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Comparative Study on Partial replacement of cement by GGBFS and RHA

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ABSTRACT

To address the challenges of availability, price, quality, and pollution, this research analyses the viability of employing industrial waste such as Ground Granulated Blast Furnace Slag (GGBFS) and Rice Husk Ash (RHA) on cement. By replacing cement with GGBFS and RHA by weight at a percentage of 0%, 10%, 20%, 30%, and 40%, cubes of solid masonry blocks of size 150X150X15 of M30 Grade Concrete were cast and made ready for testing for 7 days, 1seven days, and 28 days. Strength tests were conducted. The results of the testing indicated that replacing RHA with GGBFS was preferable.

Keywords

GGBFS, RHA, Compressive strength, Tensile strength.

1. Introduction

Since its cost has increased over the past few decades, research on concrete has been conducted to improve its performance. Concrete is the most common enormous individual material in the built environment. The vast range of uses that concrete offers and its affordability, strength, durability, and adaptability are the driving forces behind this research. Therefore, the issue is environmental, and the issue problem is cost reduction; still, the structural engineer will give a solution, analyzing the properties of concrete by partial replacement of industrial waste mixed with the cement. If the cement were partially replaced with GGBFs and RHA, it would assist the environment and economy over the durability and strength required to design structures. Concrete constructed from rice husk ash and ground granulated blast furnace slag can more effectively protect the steel reinforcement, allowing the steel to resist corrosion and making the structure environmentally.

II. Literature Review

Many researchers have researched concrete by partial replacement of concrete by GGBFS and RHA and found interesting results. The curing period othe f GGBFS concrete is observed more when compared to the normal and RHA Concrete. It has been demonstrated through research and experimentation by Er. Kimmi Garg and Er. Kshipra Kapoor that GGBS may be utilized as a cement substitute, lowering cement consumption and construction costs. Utilizing items made from industrial waste helps protect the environment and preserve natural resources. Vinayak Awasare and Prof. M. V. Nagendra researched to examine the

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strength characteristics of GGBS concrete that had been partially rebuilt. The flexural strengths achieved for M20 grade concrete of OPC cement and crushed sand are 3.01Mpa, 3.45Mpa, 3.58Mpa, 3.44Mpa, and 3.12Mpa at 0%, 20%, 30%, 40%, and 50%, respectively. This study demonstrates that tensile strength also performs well at replacement rates of 20%, 30%, and 40%, which are higher than those for regular plain concrete. In a study, Yasutaka SAGAWA, Daisuke Yamamoto, and Yoshikazu HENZAN found that specimens with normal-strength concrete strength concrete were evaluated when W/B was changed from 65% to 35%. The migration test was used to determine how well GGBS affected the chloride ion diffusion coefficient. Also demonstrated was the use of GGBS, which has a surface area of 6000 cm2/g for bridge superstructures. Ryan (1999)1 looked at the durability of concrete. In his work published by the QCL group, he discusses two issues related to concrete serviceability that have recently generated much debate and research: sulfate attack and chloride ion penetration. In their study on using rice husk ash in concrete, P. Padma Rao et al. The gothic experiment aims to determine whether it is feasible to use rice husk ash as an additive to concrete that was previously using Portland Pozzolana Cement, which has been substituted with fly ash. For the study about Five distinct replacement levels—5%, 7.5%, 10%, 12.5%, and 15% have been selected for the study about the replacement procedure wide range of curing times, including 3threedayseven, seven days, 28 days, and 56 days, considered out. Before starting the results, all ingredients must be brought to room temperature, preferably 270+ 30 C. Compressive strength gradually rises at all degrees of rice husk ash cement replacement from three to 7 days.

III. MATERIALS

The materials used in the experimental investigation include:

3.1. Cement

Regular Portland cement from the neighborhood market will be used for the investigation. The adhesive used must be examined foseveralof qualities by IS 4031-1988 and determined to meet several requirements in aby12269-1987. Cement needs to meet the requirements of grade 53, which are listed below.

