|| Volume 08|| Issue 01 || January 2024 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH AND ENGINEERING TRENDS

ASSESSMENT OF DIFFERENT CURING METHODS ON RICEHUSK ASH CONCRETE

[1]Faizan Ahemad Khan, [2]Prathmesh Gotmare, [3]Mayank Dhurve, [4]Dr. Monika Jain,

[1,2,3]*Research Scholar, G. H. Raisoni Institute of Engineering and Technology, Nagpur, Maharashtra, India.*

[4]*Assistant Professor, G. H. Raisoni Institute of Engineering and Technology, Nagpur, Maharashtra, India.*

Abstract: The study, entitled "Assessment of Different Curing Methods on Rice Husk Ash Concrete," is a comprehensive exploration into the effects of various curing methodologies on the performance of concrete that incorporates Rice Husk Ash (RHA) as a supplementary material. The research adopts a meticulous approach, design 9 distinct sets of concrete specimens for each mix type, including Normal OPC Concrete, 10% RHA Concrete Cube, and 15% RHA Concrete Cube. Additionally, six cylindrical specimens are created for each mix category, covering both Normal and 10% RHA Concrete Cylinder.

The experimentation involves subjecting these specimens to three different curing methods: immersion in water, gunny bag curing, and open-air curing. The curing process is a critical factor in concrete development, influencing properties such as compressive strength and durability. To provide a thorough analysis, three cubes for each curing method and two cylinders for each curing method are meticulously examined over a period of 28 days.

Keywords: *Rice Husk Ash, RHA Concrete Cylinder, Curing.*

I.INTRODUCTION:

The world produces about 580 million tonnes of rice annually, and this number is growing as the world's population and rice consumption rise daily. Table 1 lists the nations with the highest rates of rice growth along with their potential production of husk and ash. Rice husk is a waste product that is produced during the milling of rice. By weight of processed rice, rice husk is produced at an average rate of 20%. The husk is primarily burned or disposed of as waste. Ash is produced during the burning process at a rate of 18% of the total weight of the husks. Before 1970, uncontrolled combustion was typically used to produce RHA, and the ash that resulted from this process was typically crystalline and had poor pozzolanic qualities.

In response to mounting environmental concerns and the need to preserve energy and materials, efforts have been made to burn the husk in an atmosphere and at a temperature that are regulated, and to use the ash that is produced as an additional cementing material. In concrete, workability, strength, and durability are its three main characteristics. Workability is the measure of how much productive internal work is required to reduce internal friction and achieve complete compaction. Important elements influencing the workability of concrete include the size, shape, surface texture, and grading of the aggregates, the water-to-cement ratio, the use of admixtures, and the mix proportion.

The primary aim of this thesis is to present data regarding the application of rice husk ash as an alternative cementing material in the production of high-performance concrete. In addition to discussing the characteristics of concrete that incorporates rice husk ash as a substitute cementing material, this project presents data on the physical and chemical properties of the ash. In addition to the effects on the properties studied of the water-to-cementitious materials ratio and the percentage of RHA as a cement replacement.

Approximately one-fifth of the 300 million metric tonnes of rice produced worldwide each year is made up of rice husk, an agricultural waste. In response to mounting environmental concerns and the need to preserve energy and materials, efforts have been made to burn the husk in an atmosphere and at a temperature that are regulated, and to use the ash that is produced as an additional cementing material. The optimised RHA has been utilised as a pozzolanic material in cement and concrete through controlled burning and/or grinding. Utilising it has a number of benefits, including increased durability and strength as well as environmental advantages from reduced carbon dioxide emissions and waste material disposal.

II.LITERATURE SURVEY

D.V. Reddy, Ph. D, P.E. and Marcelina Alvarez, B.S 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 cementitious 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.

2.1.3 Ramakrishnan S, Velrajkumar G, Ranjith S, explain the behavior of concrete for pavement replacing different percentages of ashes hush up by weight of cement for concrete quality controlmixture M40. To study the effect of the rice hull ash (RHA) on the performance of various concrete parameters to produce an economic concrete for rigid 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).

2.1.4 P.Padma Rao, A.Pradhan Kumar, B.Bhaskar Singh, explains, a feasibility study is made using rice husk Ash as an adjunct to cement already replaced by fly ash (pozzolan 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 studyconcerning the replacement method.

