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PERFORMANCE OF CONCRETE WITH PARTIAL CEMENT REPLACEMENT BY GLASS POWDER & RICE HUSK ASH

Shivendra Singh Kushwah[1], Prof. Monika Koshal[2]

[1]M.Tech Student, BM College Of Technology, Indore MP, India.

[2]Associate Professor, Civil Department, BM College Of Technology, Indore MP, India.

ABSTRACT

Concrete is world's most consuming material and its one of the most Important material in various type of Construction work so it has gravitation to attract researchers to improve various properties of concrete such as Compressive strength, Flexural strength, Density, Workability etc. and reduce its cost to and reach economy because its widely used material all around the world. Glass Powder and Rice husk Ash is Pozzolanic waste Material available in bulk. In this study we have used combination of both the material to partial replace with cement with various percentage and check the performance of concrete by testing various essential properties of concrete like Compressive strength, Flexural Strength, Bulk Density and Workability. The use of Pozzolanic waste such as Glass Powder and Rice husk Ash helps in enhancing strength of concrete to an optimum partial replacement of cement further increment in percentage replacement cause reduction in strength in this study, we will reach test various combination to Reach that optimum percentage.

Keywords: Glass Powder, Rice Husk Ash, Workability, Strength.

1. INTRODUCTION

Concrete is the most widely used material in the world for construction work. Concrete contains cement, sand, aggregate, water and plasticizer. Sometimes other Pozzolanic materials like glass powder, rice husk ash, fly ash etc. are added in concrete by partial replacement of cement in the concrete mix. Since almost every industry, produces waste materials and the effective disposal of these wastes is a challenging task for engineers. According to Coutinho, S. J. 2022 "Annually global cement production has reached 2.8 billion tons and is expected to increase to some 3.5 billion tons per year. Production of cement requires more amount of energy and produce large amount of CO2. These CO2 affects the atmosphere. If cement will replaced by glass powder and rice husk ash, it will reduce the CO2 emission, increasing the strength and save the cost of construction.

Application of glass powder:

- Glass powder use in paint and lining in chemical plants, marine construction & harbor facilities and petroleum tanks.
- Glass powder use in pollution control facilities, plating metal industries, boiler & water tanks, food industries, transportation concerns and fishery concerns.
- Glass can be used as a dry blasting media or combined with water for use in slurry blasting.
- It has excellent anticorrosion characteristics in the fields of paint and lining.

Rice husk ash

Rice husk is an agro-waste material, which is produced in about 300 million metric tons in worldwide annually. Approximately, 100 Kg of rice husk are obtained from 500 Kg of rice. Rice husks contain organic substances and 20% of inorganic material. Rice husk ash (RHA) is obtained by the combustion of rice husk.

Application of Rich Husk Ash:

RHA is a carbon neutral green product. Lots of ways are being thought of for disposing them by making commercial use of this RHA. RHA is a good super-pozzolan. This super- pozzolan can be used in a big way to make special concrete mixes. There is a growing demand for fine amorphous silica in the production of special cement and concrete mixes, high performance concrete, high strength, low permeability concrete, for use in bridges, marine environments, nuclear power plants etc. Some other uses of RHA are given below-

- Green Concrete
- High performance of concrete
- Refractory
- Ceramic glaze
- Insulator

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- Water proofing chemicals
- Roofing Shingles

Objectives of Study:

The objectives of the work for the study under consideration are includes the following.

- To find out properties of concrete that is compressive strength & flexural strength with and without addition of glass powder and rice husk ash.
- To find out suitable proportion of Glass Powder and RHA that provides good strength to concrete mix.
- To calculate of economy.
- Utilization of Industrial waste in a useful manner.
- Protect the environment by the use of industrial waste.
- To provide economical construction material.

2. LITERATURE REVIEW

1. Dr. Patagundi B.R. et. al. (Oct-2022) Presented "Effect of temperature on the properties of concrete containing glass powder as pozzolana" studied an attempt were made to find out the effect of temperature on the properties of concrete containing waste glass powder as pozzolana. The cement is replaced by glass powder in different percentages like 0%, 5%, 10%, 15%,20%, 25%, 30%, 35% and 40%. And carried out physical test like compressive strength, flexural strength, split tensile strength and impact test when cement is replaced by glass powder in different proportion and when subjected to high temperature of 200°C and 500°C for 12 hrs. 20% replacement of cement by glass powder is found to be beneficial when concrete is subjected to temperature.

