International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 8 Aug. 2022, pp: 20-24 www.ijaem.net ISSN: 2395-5252

Study of rice husk ash on Concrete: a Review

Rohit chaurasia[1], Sheela Malik[2], Ravinder[3]
[1](M.Tech Scholar, Department of Civil Engineering, Ganga Institute of techbology & management, jhajjar haryana)
2(Assistant Professor, Department of Civil Engineering, Ganga Institute of techbology & management, jhajjar haryana)
[1](M.Tech Scholar, Department of Civil Engineering, Ganga Institute of techbology & management, jhajjar haryana)

Submitted: 01-08-2022 Revised: 02-08-2022 Accepted: 08-08-2022

ABSTRACT: Concrete is a popular civil engineering construction material because the ingredients are readily available. Cement is commonly used as a major binding material. Because the use of cement in concrete causes significant environmental pollution due to greenhouse gas emissions, it is necessary to reduce cement usage by introducing new supplementary cementitious materials that are by-products of industries to reduce debris. Rice husk ash (RHA) is a pozzolanic material produced in large quantities by rice mills. This paper summarizes the results of concrete experiments in which plain Portland cement (PPC) was replaced with rice husk ash (RHA). Concrete specimens were made with 5%, 10%, 15%, and 20% RHA as a weight replacement for cement. Compressive strength is the most important mechanical property of concrete, and it is measured on 150 mm cubes. The compressive strength is measured for 7 and 28 days and the results are analysed..

Keywords: Rice husk ash, Plain Portland cement (P.P.C.), Compressive strength, pozzolan.I

I. INTRODUCTION

Controlled burn and grinding were used to optimize RHA for use as a pozzolanic material in concrete. It has several advantages, including improved strength and durability properties, as well as environmental benefits related to waste disposal and reduced carbon dioxide emissions. Until now, there has been little research into the use of RHA as a supplementary material in cement and concrete production. For example, in one paper, they burned rice husk in a drum incinerator to produce RHA and investigated the particle-size effect on the strength of RHA blended gap-graded Portland cement concrete. As a result, the purpose of this study is to investigate the compressive strength of concrete containing residual RHA generated when burning rice husk pellets and RHA obtained after grinding residual RHA. The effect of partial cement replacement with various percentages of ground RHA on concrete compressive strength is investigated.

Because of its structural stability and strength, concrete is a popular building material for a wide range of structures. The earth's crust provides all of the materials required to produce such massive amounts of concrete. As a result, it depletes its resources year after year, causing ecological strains. Human activities on Earth, on the other hand, generate significant amounts of solid waste (over 2500MT per year), including industrial wastes, agricultural wastes, and waste from rural and urban societies. Recent technological advances have demonstrated that these materials are valuable as inorganic and organic resources capable of producing a variety of useful products. The most common solid wastes are fly ash, blast furnace slag, rice husk, silica fume, and demolished construction materials. Since the mid-twentieth century, the cement and concrete industries have increased their use of mineral admixtures. Partial cement replacement helps to meet the growing demand for cement and concrete. When industrial by-products are used as a partial replacement for the energy of intense Portland cement, significant energy and cost savings can be realised. The use of by-products is an environmentally friendly way of disposing of large amounts of materials that would otherwise pollute land, water, and air. The use of supplementary cementing materials will meet the majority of the increase in cement demand..

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 8 Aug. 2022, pp: 20-24 www.ijaem.net ISSN: 2395-5252

II. LITRATURE REVIEW:

Some of the early researches have examined the use of rice husk ash (RHA) in concrete.

DaoVan and PhamDuy: Using RHA, they demonstrated several key properties of high strength concrete. RHAs were obtained from two different sources: India and Vietnam. The RHA in India is far superior to the RHA in Vietnam. The acceptable content to replace cement is 10% with the acceptance of a reduction in compressive strength. It has been determined that rice husk is a plentiful agricultural waste in Vietnam. Investigations into the production of high-quality RHA in Vietnam are required.

Ramezanianpour and Khani looked into the effects of rice husk ash on the mechanical properties and durability of sustainable concrete. The percentages of RHA replaced by cement by weight are 7%, 10%, and 15%. The results show that concrete incorporating RHA had higher compressive strength, splitting tensile strength, and modulus of elasticity at different ages than control cement concrete. Furthermore, the results show that using RHA as an artificial pozzolanic material improved the durability of RHA concretes and reduced chloride diffusion.

Abhilash and Arbind tested one commercially available RHA as a supplementary cementitious material for cement. At 7 and 28 days, there was a significant improvement in the compressive strength of the concrete with a RHA content of 10% for M30 and M60, i.e. 4.23 percent to 10.93 percent. It has been determined that RHA can be used to replace 10% of cement with no negative consequences.

