, but also reduce carbon dioxide (CO2) emissions from cement production. The partial replacement of cement by RHA will result in lower energy consumption associated with cement production. The potential market for rice husk energy systems and equipment has been studied by Velupillai et al. (1997). The reference also addresses economic development, urbanization, living standards, stricter environmental regulations, and consolidation in the rice milling industry is the reduction of certain traditional uses balls, and creating new opportunities for the use of the envelope. He discusses the potential use of rice husk Ash (RHA) as a cementations material in concrete mixes. RHA is produced by burning rice husk which is a by-product of rice milling. The ash content is about 18 to 22% by weight of rice hulls. Research has shown that concrete containing RHA in partial replacement of cement concentrations of 10% to 20% by weight of cement has superior performance characteristics compared to normal concrete. In addition, the use of ORS would result in a reduction in the cost of concrete construction, and the reduction of the greenhouse effect on the environment.

B. Mehta , P.K., Symposium Paper Publication (5 January 1995)

Explain the durability of cement mortar in the presence of rice husk Ash (RHA). The strength and durability of mortar with different replacement levels (10%, 20% and 30%) of ordinary Portland cement (OPC) by the RHA is studied here. RHA was manufactured from an uncontrolled combustion process. The test samples were prepared with 2.73 FM river sand. The samples were stored in a controlled environment to test time. The results show that the addition of RHA has shown better results for 20% replacement level OPC 90 days. In the durability test all samples passed for 20 cycles except 25% replacement level of 30%.When the rice husk ash is converted by uncontrolled combustion of generally from 3,000 to 4,500 C, the ignition has not been completed and the considerable amount of unburned carbon found in the resulting ash. The reactivity of the amorphous silica is directly proportional to the surface area of the ash. Some research papers discover that not only the temperature, but time is also a factor of burning rice husks to produce effective. In the case of uncontrolled burning combustion especially heap, the burning time is totally dependent on the ambient environment say temperature, humidity and wind speed. Now limited research has been conducted again with the rice husk ash collected from uncontrolled combustion process.

C. Ramakrishnan S, Velrajkumar G, Ranjith S R.S. Publication (January 2014)

This paper explain the behavior of concrete for pavement replacing different percentages of ashes hush up by weight of cement for concrete quality control mixture M40. To study the effect of the rice husk ash (RHA) on the performance of various concrete parameters to produce an economic concrete for rigid pavements. An attempt was made to use the bending strength of concrete reaches in the design of the rigid floor which is greater than the resistance to bending about the necessary IRC: 58-2002. Test conducted to study the effect of rice husk ash (RHA) on the performance of different concrete parameters to produce an economic concrete for rigid pavements. The partial replacement of cement with RHA provides the equivalent flexural strength of concrete which is more important for concrete pavements.

They conclude their paper:-

1) The compressive strength decreases with the increases in percentage of rice husk ash (RHA).For 10% replacement, the reduction is very less when compare to 20%, and 30% replacement.
2) The flexural strength of the cement-RHA concrete very less reduction in 5% & 10% of replacement
3) The porosity test shown the void ratio is reduced up to 10% replacement, and voids increases in future increment of RHA.
4) The split tensile strength, impact strength also decreases with the increases in percentage of rice husk ash (RHA)

D. P.Padma Rao, A.Pradhan Kumar, B.Bhaskar Singh,International Journal Of Education And Applied Research (Jan-June 2014)

Explains, a feasibility study is made using rice husk Ash as an adjunct to cement already replaced by fly ash (pozzolana Portland cement) in concrete, and an attempt was made to study the strength parameters concrete (compressive and bending strength). For the control of concrete, is the mixture design method is adopted and given that basis, the design for the replacement method was made mix. Five different replacement levels, namely 5%, 7.5%, 10%, 12.5% and 15% were selected for the study concerning the replacement method.

Table- 1: Highest Compressive strength obtained at different ages

Age in days	0% RHA	5% RHA	7.5% RHA	10 % RHA	12.5% RHA	15% RHA
3	14.51	12.96	13.32	12.7	10.7	8.88
7	20.58	19.3	19.7	18.96	18.58	16.22
28	30.3	31.5	31	30	30.14	21
56	36.36	35.84	37.62	36.15	32.88	25.88

Table- 2: Increase or decrease in strength of concrete at 3 days w.r.t % replacement of RHA

Rice Husk Ash Replacement Percentage Replacement	Compressive strength (N/mm^2)Increase or decrease in strength
0-5 %	-11.95
0-7.5 %	-8.93
1-10 %	-14.25
0-12.5 %	-35.60
0-15 %	-63.40

Table- 3: Increase or decrease in strength of concrete at 7 days w.r.t % replacement of RHA

Percentage Replacement	Increase or decrease in strength
0-5 %	-6.63
0-7.5 %	-4.46
1-10 %	-8.54
0-12.5 %	-10.76
0-15 %	-26.88

Based on the limited study conducted on the behavior of the strength of Rice husk ash, the following conclusions are drawn:
At all levels of cement replacement rice husk ash; there is gradual increase of the compressive strength 3 days and 7 days.
However, there is significant increase in compressive strength of 7 to 28 days followed by a gradual increase of 28 days to 56 days.
At retirement age, with increasing replacement percentage rice husk ash both, the flexural strength of the rice husk ash the concrete is deemed to decrease gradually to 7.5% of replacement. However, there is a significant decrease in the flexural strength of concrete rice husk ash.