OBILADE, I.O. summarizes the research on the properties of rice husk Ash (RHA) when usedas 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 revealedthat the compaction factor decreases as OPC percentage replacement with RHA increased. Thecompressive 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.

III.METHODOLOGY

3.1.1 Cement

Cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete. Cement is the most widely used material in existence and is only behind water as the planet's most-consumed resource.

The most common cement is used is ordinary Portland cement. Out of the total production ordinary Portland cement accounts for about 80-90 percent. Many tests, were conducted to cement some of them are consistency test, setting tests, soundness tests, etc.

Portland cement (often referred to as OPC, from Ordinary Portland Cement) is the most Common type of cement in general use around the world ,used as a basic ingredient of concrete mortar, stucco, and most non-specialty grout. It usually originates from limestone.it is a fine powder produced by grinding Portland cement clinker (more than 90%), a limited amount of calcium sulfate (which controls the set time) and up to 5% minor constituents as allowed by various standards.

The most common use for Portland cement is in the production of concrete. Portland cement is also used in mortars (with sand and water only) for plasters and screeds, and in grouts (cement/water mixes squeezed info gaps to consolidate foundation, road-beds, etc.

- Cement is a major industrial commodity that is manufactured commercially in over 120 countries.
- Mixed with aggregates and water, cement forms the ubiquitous concrete which is used in construction of buildings, roads bridges and other structures.

Testing on Cement

Testing of cement is a critical aspect in the construction industry to ensure the material's adherence to quality standards. Various parameters are examined to assess the suitability and performance of cement in concrete construction. These tests are conducted in accordance with the Indian Standard (IS) Code, primarily IS 4031, to guarantee compliance with established norms.

The following are key tests conducted on cement, each serving a specific purpose in evaluating its properties.

Specific Gravity Test (IS 4031 Part 11 - 1988):

The Specific Gravity test, as per IS Code (IS 4031 Part 11), is conducted to determine the density of cement relative to the density of water.

It provides insights into the compactness and porosity of the cement particles. This test is crucial for assessing the quality and purity of the cement, as variations in specific gravity can indicate the presence of impurities.

Initial Setting Time Test (IS 4031 Part 5 - 1988):

The Initial Setting Time of cement, according to IS Code (IS 4031 Part 5), is the duration from the addition of water to the point when the cement paste begins to lose its plasticity and resist penetration.

|| Volume 08|| Issue 01 || January 2024 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

Final Setting Time Test (IS 4031 Part 5 - 1988):

The Final Setting Time test, following the IS Code (IS 4031 Part 5) guidelines, is the duration from the addition of water to the point when the cement paste attains sufficient rigidity to resist certain pressures. This property is crucial to ensure that the concrete has set adequately before finishing operations commence.

Normal Consistency Test (IS 4031 Part 4 - 1988):

The Normal Consistency test, in adherence to the IS Code (IS 4031 Part 4), is performed to determine the water content required to produce a cement paste of standard consistency. This test aids in understanding the cement's behavior under various conditions and ensures uniformity in its performance.

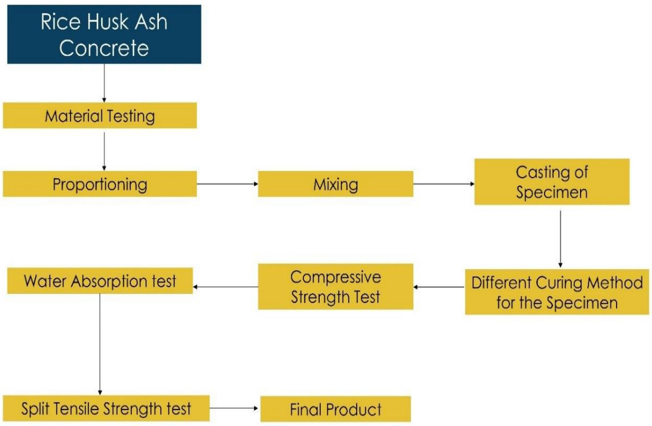
Color Test (IS 4031 Part 2 - 1999):

The Color test, as specified by the IS Code (IS 4031 Part 2), involves visually inspecting the color of the cement. While color may not directly impact the structural properties, it can be indicative of certain impurities or variations in raw materials. This test contributes to the overall assessment of cement quality.