2. Memon Shazim Ali et. al. (Aug-2022) presented "Production of low cost self-compacting concrete using rice husk ash" studied focuses on comparison of fresh properties of SCC containing varying amounts of RHA with that containing commercially available viscosity modifying admixture. The comparison is done at different dosages of super plasticizer keeping cement, water, coarse aggregate, and fine aggregate contents constant.

Test results substantiate the feasibility to develop low cost SCC using RHA. Cost analysis showed that the cost of ingredients of specific SCC mix is 42.47 percent less than that of control concrete. The utilization of RHA in SCC solves the problem of its disposal thus keeping the environment free from pollution.

3. Kawahata Celso Yoji et. al. (June-2022) presented "Rice husk derived waste materials as partial cement replacement in light weight concrete" They were studied that, rice husk ash (RHA) and broiler bed ash from rice husk (BBA), two agricultural waste materials, have been assessed for use as partial cement replacement materials for application in lightweight concrete. Properties of concrete investigated were compressive and flexural strength at different ages, absorption by capillarity, resistivity and resistance to chloride ion penetration (CTH method) and accelerated carbonation. Test results obtained for 10% cement replacement level in lightweight concrete indicate that although the addition of BBA conducted to lower performance in terms of the degradation indicative tests, RHA led to the enhancement of mechanical properties, especially early strength and also fast ageing related results, further contributing to sustainable construction with energy saver lightweight concrete.

4. Chik Farah Alwani Wan et al. (2021) studied on the effect of gasses incinerating rice husk ash (GIRHA) on properties of concrete block. The compressive strength, water absorption, moisture movement and modulus of elasticity were investigated. Preliminary analysis of the constituent materials of the ordinary Portland cement and Rice Husk Ash concrete blocks were conducted to confirm their suitability for block making. Physical test of the recently prepared mix was also carried out. 390mm x 190mm x 100mm concrete blocks were cast and compacted by a KANGO hammer for 7, 14, 28 and 60 days at 0, 10, 15 and 20 percent replacement levels. They conclude that, the high performance of masonry blocks can be produced using rice husk ash (RHA) as cement replacement material. The compressive strength of the OPC and RHA concrete blocks increases with age at curing and decreases as the percentage of RHA content increases. The study arrived at an optimum replacement level of 15%.

5. Khatib J.M. et. al. (2021) presented "Glass Powder Utilization in Concrete Production" Investigated the performance of concrete contains glass powder as partial substitution of cement. Portland cement (PC) was partially replaced with 0-40% glass powder. Testing included ultrasonic pulse velocity, compressive strength and absorption. Specimens were cured in water at 20°C. The results indicate that the maximum strength of concrete occurs at around 10% glass powder. The slump of seems to increase with the increase in glass powder in the concrete mix. Beyond 10% glass powder the strength of concrete reduces and is lower than that of the control.

6. Shahid Ali Shaikh Shaikh (JANUARY 2021) The Utilization of Glass Waste as Fine Aggregate Replacement and

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Rice Husk Ashas Cement Replacement in Concrete: A Review Cement as abinder used in the mixture of concrete is a costly product and it is also harmful to the environment due to the emission of huge amounts of CO_2 and other gases. Like cement the fine aggregate is also the main constituent of the concrete used as inert filler in concrete is also expensive. The researchers are probing towards the new inexpensive and environment friendly materials for the concrete. They have agreed over the point that by utilizing the recycled waste materials could be helpful in achieving the sustainable construction. So in this case a lot of research has been carried out for the utilization of rice husk ash as cement substitution and recycled waste glass as alternative of concrete fine aggregate. The outcome of this research is that these both green materials have enormous potential to contribute in the long-lasting handling of in effectual solid waste, reduction of landfill sites, preserving natural resources and protecting atmosphere from extremely hazardous gases. The purpose of this review work is to summarize the previous research findings on utilization of rice husk ash and recycled waste glass as a substitution to the cement and fine aggregate respectively. This review paper will come up with the remarkable idea and valuable information for the upcoming researchers working for the aim of utilization of renewable and futile materials in the field of concrete technology.

3. METHODOLOGY

In this study of testing cement, Cement used in this experimental work is “43 grade” which is available under the commercial name “Ultra Tech cement”. Coarse aggregate fine aggregate will be done. In this study property of fresh concrete and hardened concrete such as workability test, compressive and flexural strength test to be done. In the mix cement will replace by 5% ,10%, 15%, 20% of Glass powder and Rise husk ash mix suitable percentage will be carried out by the mix giving maximum compressive and flexural strength after 7 Days and 28 Days . Then Cost analysis will be done between conventional concrete and modified concrete.

