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Achieving Sustainability By Partial Replacement Of Cement With Rice Husk Ash

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ABSTRACT- India is a major rice producing country , and the husk generated during milling is mostly used as a fuel in the boilers for processing paddy, So for every 1000 kgs of paddy milled , about 220 kgs (22 %) of husk is produced , and when this husk is burnt in the boilers , about 55 kgs (25 %) of RHA is generated. This RHA is a great threat to environment causing damage to the land and the surrounding area in which it is dumped. To achieve sustainability, In the present study an attempt was made to partially replace the cement with rice husk ash and compare the strength of concrete thus obtained with conventional concrete. The compressive strength of the concrete with partial replacement of rice husk ash increased with increase in percentage of rice husk ash to some extent.

Keywords: Compressive strength, Rice husk ash, Concrete, Environment

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I. INTRODUCTION

The rice paddy milling industries give the by-product rice husk. Due to the increasing rate of environmental pollution and the consideration of sustainability factor gave the idea of utilizing rice husk ash. A way to use these by-products to make a new product is the best sustainable idea. The rice husk ash is a green supplementary material that has applications in small to large scale. The incorporation of rice husk ash in concrete convert it into an eco-friendly supplementary cementitious material.

The production of cement contributes to emission of carbon dioxide in atmosphere, worldwide 7% of carbon dioxide emission results from the production of OPC. By partially replacing cement with RHA is also an attempt to reduce carbon dioxide emission. The compatibility of the RHA is assessed by the compressive strength of the cement concrete mix. A series of laboratory compression strength tests were carried out with at different age with varying content of fly rice husk ash and cement as binder. The results obtained from the tests are presented, compared and discussed in this paper.

II. LITERATURE REVIEW

(M.U Dabai, 2009)[18] investigated the effect of partial replacement of cement by rice husk on the compressive strength of concrete He concluded that rice husk ash can be used as cement substitute at 10% and 20% replacement and 14 and 28 day curing age.

(Dao Van Dong, 2008)[19] Investigated key properties of high strength concrete using rice husk ashes (RHAs). Properties of concrete, including: slump, density, compressive strength, water and chloride permeability resistances, were investigated .Experimental results showed reasonable improvements in compressive strength, water and chloride permeability rest of concrete using the RHAs

(FENG Qing-ge, 2004)[17] Investigated the effect of highly active rice husk ash (RHA) produced by an industrial furnace on some properties of concrete. The strength, pore volume and pore distribution of concrete and the Ca(OH)2 content in concrete were investigated .He concluded that, with RHA replacement of cement , the compressive strength of concrete increases and the average pore radius of concrete is greatly decreased,

(Ramasamy, 2011)[20] Investigated on Rice Husk Ash (RHA) concrete to evaluate the compressive strength and to study its durability properties. His findings shows that strength of the concrete increased with the levels of percentage of replacement of 10% at which the increase in strength was 7.07% at 90 days compared to normal concrete.

(Le Anh-tuan Bui, 2012)[21]Investigated strength and durability properties of concrete with or without three types of rice husk ash (RHA), namely, amorphous, partial crystalline, and crystalline RHA. The three types of RHA were added into concrete at a 20% replacement level. His findings shows that the pozzolanic reactivity of

amorphous RHA was higher than that of partial crystalline and crystalline RHA.

(Ramadhansyah Putra Jaya, 2011)[22] Studied the compressive concrete strength and the gas permeability properties over varying fineness of the rice husk ash were experimentally investigated. The ordinary Portland cement was partially replaced with the rice husk ash (15 wt%). His findings showed that at 9.52 µm fineness size the concrete showed good strength and low porosity.

(Makarand Suresh Kulkarni, 2014)[23] In this investigation optimized RHA, by controlled burn or grinding was used as a pozzolanic material in cement and concrete. Result concluded several advantages, such as improved strength and durability properties, and environmental benefits related to the disposal of waste materials and to reduced carbon dioxide emissions. Results from the entire experimental work & studies concluded that mix with 20%RHA is the best combination among all mixes, which gives maximum tensile,flexure & compression strength over normal concrete.

III. MATERIAL USED

A. Cement

Cement is the fine grey powder that acts as a binding materials which is used for the construction. The cement that was used during experiment was Ordinary Portland Cement 43 grade confirming to IS 8112 impurities were removed before the process.

B. Rice Husk Ash (RHA)

Rice Husk Ash is the ash that is obtained by burning the rice husk until it gets reduced by 25%. The Rice Husk for the work was obtained locally. These Husk then was ground to the required level of fineness and sieved by the 600 micron sieve to reduce the impurities.

C. Water

The water that is used for testing work was obtained locally that fulfilled the requirement provided by Indian Standard. The water was clean and free from any visible impurities. Water is being supplied partially to maintain the proportionate ratio

D. Fine Aggregate

The sand used for work was obtained locally that fulfills the requirement provided by Indian Standard 383 1970.The purity of the sand was analyzed glancing the code provided by Indian Standard.

E. Coarse Aggregates

The aggregates used are that get retained on 4.75micron sieve after being crushed. These granite passes the requirement provided by Indian Standard 383 1970.

IV. METHODOLOGY

The experimental investigations were carried out by replacing cement with different proportions of RHA by weight, accordingly five different mixes were prepared Mix1- 0% RHA, Mix2- 5% RHA, Mix3- 10% RHA, Mix4- 15%RHA, Mix5- 20%RHA.

Compressive strength tests were carried out to study the effect of varying percentage of Rice husk ash on the compressive strength of concrete and further we studied the effect on compressive strength with age of concrete.

