|| Volume 8 || Issue 9 || September 2024 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

EFFECT OF GLASS POWDER AND RICE HUSK ASH ON CONCRETE PROPERTIES

[1]RAVITA AHIRWAR, [2]MAHROOF AHMED

[1]M.Tech Scholar, Department of Civil Engineering, Sushila Devi Bansal College of Engineering Indore
[2]Assistant Professor, Department of Civil Engineering, Sushila Devi Bansal College of Engineering Indore

---

Abstract: Concrete is the most widely used man made material for construction. In this project work cement were partially replaced by different combination of waste glass powder and rice husk ash. For that prepared number of cubes and beams by addition of waste glass powder and Rice Husk Ash at various proportions. In this project work percentage of waste glass powder was taken constant at 5, 10, 15, 20 and varying the percentage of rice husk ash like 5, 10, 15 and 20. Conventional concrete cube have also been prepared. The casted specimens have been tested for its compressive and flexural strength at 7 days and 28 days age and compare this strength with conventional concrete strength. Test result shows that the combination of 15% waste glass powder and 10% rice husk ash gives maximum strength. In this project work waste materials are used in concrete so cost of concrete is low then conventional concrete. It is also it is eco friendly. This study will have a positive impact on the environment, as it will reduce the volume of Glass Powder and Rice Husk Ash to be disposed off by incineration and land filling. In addition, it will reduce the use of cement.

Keywords: *Concrete, Cement, Compressive strength, Flexural strength, Bulk Density, Workability, Glass Powder, Rice husk*

I.INTRODUCTION:

Glass powder is waste product. The key sources of waste glasses are waste container, window glasses, window screen, medicinal bottles, liquor bottles, tube lights, bulbs, electronic equipments etc. Only some part of this waste glass can be used in recycling. The waste glass when grounded to a very fine powder shows some pozzolanic properties. Therefore the glass powder to some extent can replace the cement and contribute to the strength development. The typical glass contains 70% silica approximately. Past study shows pozzoloonic properties of glass are noticeable on particle sizes below approximately 100µm. Size of glass powder less than 75µm possessed cementitious capability and improves compressive strength, resistance to sulphate attack and chloride ion penetration.

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. The burning temperature must be within the range of 600 to 800 ^{0}C. The ash obtained has to be grounded in a ball mill for 30 minutes and its appearance in colour will be grey. The most important property of RHA that determines pozzolanic activity is the amorphous phase content. RHA is a highly reactive pozzolanic material suitable for use in lime-pozzolana mixes and for Portland cement replacement.

MATERIAL CHARACTERISATION

1.1 Glass powder

Glass powder collected from post consumer source in Indore city. For determined the specific gravity of glass by Le- Chatelier apparatus.

1.2 Rice husk ash

The rice husk ash was collected from N.K. Enterprises, Jharsuguda, Orissa, India. The rice husk ash used in this study was prepared by burning at the temperature within the range of 600 ^{0}C to 800 ^{0}C at approximately 48 hours under uncontrolled combustion process. The ash obtained was grounded in a ball mill for 30 minutes and its appearance in colour was grey.

1.3 Cement

Cement used in this experimental work is “43 grade” which is available under the commercial name “Ultra Tech cement”. Table 2.1 shows chemical properties of binder materials. Table 2.2 shows physical properties of various concrete materials.

Table2.1 Chemical properties of binder materials

	Cement %	Glass powder %	Rice husk ash %
Cao	60-67	9.79	2.51%
SiO_2	17-25	73.1	92.62%
Al_2O_3	03-08	1.36	0.49%
Fe_2O_3	0.5-6	0.67	0.73%
MgO	0.1-4	3.45	0.88%
So_3	1.3-3	-	
Alkalies(K_2O, Na_2O)	0.4-1.3	11.1	