Malleswara and Patnaikuni investigated the performance of RHA concrete in seawater. It can be concluded that RHA concrete for M20 grade is exposed to seawater for 28 and 90 days. The compressive strengths of the 7.5 percent replacement were higher. After 90 days of exposure to seawater, the compressive strength of the concrete was found to be higher than that of normal concrete.

Maurice and Godwin investigated the effects of replacing OPC with RHA in part. In comparison to the control sample, adding RHA to concrete resulted in increased water demand, increased workability, and increased strength. The results show that a 5-10% addition of RHA will increase the strength.

III. EXPERIMENTAL PROGRAM:

Materials Used: The various material used in the preparation of concrete are cement, sand, cement coarse aggregates, rice husk ash (RHA) and water.

Rice husk ash:- Rice husk ash is a pozzalanic material derived from paddy in the district of Jabalpur. It can be burned to produce ash that has the physical properties and chemical composition of mineral admixtures. Pozzolanic activity of rice husk ash (RHA) is affected by I silica content, (ii) silica crystallization phase, and (iii) ash particle size and surface area. Furthermore, ash must contain only a trace amount of carbon. RHA with amorphous silica content and a large surface area can be produced by controlled temperature combustion of rice husk. Tables 1 and 2 list the physical and chemical properties, respectively.

Table 1 .Typical physical properties of RHA.

Property	Value
Appearan ceColour Mineralo gyOdour Specific	Very fine powdergrey non- crystalline odourless

Table 2. Typical chemical composition of RHA

Compound	Percentage composition
Calcium oxide (CaO)	2.2
Silicon oxides (SiO_2)	86.9
Aluminum oxide	4
(Al_2O_3)Iron oxide	0.2
(Fe_2O_3) Magnesium	0.1
oxide (MgO)Sodium	0.6
oxide (Na_2O)	0.8
Potassium oxide	2.3

Cement: Plain Portland Cement (43 Grades) which is available in market is used.
Fine Aggregate: The natural river sand available in local market which passes through 4.75mm sieve with specific gravity of 2.62. Conforming to Zone II.
Coarse Aggregate: Crushed granite conforming to IS 383 - 1970 is used in this study. Coarse aggregate passing through 20mm and retained on 16 mm sieve and specific gravity 2.82 was used.
Water: Water is an important ingredient of concrete as it actively participated in chemical reaction with cement, clean portablewater which is available in our college campus is used.
Mix Proportion: The mixture proportion for the controlled concrete of M25 grade was arrived from the trial mix as per IS 10262-2009.

Table 3. Mix proportions

S.no.	Mix	Cement (Kg/m^3)	Rice husk ash (Kg/m^3)	Fine aggregate (Kg/m^3)	Coarse aggregate (Kg/m^3)	Water (Kg/m^3)	w/c ratio
1.	M0	372	0	692	1216	186	0.5
2.	M5	353.4	18.6	692	1216	186	0.5
3.	M10	334.8	37.2	692	1216	186	0.5
4.	M15	316.2	55.8	692	1216	186	0.5
5.	M20	297.6	74.4	692	1216	186	0.5

IV. METHODOLOGY:

For this study, replacement levels of PPC by RHA of 0%, 5%, 10%, 15%, and 20% were chosen. Batching was done by weighing the calculated amount of each concrete constituent according to the mix ratio of 1:1.86:3.26 and using M-25 grade concrete. The constituents were then thoroughly mixed until a uniform mix was achieved. After that, water was added and the process was repeated. The fresh concrete mix was then compacted and left for 24 hours before testing in a 150 mm mould. Compressive specimens were tested at 7 and 28 days of age.

V. RESULT AND DISCUSSION

Compressive Strength:-

Table 4 displays the compressive strength results. The test was performed to determine the compressive strength of concrete at 7 and 28 days of age. The cubes were tested on a Compression Testing Machine (CTM) with a capacity of 2000KN that was available in the structures lab. According to Fig. 1, the compressive strength can reach 22.20 N/mm2 and 31.12 N/mm2 after 7 and 28 days, respectively. At 10% replacement of rice husk ash, the maximum compressive strength is observed. When higher ash percentages were used, compressive strengths decreased. RHA contains significant impurities such as alumina, free lime, and others.

Table 4. Compressive strength test result of RHA concrete at different ages.