OPC 43 Grade of Cement (confirming IS-269) is used for casting of Normal Pervious Concrete samples and Rice Husk ash Concrete samples.

1. The main objective of this work is to study the suitability of the rice husk ash as a pozzolanic material for cement replacement in concrete. However it is expected that theuse of rice husk ash in concrete improve the strength properties of concrete.
2. Also it is an attempt made to develop the concrete using rice husk ash as a source materialfor partial replacement of cement, which satisfies the various structural properties of concrete
3. like compressive strength and Flexural strength.
4. It is also expected that the final outcome of the project will have an overall beneficial effect on the utility of rice husk ash Concrete in the field of civil engineering constructionwork.
5. Following parameters influences behavior of the rice husk ash concrete, so theseparameters are kept constant for the experimental work:

- Percentage replacement of cement by rice husk ash
- Fineness of rice husk ash
- Chemical composition of rice husk ash
- Water to cementitious material ratio (w/c ratio)



EXPERIMENTAL RESULTS

Compressive Strength of Normal Concrete

Table 5.1: Compressive strength of Normal Concrete Cube

Curing methods	Cube 1	Cube 2	Cube 3
Immersed in Water	26.35	26.15.	25.95
Gunny Bag	25.65	25.43	25.40
Open Air	25.45	25.32	25.20

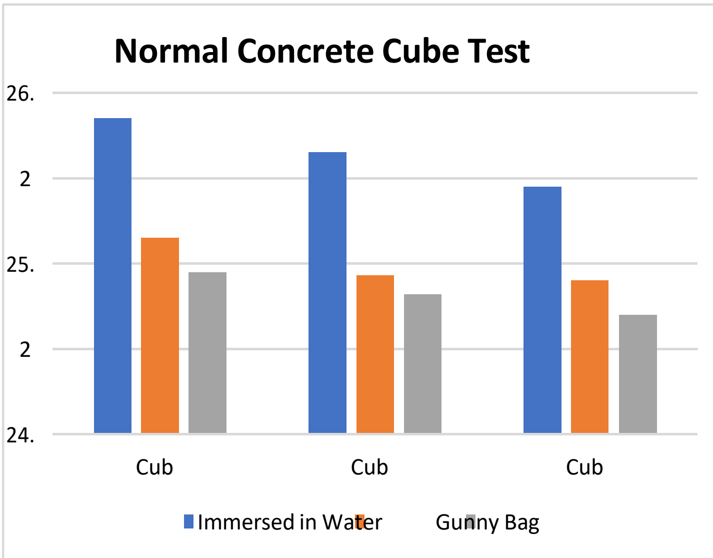


Fig. 5.7: Compressive strength of Normal Concrete Cube

Compressive Strength of 10% RHA Concrete

Table 5.2: Compressive strength of 10% RHA Concrete Cube

Curing methods	Cube 1	Cube 2	Cube 3
Immersed in Water	24.95	25.15	24.90
Gunny Bag	24.65	24.43	24.40
Open Air	24.35	24.28	24.10

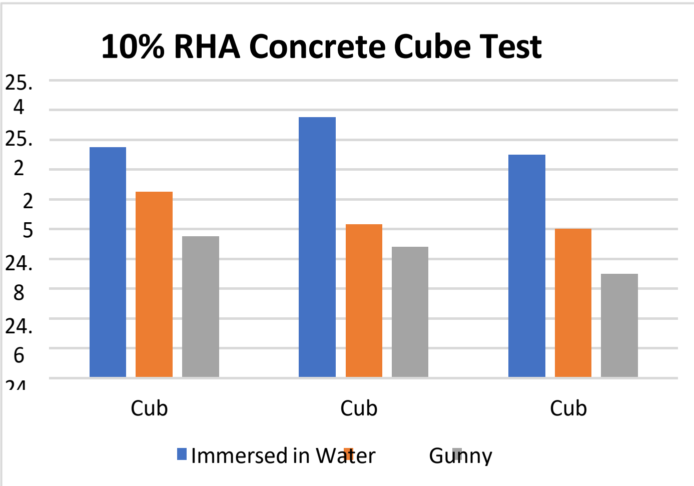


Fig. 5.8: Compressive strength of 10% RHA Concrete Cube

The project aimed to investigate the suitability of Rice Husk Ash (RHA) as a pozzolanic material for cement replacement in concrete. The main objective was to enhance the strength properties of concrete while utilizing a by-product of rice milling. However, the experimental results demonstrated a consistent decrease in compressive strength when incorporating RHA into the concrete mix. This reduction was observed and in samples with 10% and 15% cement replacement levels with RHA.