Table 2.2 Physical properties of materials

	Specific gravity	Fineness modulus	Finenes s
Cement	3.12	-	96%
Glass powder	2.95	-	100%
Rice husk ash	2.1	-	97%
Coarse aggregate	2.87	6.27	-
Fine aggregate	2.47	2.537	-

1.4 Coarse aggregate & fine aggregate

Coarse aggregate is collected from nearby quarry. Fineness of coarse aggregate is 2.805. Coarse aggregate are used with size between 20mm-4.75mm. River sand confirming to zone 2 and with fineness modulus of 2.80 was use in study

1.5 Admixture

In the present study water reducer admixture is added to reduce the water content. Plasticizer used in this experimental work is water reducer type which is available in commercial name is fosroc.

II.OBJECTIVES OF THE PRESENT STUDY

- ✓ 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 over 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.

III.PREPARATION OF MIXES

In this study an attempt is made to find out the hardened properties of concrete such as compressive Strength andFlexural Strength of M30 grade(1:1.3:2.6) concrete containing waste glass powder and rice husk ash as pozzolana. Cement (43 grade) is used as main binder in the mixes. . Plasticizer do is optimized to make the mixes workable for paving application. The water that is available in laboratory is used. The mixes were designated as a mix with the varying percentage of Glass Powder and Rice husk ash such as 5%, 10%, 15%, 20% respectively and finding out its suitable combination, which shows the higher compressive strength and higher flexural strength at 7-days and 28-days. Designing the mix as per IS 10262-2009,batching, mixing, compacting of concrete, casting the specimen for various test considered for the study, testing the specimen, tabulation and analysis of data and finally discussion followed by conclusion based on test results

IV.RESULTS

To select optimal level of replacement of GP & RHA, the 7 days and 28 days compressive and flexural strength of all the 17 combination of concrete were investigated.

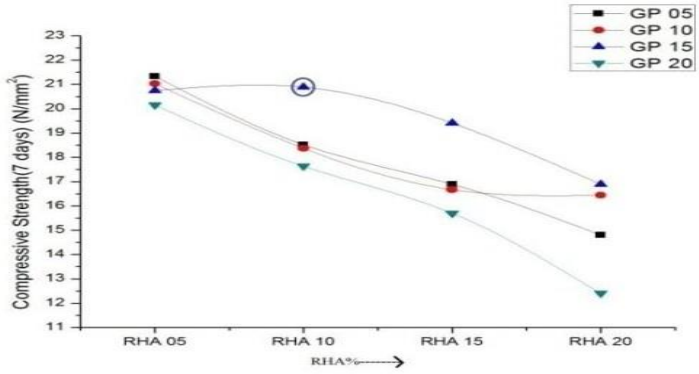
4.1 Compressive strength

Fig. 5.1 and fig. 5.2 shows compressive strength of concrete for various combinations for 7-days and 28-days respectively. For all tests, three specimens were casted for each combination. GP15RHA10 combination shows slightly less compressive strength than conventional concrete at 7-days curing but at 28-days curing shows more strength than conventional concrete. Table 5.1 shows the result for compressive strength of concrete.

4.2 Flexural strength

Fig. 5.3 and fig. 5.4 shows flexural strength of concrete for all various combinations and conventional concrete for 7-days &28- days curing age respectively. Table 5.2 numerical values of flexural strength for each combination for 7-days & 28-days curing age. GP15RHA10 combination shows more flexural strength than conventional concrete

Fig.5.1- 7 days Compressive Strength of concrete for keeping Glass Powder constant & RHA varying