E. OBILADE, I.O. The International Journal Of Engineering And Science (25 August 2014)
Summarizes the research on the properties of rice husk Ash (RHA) when used as a partial replacement of ordinary Portland cement (OPC) in concrete. OPC was replaced by RHA by weight to 0%, 10% and 20%. 0% replacement served as a control. Compaction factor test was performed on fresh concrete while the compressive strength test was performed on 150mm hardened concrete cubes after 7, 14 and 28 days of curing in water. The results revealed that the compaction factor decreases as OPC percentage replacement with RHA increased. The compressive strength of hardened concrete also decreased with increasing substitution of OPC with the RHA. It is recommended that further studies be conducted to gather more facts about the relevance of partial replacement of OPC with the RHA in concrete. Rice Husk Ash (RHA), which is an agricultural by-product has been reported to be a good pozzolana by many researchers.

F. Mehta and Pirth (2000)
studied the use of ORS to reduce the temperature in high strength concrete mass and obtained results showing that the RHA is very effective in reducing the temperature of the concrete mass compared to OPC concrete. Malhotra and Mehta (2004) reported later that RHA pattern with finer particle size OPC improves concrete properties, including higher amounts substitution results in lower water absorption values and the addition of RHA causes an increase in the compressive strength. The results of the compressive strength of concrete cubes show that compressive strengths reduced RHA increased the percentage. However, the compressive strength increased the number of days for each percentage increased hardening RHA replacement.

Table- 4: Compressive Strength of Concrete Cubes with various percentages of RHA

Percentage	7 days	14 days	28 days
0	17.51	21.60	29.15
5	16.88	17.44	27.68
10	12.01	12.83	20.88
15	11.24	12.55	18.70
20	10.86	11.51	1859
25	7.95	8.98	13.29

G. Dr. A.M. Pande and S.G.Makarande International Journal Of Engineering Research And Applications (Jan-Feb 2013)
Detailed, Rice Husk Ash used in this work was done in the laboratory by burning the ball using furnace Ferro cement, incineration with temperatures not exceeding 7000 c. The ash was milled using mill Los Angeles 180, 270 and 360 minutes, XRD analysis was conducted to determine the shape of silica powder produced RHA samples. RHA samples were analyzed by electron microscope to show multilayer porous surface and micro RHA.

Other materials used in the concrete mix were Portland cement, coarse aggregate 20 mm maximum size, and sand mining 5mm maximum size as fine aggregate. The fineness modulus of coarse aggregate and fine aggregate were 2.43 and 4.61 respectively.

Effect of adding RHA on the properties of concrete:

The fresh concrete properties of all mixtures are given. The fall was in the order of (210-230 mm), bleeding was negligible for the control mixture. For concretes incorporating RHA, no bleeding or segregation was detected. The fresh density was within (2253-2347 kg / m3), the lowest density values were for mixing this is due to the low density of RHA that lead to a reduction in the mass per unit volume. Concrete incorporating finer RHA resulted in heavy concrete matrix. The SP had to be content with increased finesse and RHA percentage, due to the high surface area of RHA thus increase the demand for water to maintain fluidity, Sp content increased to 2.00% for the mixture.

He gave following results in his experiments 2.1% Strength achieved for M20 grade concrete with 12.5%, 25% & 37.5% RHA: The resistance to the average is considered more for 90 days and then less for 28 days and 7 days using 75 micron RHA. The average strength obtained is 12.5% CER compared to other proportions. One of recorded samples to reach 123.81% resistance to 90 days of curing compared to CCP. When RHA 150 microns is used, again reached the average strength is more for 90 days and there is less for 28 days and 7 days. The resistance% was obtained in the range of 85% to 90% for 7 days, compared to the CCP. Then, is considerably reduced 28 and 90 days of curing. At the very least, the minimum force was achieved in 25% of RHA using 75 microns. After 90 full days of healing was 67.37%. For 150 microns reached the minimum force was 37.5% of RHA. After 90 full days of healing was 34.78%. It can also be observed that when RHA fine was used (75 microns), the strength of% achieved was higher compared to the size of the ORS 150 microns.