S.NO.	Name of cube sample	Rice husk ash (%)	Average Ultimate Compressive strength(N/mm^2)	
			(7 days)	(28 days)
1.	M0	0	22.20	31.12
2.	M5	5	22.25	31.85
3.	M10	10	22.50	32.93
4.	M15	15	22.85	32.05
5.	M20	20	23.15	31.15

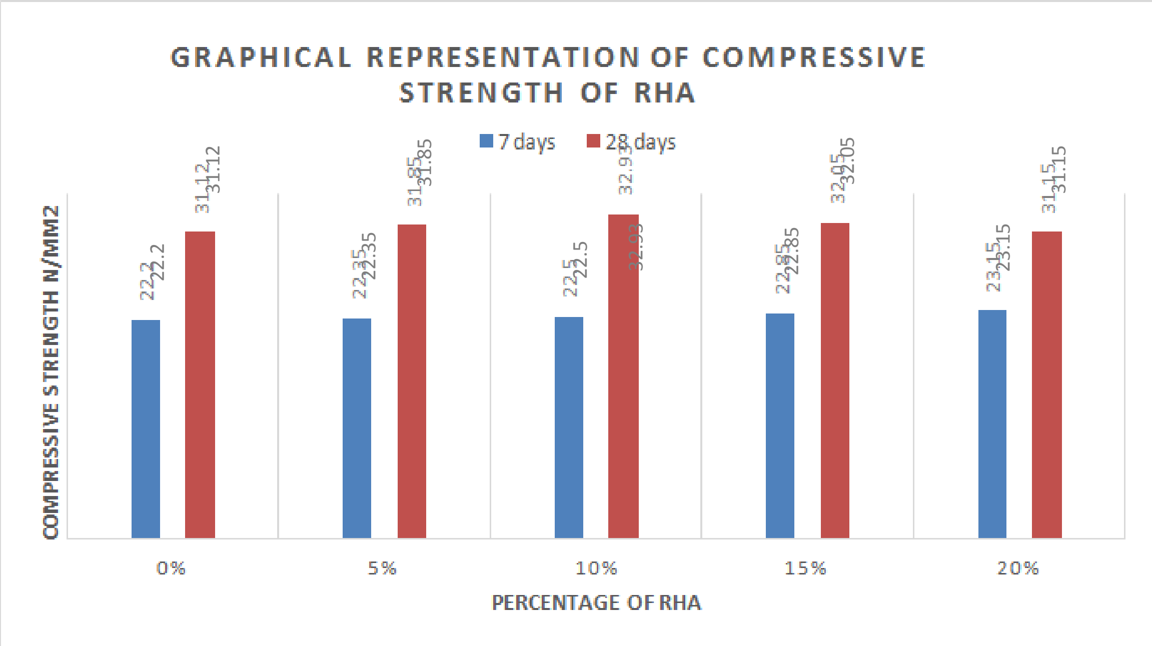

Figure 1. Relationship between compressive strength and different percentage of RHA. at a age of 7 and 28-days

VI. CONCLUSION:

1. According to test results, higher compressive strength is achieved when compared to conventional concrete.
2. The addition of RHA reduces strength due to impurities in RHA such as free lime, alumina, and other raw minerals.
3. However, the greatest strength is obtained when 15% RHA is replaced with cement at 7 days of age.
4. When 10% of the RHA is replaced with cement at 28 days of age, the strength increases.
5. When the RHA addition for 28-day-old concrete cubes is greater than 10%, the strength produced by the concrete is less than the target strength.
6. If RHA replacement is greater than 15% for 7-day-old cubes, compressive strength is reduced..

REFERENCES:

[1]. Indian Standard IS 456-2000, Plain And Reinforced Concrete - Code Of Practice

[2]. Shazim Ali Memona, Muhammad Ali Shaikh, and Hassan Akbar, "Utilization of Rice Husk Ash as a Viscosity Modifier in Self-Compacting Concrete," Construction and Building Materials, July 2010, pp.1044-1048.

[3]. "Properties of Blended Cements Made from Rice Husk Ash," P.K. Mehta, ACI Journal, September 1977, pp. 440-442.

[4]. "Study on Strength Characteristics of High Strength Rice Husk Ash Concrete," R. Kishore, V. Bhishma Hikshma, and P. Jeevana Prakash, Procedia Engineering, 14 (2011), 2666-2672.

[5]. Shazim Ali Memona, Muhammad Ali Shaikh, and Hassan Akbar, "Utilization of Rice Husk Ash as a Viscosity Modifier in Self-Compacting Concrete," Construction and Building Materials, July 2010, pp.1044-1048.

[6]. "Rice Husk Ash Concrete: the Effect of RHA Average Particle Size on Mechanical Properties and Drying Shrinkage," G.A Habeeb and M.M Fayyadh, Australian Journal of Basic and Applied Sciences, 3(3), 1616-1622, 2009.
[7]. "Mechanical Properties of Rice Husk Ash (RHA) High strength Concrete," Deepa G Nair, K. Sivaraman, and Job Thomas, American Journal of Engineering Research, Vol. 3, pp-14-19.