Chemical name	Percentage of chemicals in the cement
Sio_2	19.71
Al_2O_3	5.20
Fe_2O_3	3.73
CaO	62.91
MgO	2.54
SO_3	2.72
K_20	0.90
Na_2O	0.25

Table No 1

Chemical properties of cement

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3.2. Riche Husk Ash (RHA)

Rice Husk Ash was acquired from a native plant from burning rice husk. The rice husk has a specific gravity of 2.45 and a fineness of 71.80, and it exhibits excellent reactivity and pozollonic properties. RHA's chemical characteristics

Chemical Name	Percentage of chemical
Sio_2	$(Sio_2 + Al_2O_3 + Fe_2O_3) = 86.19$
Al_2O_3	
Fe_2O_3	
CaO	0.20
MgO	0.52
SO_3	0.11
K_20	0.13
Na_2O	0.16

Table No 2

Chemical properties of RHA

3.3. Ground Granulated Blast Furnace Slag (GGBFS):

The molten iron blast furnace slag used to make GGBFS is quickly cooled by immersion in water at a local factory. It is a granular product that hydrates like the PPC but has minimal crystal formation, is highly cementative in nature, and is also processed to cement fineness (Portland Pozzolana Cement). GGBFS has a specific gravity of 2.43.

Chemical Name	Percentage of chemical
Sio_2	$(Sio_2 + Al_2O_3 + Fe_2O_3) = 48.63$
Al_2O_3	
Fe_2O_3	
CaO	40
MgO	8
SO_3	0.85
K_20	1.28
Na_2O	1.32

Table No 3

Chemical Composition of GGBFS

3.4. Aggregate

The Fine Aggregates used for the research were obtained locally and met the specifications by IS 383-1970. 2.40 is the specific gravity. The coarse aggregate has been crushed and is still present in a 4.75mm micro sieve. The coarse aggregate has a specific gravity of 2.79.

3.5. Water

Concrete was mixed and then allowed to cure using the same water that was utiliutilizedthe study work, which is free of organic material and contaminants. The fresh potable water used for mixing and curing complies with IS 3025-1964 and IS 456-2000.

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IV EXPERIMENTAL PROCEDURE

According to IS 10262-2009, the M30 grade concrete mix fraction is created. The cement was 468 kg/m3, 620.205 kg/m3 of fine aggregate, and 1050 kg/m3 of coarse aggregate were used. This study is conducted in two phases; in the first, concrete is replaced with GGBFS to varying degrees (0%, 10%, 20%, 30%, 40%). Thirty full cubes cured for 7 and 28 days will be used in the experiment to determine the compressive strength. The RHA replaces cement in the second phase with 0%, 10%, 20%, 30%, or 40%. The cubes were cast, then evaluated for tensile and compressive strength at & days and 28 days in the compressive testing device, and the outcomes of two partial cement replacements by GGBFS and RHA were compared.

V RESULT

The following tables show GGBFS and RHA results when partially mixed with Concrete.

Table 4
Compressive Strength of Concrete

S. no	% replacement of GGBFS	% replacement of RHA	Compressive strength for seven days, 14 days, and 28 days					
			GGBFS	RHA	GGBFS	RHA	GGBFS	RHA
1	0	0	15.36	17.6	21.30	24.56	35.61	34.21
2	10	10	17.36	16.94	23.02	25.61	38.20	34.62
3	20	20	19.02	10.96	25.79	26.28	39.41	20.86
4	30	30	21.89	7.34	30.20	22.14	40.02	15.42
5	40	40	20.02	5.01	35.64	15.32	38.91	10.96

Table 5
Split tensile strength of concrete

S. no	% percentage of GGBFS	% percentage of RHA	Tensile strength of GGBFS and RHA for seven days, 14 days & 28 days.					
			GGBFS	RHA	GGBFS	RHA	GGBFS	RHA
1	0	0	2.18	2.23	2.4	2.42	4.1	2.8
2	10	10	2.21	2.29	2.52	2.59	4.3	2.95
3	20	20	2.29	1.91	2.91	2.72	4.4	2.12