V. RESULTS

A. Compressive strength for different proportions of RHA after 7 days of curing

In the figure given below we can compare variation of compressive strength of concrete for different proportions of RHA after 7 days of curing. From the results obtained it can be clearly seen that compressive strength decreases with increase in percentage of RHA at 7days of curing.

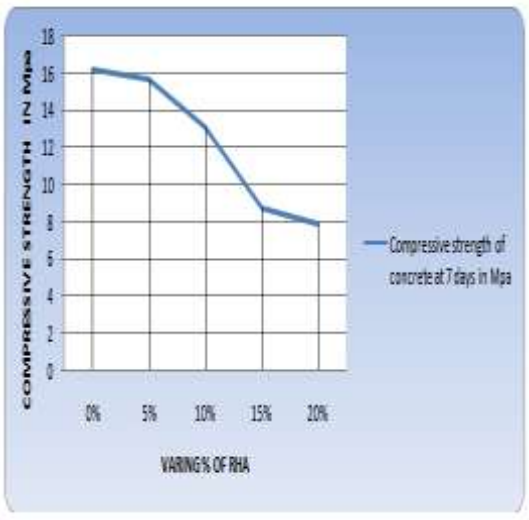

Fig 1:Compressive strength for different proportions of RHA after 7 days of curing

B. Compressive strength for different proportions of RHA after 14 days of curing

In the figure given below we can compare variation of compressive strength of concrete for different proportions of RHA after 14 days of curing. From the results obtained it can be clearly seen that compressive strength has increased for

5% replacement of cement with RHA (by weight), whereas when further increase in percentage of RHA was done a considerable decrease in compressive strength has been notices at 14 days of curing.

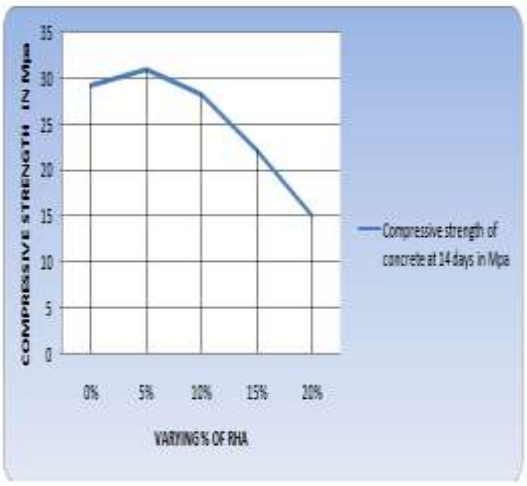

Fig 2:Compressive strength for different proportions of RHA after 14 days of curing

C. Compressive strength for different proportions of RHA after 28 days of curing

In the figure given below we can compare variation of compressive strength of concrete for different proportions of RHA after 28 days of curing. From the results obtained it can be clearly seen that compressive strength has increased at 5% and 10% replacement of cement by RHA on further increase in percentage of RHA Compressive strength dropped steeply.

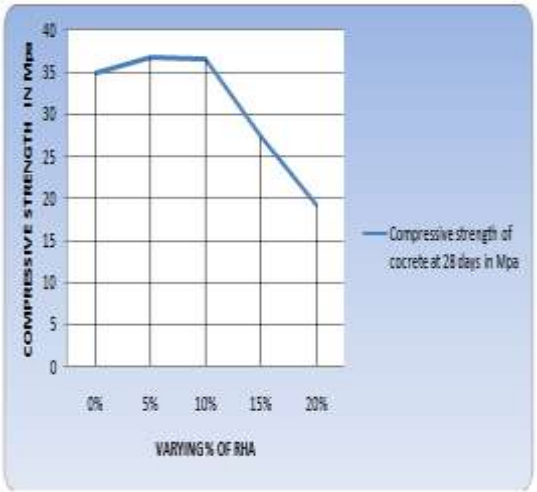

Fig 3:Compressive strength for different proportions of RHA after 28 days of curing

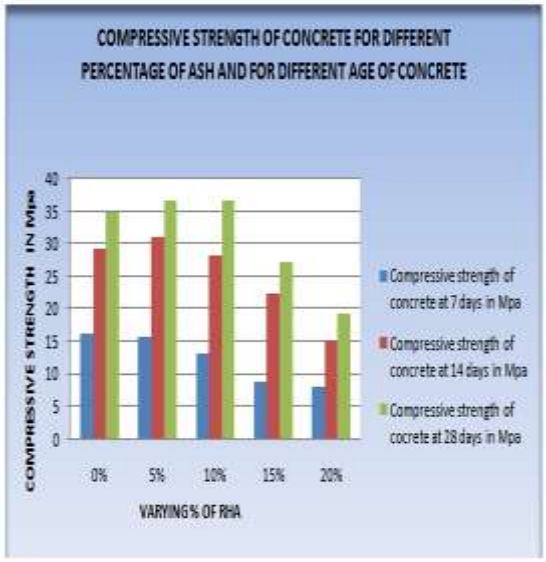

Fig 4:Comparision of compressive strength for different proportions of RHA at different age

From the figure above we can compare variation of compressive strength of concrete for different proportions of RHA(0% to 20%) and for different age of concrete. From the results it can be clearly seen that for 5% and 10% replacement of RHA with weight of cement compressive strength has increased and for further increase of % of RHA, Compressive strength has decreased.

VI. CONCLUSION

From the test results it can be concluded that if approximately 10 % cement by weight is replaced by rice husk ash, slight increase in the compressive strength of concrete is achieved at 28 days of age. Hence rice husk ash(a waste material)can be used as partial replacement of cement to reduce the expenses of construction in the areas where rice husk ash is easily available.

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