IV. CONCLUSION

1) From the above discussion, it is observed that when RHA 75 microns is used, the percentage of resistance achieved for 90 days is greater than that of PCC, while it is reduced in case of 28 days and 7 days.

2) The average force obtained proves to be more for 7 days and 28 days, then it is reduced for 90 days with 75 micron RHA.

3) The average force obtained is 25% CER compared to other proportions. One of the samples stored for maximum resistance 55.08% for 90 days of curing compared to CCP.

4) When RHA 150 microns is used, again reached the average strength is more for 7 days and 28 days, then there is less for 90 days. The average strength obtained is 12.5% CER compared to other proportions. One of the samples stored for maximum strength 57.2% for 90 days of curing compared to CCP. At the very least, the minimum strength attained was 37.5% RHA using 75 microns. After 90 full days of healing was 26.96%.

5) For 150 microns reached the minimum force was 25% RHA. After 90 full days of healing was 34.75%. It can also be observed that when RHA fine was used (75 microns), the force reaches % was slightly lower this year compared to the size of the ORS 150 microns.

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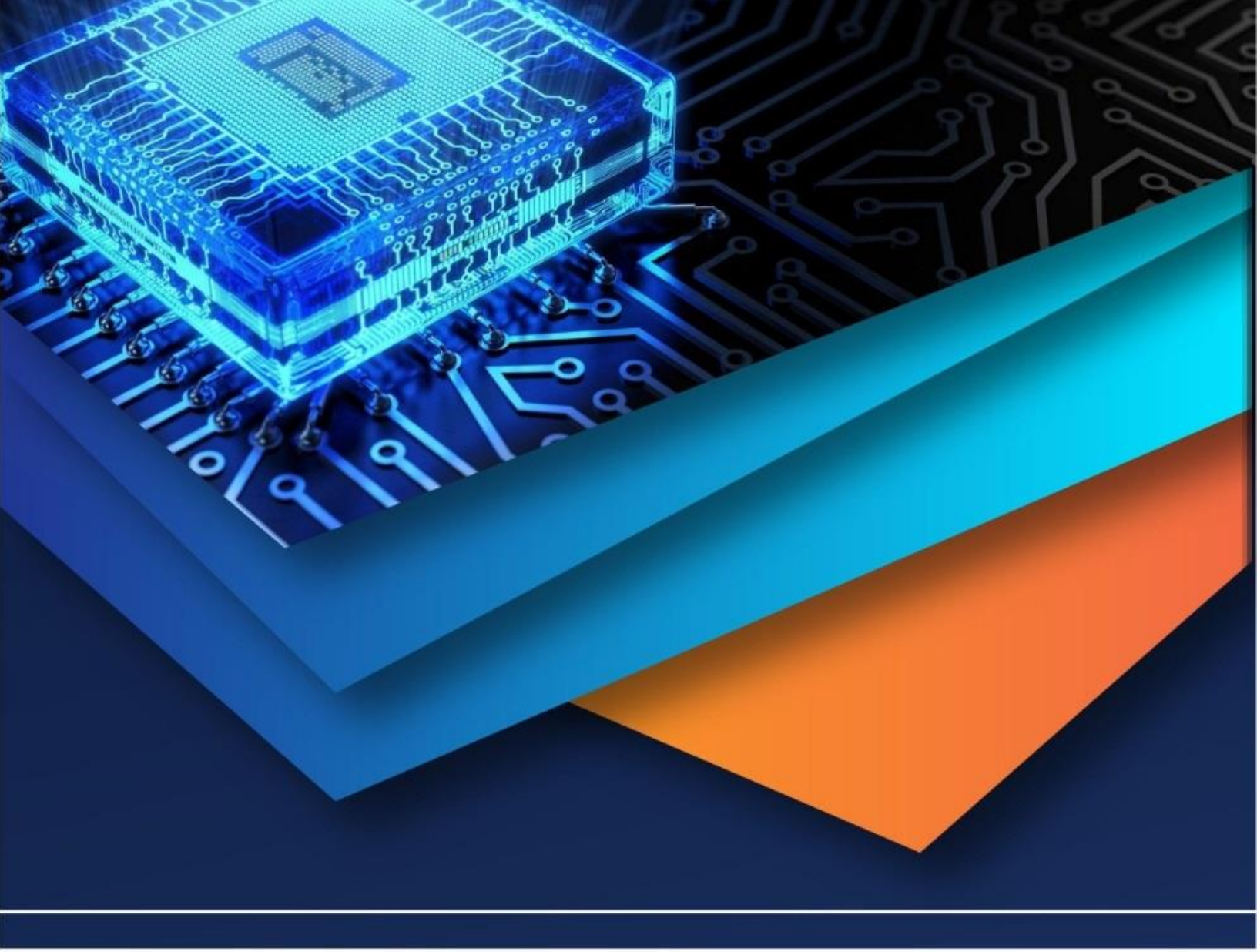

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