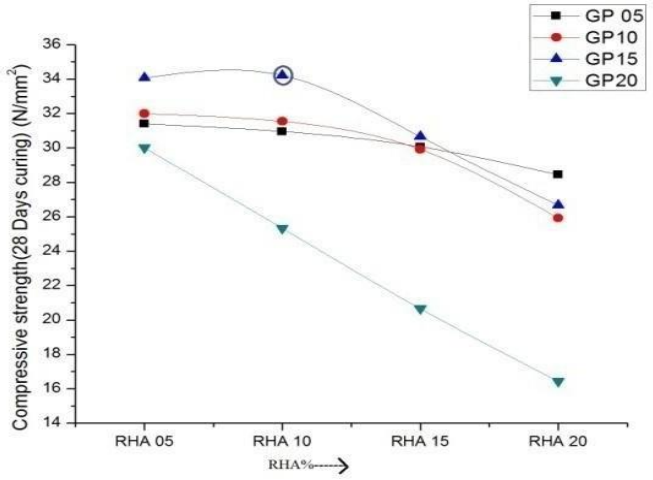


Fig.5.2- 28 days Compressive Strength of concrete for keeping Glass Powder constant & RHA varying

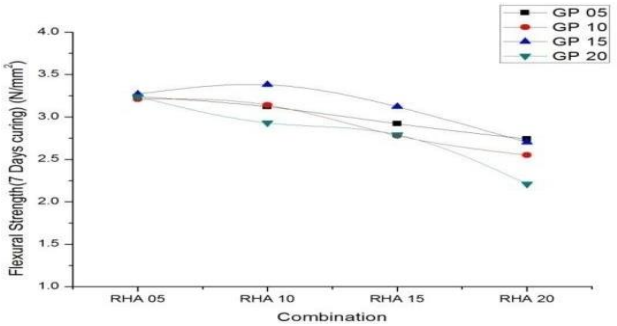


Fig.5.3- 7 Days Flexural Strength of concrete for keeping

Glass Powder constant & RHA varying

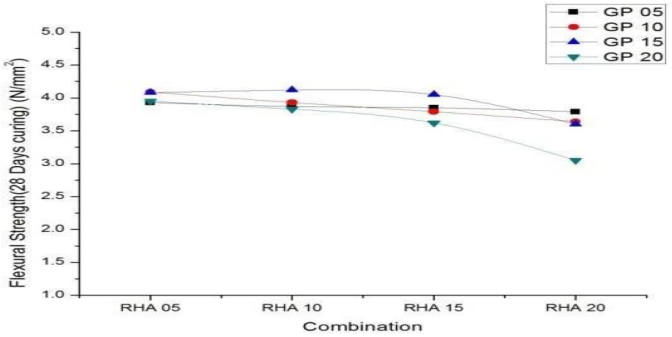


Fig. 5.4- 28 Days Flexural Strength of concrete for keeping Glass Powder constant & RHA varying

Table 5.1 Compressive Strength of Various Concrete Mixes

Material Mixture	Compressive strength of concrete cubes (N/mm^2)		Material Mixture	Compressive strength ofconcrete cubes (N/mm^2)	
	7 days	28 days		7 days	28 days
GP00RHA00	22.22	32.74	GP15RHA05	20.74	34.07
GP05RHA05	21.33	31.4	GP15RHA10	**20.89**	**34.22**
GP05RHA10	18.52	30.96	GP15RHA15	19.41	30.66
GP05RHA15	16.89	30.07	GP15RHA20	16.89	26.67
GP05RHA20	14.81	28.44	GP20RHA05	20.15	30
GP10RHA05	21.03	32	GP20RHA10	17.63	25.33
GP10RHA10	18.37	31.55	GP20RHA15	15.7	20.66
GP10RHA15	16.67	29.92	GP20RHA20	12.4	16.44
GP10RHA20	16.44	25.92			

GP- Glass powder, RHA- Rice husk ash

Table 5.2 Flexural Strength of Various Concrete Mixes

Material Mixture	Flexural strength of concrete cubes (N/mm^2)		Material Mixture	Flexural strength of concrete cubes(N/mm^2)	
	7 days	28 days		7 days	28 days
GP00RHA00	3.3	4.05	GP15RHA05	3.27	4.08
GP05RHA05	3.24	3.93	GP15RHA10	**3.38**	**4.12**
GP05RHA10	3.12	3.87	GP15RHA15	3.12	4.05
GP05RHA15	2.92	3.85	GP15RHA20	2.7	3.6
GP05RHA20	2.74	3.79	GP20RHA05	3.24	3.95
GP10RHA05	3.21	4.09	GP20RHA10	2.93	3.83
GP10RHA10	3.14	3.93	GP20RHA15	2.79	3.62
GP10RHA15	2.78	3.79	GP20RHA20	2.21	3.05
GP10RHA20	2.55	3.64			