4. RESULTS AND TESTING

Flexural strength of concrete when RHA is 5% and GP with varying 5%, 10%, 15% and 20% after 7 days and 28 days curing are shown in table 2 and are depicted in Fig. 1

Table 1: Flexural Strength for varying % of GP & for 5% RHA

Material Mixture	Flexural strength of concrete beams(N/mm^2)	
	7 days	28 days
RHA05GP05	3.24	3.93
RHA05GP10	3.21	4.09
RHA05GP15	3.27	4.08
RHA05GP20	3.24	3.95

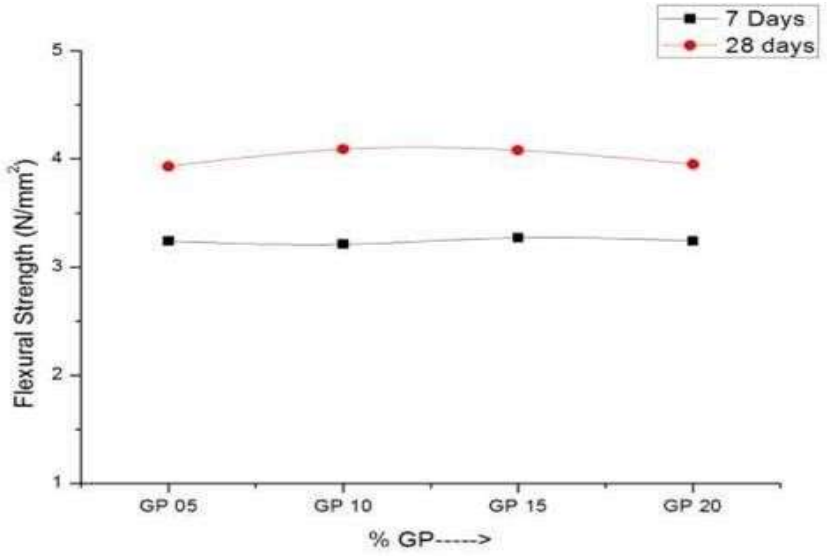

Fig 1: 7 days & 28 days Flexural Strength for 5% RHA and varying Glass Powder

Flexural strength of concrete when RHA is 10% and GP with varying 5%, 10%, 15% and 20% after 7 days and 28 days curing are shown in table 3 and are depicted in Fig. 2

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Table 2: Flexural Strength for varying % of GP & for 10% RHA

Material Mixture	Flexural strength of concrete beams(N/mm^2)	
	7 days	28 days
RHA10GP05	3.12	3.87
RHA10GP10	3.14	3.93
RHA10GP15	3.38	4.12
RHA10GP20	2.93	3.83

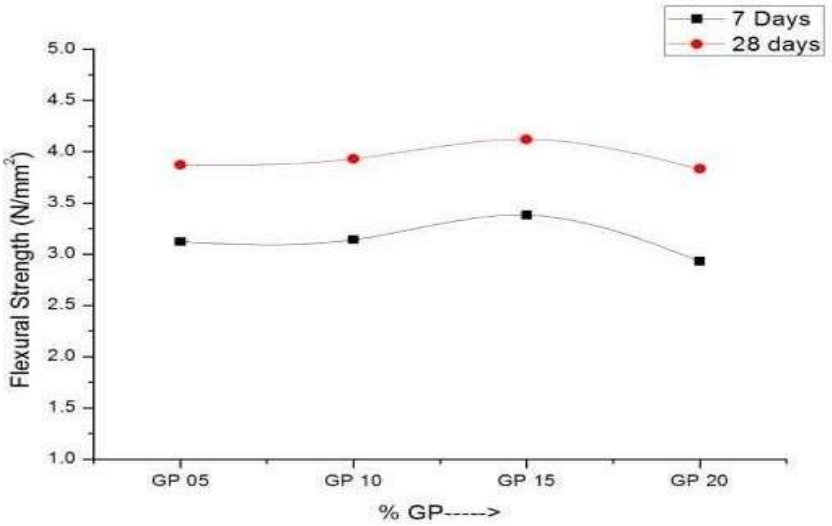

Fig 2: 7 days & 28 days Flexural Strength for 10% RHA and varying Glass Powder

Flexural strength of concrete when RHA is 15% and GP with varying 5%, 10%, 15% and 20% after 7 days and 28 days curing are shown in table 4 and are depicted in Fig. 3