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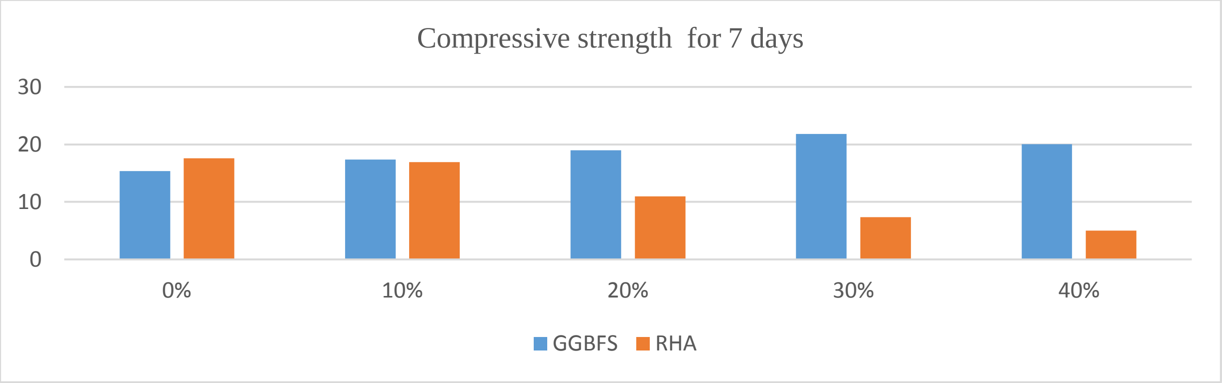
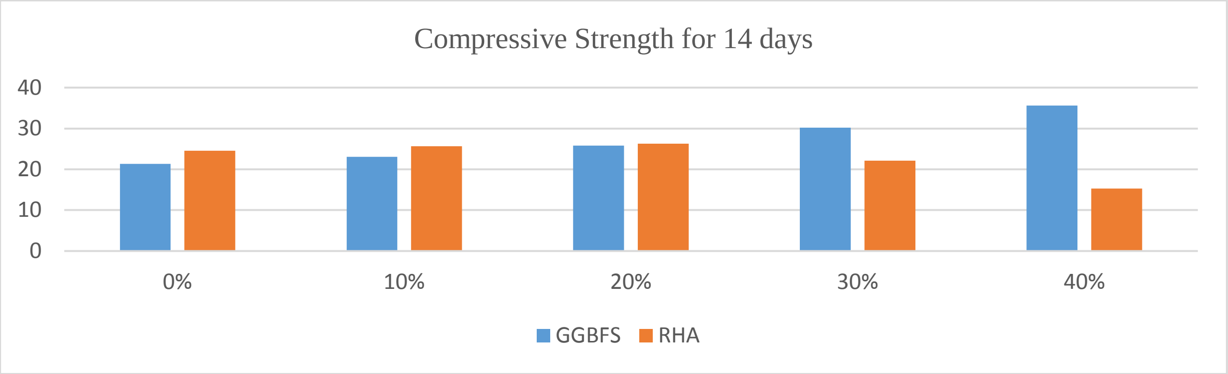
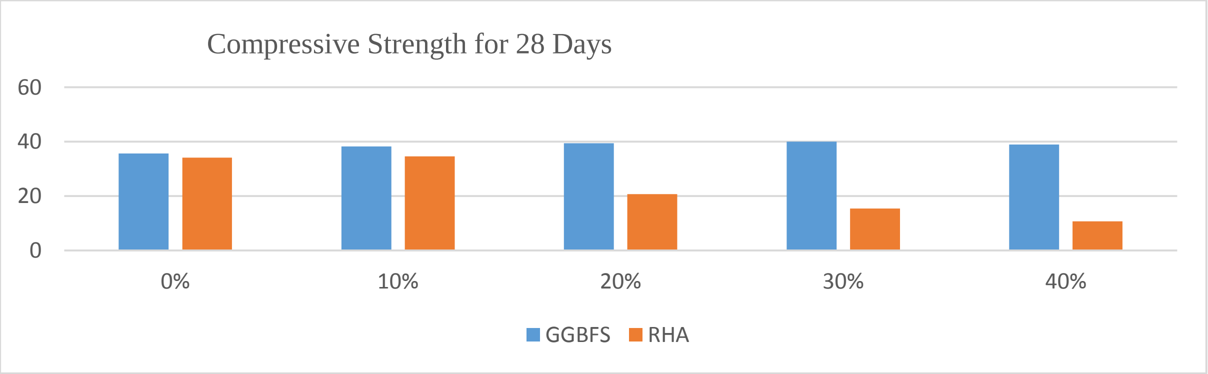
4	30	30	2.32	1.45	3.2	2.14	4.50	1.87
5	40	40	2.2	1.00	3.53	2.08	4.3	1.42

Graph Shows the Comparative results of Cement concrete by Partial replacement of cement by GGBFS and RHA.