GP- Glass powder, RHA- Rice husk ash

V.CONCLUSIONS

Within scope of present work following conclusions have been drawn

- Addition of Glass Powder and Rice husk ash in cement concrete for replacement of cement solve the problem of disposal of waste material.
- When 25 % of cement is replaced by 15% Glass Powder and 10% Rice husk ash compressive strength of modified concrete is 1.04% more than the conventional concrete.
- When 25 % of cement is replaced by 15% Glass Powder and 10% Rice husk ash flexural strength of modified concrete is 1.01% more than the conventional concrete.
- On addition of Glass powder and Rice husk ash initially up to 7 days the rate of gain of strength is slightly low but at 28 days it meets required design strength.
- Cost of the modified concrete when 25% of cement is replaced by 15% Glass Powder and 10% Rice husk ash is 16.36% less than the conventional concrete.
- The modified concrete is eco friendly as cement consumption is low.
- Use of the modified concrete will reduce the cement consumption hence saving of energy will take place. Modified concrete is economical than conventional concrete

VI.REFERENCES

[1]Coutinho, S. J., 2003 “The combined benefits of CPF and RHA in improving the durability of concrete structures”. Cement and concrete composites: 25(1): 2003, pg 51–59.
[2]Memon Shazim Ali, Shaikh Muhammad Ali, Akbar Hassan (2008) “Production of low cost self compacting concrete using rice husk ash” (ICCIDC–I)
[3]Chik Farah Alwani Wan, Bakar Badorul Hisham Abu, Johari Megat Azmi Megat & Jaya Ramadhansyah Putra, (2011) “Properties of concrete block containing rice husk ash subjected to girha” IJRRAS 8(1)
[4]Khatib J.M., Negim E.M., Sohl H.S. and Chileshe N. (2012) “Glass Powder Utilization in Concrete Production” European journal of applied science 4(ISSN 2079-2077)
[5]Celso Yoji Kawahata, Holmer Savastano Junior, Joana Sousa-Coutinho(2012) “Rice husk derived waste materials as partial cement replacement in light weight concrete” Lavras, volume 36
[6]Dr. Patagundi B.R., Dr. Prakash K.B. (2012) “Effect of temperature on the properties of concrete containing glass powder as pozzolana” IJERT,ISSN 2278-0181, Volume1 Issue 8
[7]Patil Dhanaraj Mohan, Dr. Sangle Keshav K (2013) “Experimental investigation of waste glass powder as partial replacement of cement in concrete” International journal of advanced technology in civil engineering, ISSN:22311-5721, vol. 2
[8]Dr. Kumar G. Vijay, Ms Vishaliny H., Dr. Govindarajulu (2013) “Studies on Glass Powder as Partial Replacement of Cement in Concrete Production” (IJETAE,ISSN2250-2459, vol. 3)
[9]Vandhiyan R., Ramkumar K. and Ramya R. (2013) “Experimental study on replacement of cement by glass powder” (IJERT,

ISSN:2278-0181,vol. 2 issue 5
[10]Godwin A. Akeke, Maurice E. Ephraim, Akobo, I.Z.S. and Joseph O. Ukpata(2013) "Structural properties of Rice husk ash concrete" (IJEAS, ISSN 2305-8269, vol. 3, No.3)
[11]Gambhir M L Concrete Technology (fourth edition)
[12]Urhan, S. (1987). "Alkali silica and pozzolanic reactions in concrete" Part 1: interpretation of published results and a hypothesis concerning the mechanism. Cement and Concrete Research, 17(1),141-152.