Table 4: Flexural Strength for varying % of GP & for 15% RHA

Material Mixture	Flexural strength of concrete beams(N/mm^2)	
	7 days	28 days
RHA15GP05	2.92	3.85
RHA15GP10	2.78	3.79
RHA15GP15	3.12	4.05
RHA15GP20	2.79	3.62

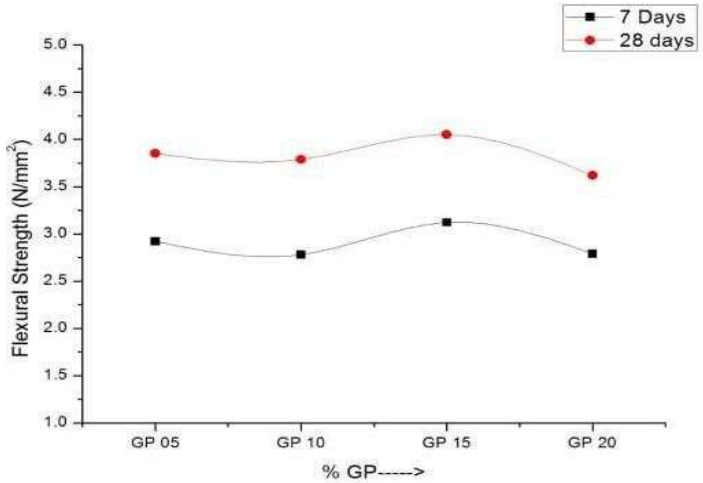

Fig 3: 7 days & 28 days Flexural Strength for 15% RHA and varying Glass Powder

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Flexural strength of concrete when RHA is 20% and GP with varying 5%, 10%, 15% and 20% after 7 days and 28 days curing are shown in table 5 and are depicted in Fig. 4

Table 5: Flexural Strength for varying % of GP & for 20% RHA

Material Mixture	Flexural strength of concrete beams(N/mm^2)	
	7 days	28 days
RHA20GP05	2.74	3.79
RHA20GP10	2.55	3.64
RHA20GP15	2.7	3.6
RHA20GP20	2.21	3.05

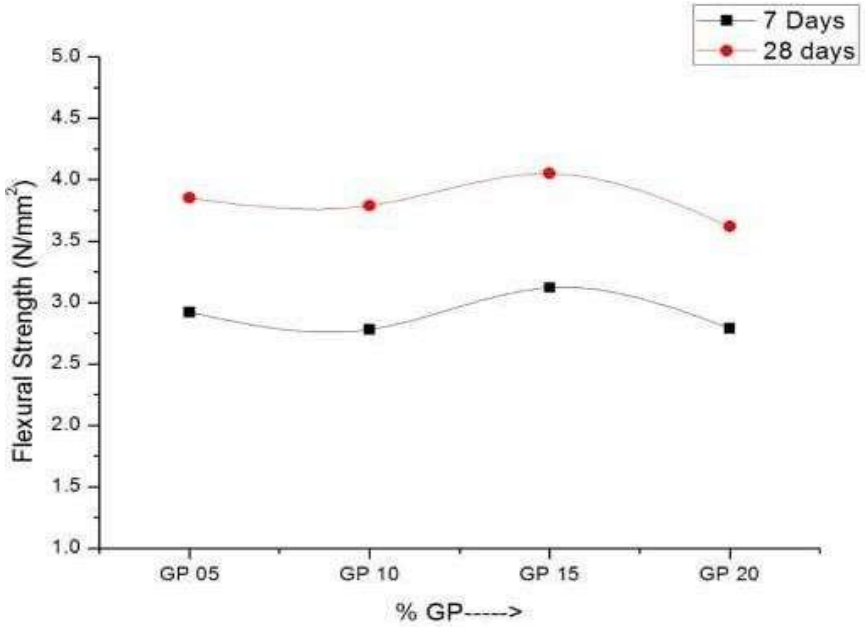

Fig 4: 7 days & 28 days Flexural Strength for 20% RHA and varying Glass Powder

Fig 5:

The combined Flexural strength of concrete of various combinations is shown in Fig. 5 and Fig 6. for 7 days and 28 days curing of concrete