Several factors influencing the behavior of RHA concrete were kept constant, including the percentage replacement of cement, fineness of RHA, chemical composition of RHA, and the water-to-cementitious material ratio. The flow chart of the system, as illustrated in Figure 4.1, guided the experimental process. Additionally, extensive testing was conducted on the raw materials, including cement, aggregates, sand, and RHA, to evaluate specific properties. Mix designs were carefully formulated, and cubes and cylinders were casted for compressive strength testing. Various curing methods, such as water immersion, open air, and gunny bag curing, were employed to study their impact on concrete strength.

In interpreting the results, it is evident that the incorporation of RHA led to a consistent reduction in compressive strength. This challenges the initial hypothesis that RHA could enhance concrete strength properties. The observed decrease indicates the need for further optimization of mix designs or exploration of alternative methods to harness the environmental benefits of using RHA while minimizing the impact on structural performance. The findings contribute valuable insights for the future development of sustainable construction materials and methodologies.

IV.CONCLUSION

In conclusion, the project aimed to assess the viability of incorporating Rice Husk Ash (RHA) as a partial replacement for cement in concrete mixes. The results consistently indicated a reduction in compressive strength when RHA was introduced, whether in Normal OPC concrete or with 10% and 15% replacement levels. While this decrease in strength poses a challenge in terms of meeting structural requirements, the project sheds light on the intricate balance needed between environmental sustainability and material performance in construction.

Despite the reduction in compressive strength, the project holds promise for future endeavors in sustainable construction. The use of agricultural waste, such as RHA, in concrete has potential environmental benefits and can contribute to reducing the carbon footprint of the construction industry. Moving forward, further research should focus on optimizing the use of RHA through adjustments in mix proportions, curing methods, or the incorporation of additives. This project, with its comprehensive analysis, provides valuable insights for future innovations in eco-friendly construction materials, emphasizing the importance of achieving a harmonious blend between environmental responsibility and structural integrity in construction practices.

V.REFERENCES

[1] D.V. Reddy, Ph. D, P.E, Marcelina Alvarez, B.S. “Rice Husk Ash-Modified Reinforced Concrete”

[2] MEHTA, P. K., "Rice Husk Ash- A unique Supplementary Cementing Material", Proc. Of the International Symposium on Advances in Concrete Technology, Athens, Greece, May 1992, V.M. Malhorta, ed., pp. 407-430.

[3] Ramakrishnan S, Velrajkumar G, Ranjith S, “BEHAVIOR OF CEMENT-RICE HUSK ASH CONCRETE FOR PAVEMENT” Issue 4, Vol.1 (January 2014)

[4] P.Padma Rao, A.Pradhan Kumar, B.Bhaskar Singh “A Study on Use of Rice Husk Ash in Concrete”, IJEAR Vol. 4, Issue Spl-2, Jan - June 2014

[5] OBILADE, I.O. “USE OF RICE HUSK ASH AS PARTIAL REPLACEMENT FOR CEMENT IN CONCRETE” Sept. 2014. Vol. 5. No. 04

[6] E. B. Oyetola, and M. Abdullahi, “The Use of Rice Husk Ash in Low - Cost Sandcrete Block Production, Leonardo Electronic Journal of Practices and Technologies Issue 8, January-June 2006, page 58-70

[7] IS: 10262-1982 (Reaffirmed 2004): Recommended guidelines for concrete mix design, Bureau of Indian

Standard, New Delhi-2004.

[8] IS: 516-1959 (Reaffirmed 2004): Methods of tests for strength of concrete, Bureau of Indian Standard, New Delhi-2004.

[9] IS: 8112-1989 (Reaffirmed 2005): Specification for 43 Grade Ordinary Portland

[10] Dr. A.M. Pande and S.G.Makarande, "Effect of Rice husk ash on concrete" Vol. 3, Issue 1, January -February 2013, pp.1718-1723

[11] Cement, Bureau of Indian Standard, New Delhi-2005.

[12] RANJITH S "Behavior OF CEMENT-RICE HUSK ASH CONCRETE FOR PAVEMENT"