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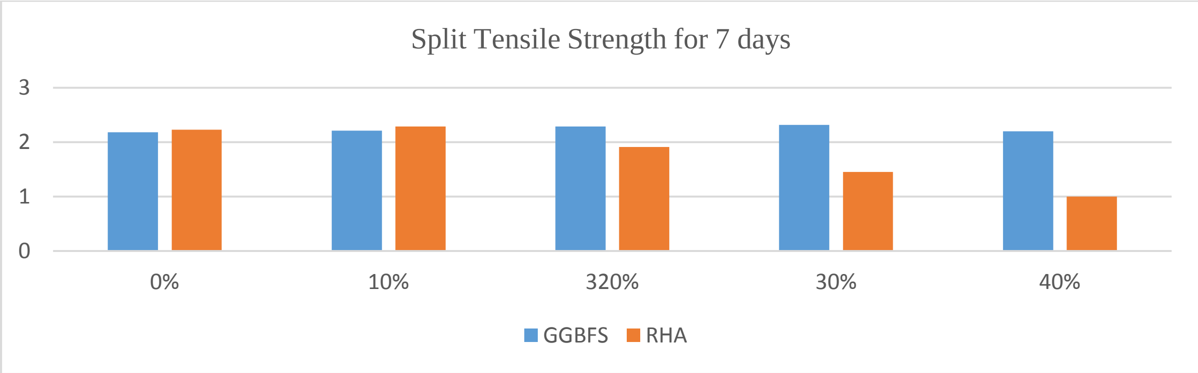

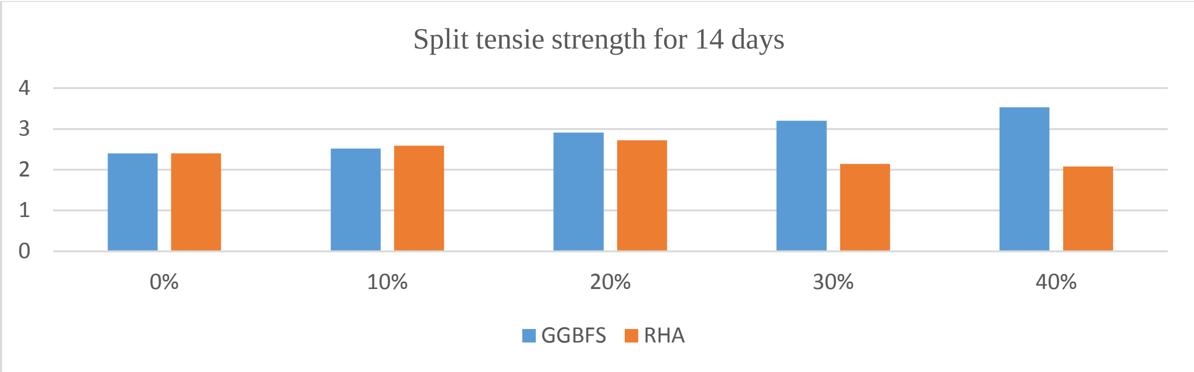

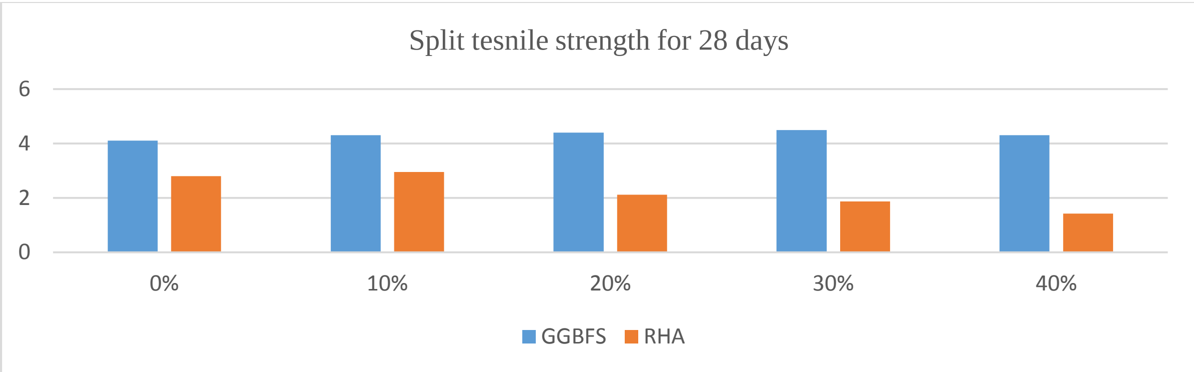

VI CONCLUSION

1. There is an increase in compressive strength for ages seven days and 28 days when GGBFS up to 30% replaces cement.
2. In contrast, there is an initial improvement in compressive strength when RHA replaces cement, followed by a loss when the number of RHA increases.
3. Tensile strength increases when GGBFS is used to replace cement by up to 30%; however, as GGBFS grows, tensile strength gradually decreases.
4. The tensile strength values for the 7 and 28 days are almost identical
5. GGBFS and RHA use reduce cement content and improve the environment's
6. Using GGBFS and RHA instead of the OPC further lowers costs.