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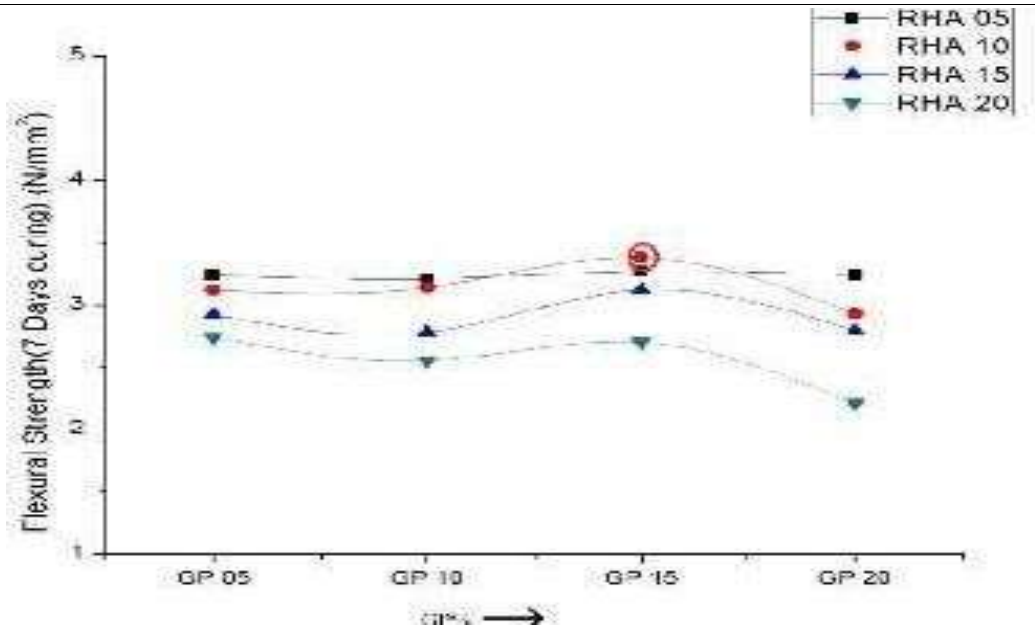

Fig 6: 7 days Flexural Strength of concrete for keeping RHA constant & Glass Powder varying

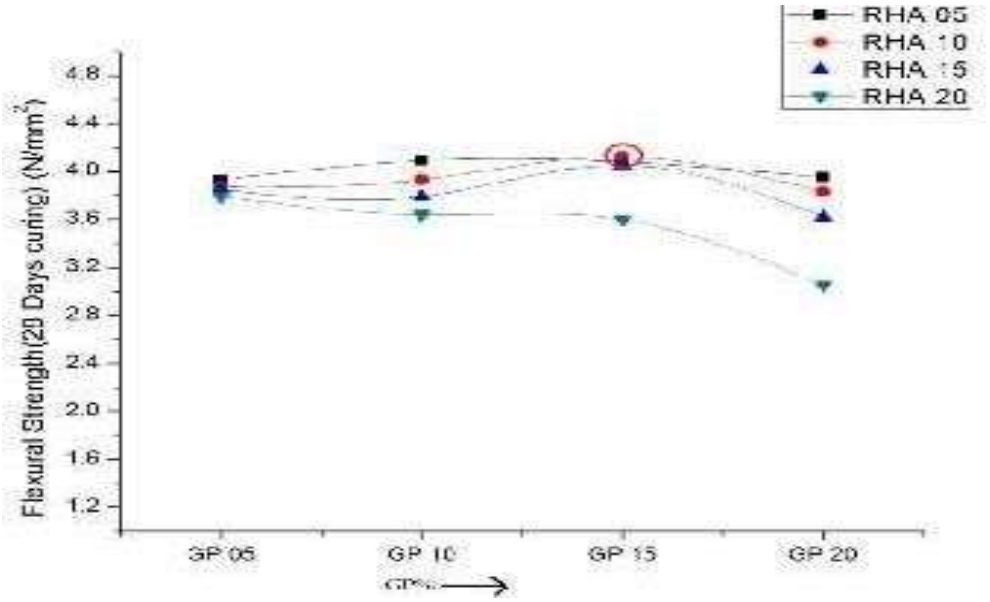

Fig 7: 28 days Flexural Strength of concrete for keeping RHA constant & Glass Powder varying

5. CONCLUSION

Using Glass powder and Rice husk ash in conventional concrete can element the problem of disposal of waste material. By finding optimum percentage used in conventional concrete of the Glass Powder and Rice husk ash can increase Compressive and Flexural strength of concrete . It can improve workability as well. Using this material as replacement of cement can reduce cement consumption and ultimately reduce per meter cube cost of concrete.

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