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VII REFERENCES

[1] Santosh Kumar Karri, G. V. Rama Rao, P. Markandeya Raju "Strength and Durability Studies on GGBS Concrete," SSRG International Journal of Civil Engineering (SSRG - IJCE), V2 (10), 34-41 October 2015. ISSN: 2348 – 8352. www.internationaljournalssrg.org/IJCE/index.html. Published by: Seventh Sense Research Group.

[2] Mojtaba Valinejad Shoubi, Azin Shakiba Borough, and Omidreza Amirsoleimani. (2013). . . "Assessment of the Roles of Various Cement Replacements in Achieving Sustainable and High-Performance Concrete." International Journal of Advances in Engineering and Technology, 6 (1): 68-77.

[3] Martin O. Connell, Ciaran McNally, and Mark G. Richardson. (2012). "Performance of Concrete Incorporating GGBS in Aggressive Wastewater Environments. Construction and Building Materials", 27 (1), 368-374.

[4] "European Journal of Scientific Research ISSN 1450-216X Vol.88 No-1" October 2012, pp.155163@Euro journals Publishing, Inc. 2012 http://www.europeanjournalof scientific research.com.

[5] Aveline Darquennes, Stephanie Staquet, and Bernard Espion. (2011). "Behaviour of Slag Cement Concrete under Restraint Conditions." European Journal of Environmental and Civil Engineering, 15 (5), 787-798.

[6] Elsayed, A.A. (2011). "Influence of Silica Fume, Fly Ash, Super Pozz and High Slag Cement on Water Permeability and Strength of Concrete." Jordan Journal of Civil Engineering, 5 (2), 245-257.

[7] Reginald B. Kogbara, and Abir Al-Tabbaa. (2011). "Mechanical and Leaching Behaviour of Slag-Cement and Limeactivated Slag Stabilized/Solidified Contaminated Soil." The science of the Total Environment, 409 (11), 2325-2335.

[8] Peter W.C. Leung, and Wong, H.D. (2010). "Final Report on Durability and Strength Development of Ground Granulated Blast Furnace Slag Concrete." Geotechnical Engineering Office, Civil Engineering and Development Department, the Government of Hong Kong.

[9]. Harunur k et al. (2010) ØDurability of Mortar in the presence of Rice Husk Ash World Academy of Science, Engineering, and Technology 43 2010.

[10] Abhilash .S et al. (2011) ØStudy of the Properties of Concrete by Partial Replacement of Ordinary Portland Cement by Rice Husk Ash‖ Department of Civil Engineering, BIT Mesra, Ranchi-835215, International Journal of Earth Sciences and Engineering ISSN 0974-5904, Volume 04, No 06 SPL, October 2011, pp. 965-968.

[11.] Kartini. K (2011) ØRice Husk Ash pozzolanic material for sustainability ØUniversity Technology MARA 40450 Shah Alam, Selangor Malaysia, International Journal of Applied Science and Technology Vol. 1 No. 6; November 2011.

[12.] Patnaikuni I et al. (2012) performance of rice husk ash concrete exposed to seawater 6 th SASTech 2012, Malaysia, Kuala Lumpur. 24- 25 March 2012. Khavaran, the Institute of Higher Education, organizes them.

[13]. Maurice E et al. (2012) Compressive strength of concrete with rice husk ash as partial replacement of ordinary Portland cement. Department of Civil Engineering, Rivers State University of Science and Technology Port Harcourt, Nigeria. Scholarly Journal of

ISSN- 2394-5125 VOL 6, ISSUE 01, 2019

Engineering Research Vol. 1(2), pp. 32-36, May 2012, ISSN 2276-8955 ©2012 Scholarly-Journals.

[14]. Marathon C (2012) Effect of Rice Husk Ash (RHA) as Partial Replacement of Cement on Concrete Properties. Civil Engineering Department, Shillong Polytechnic, Shillong, Meghalaya, India, 793008, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181, Vol. 1 Issue 6, August 2012.