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An Experimental Study on the Behavior of Concrete by Partial Replacement for Rice Hush Ash, Silica Fume & Iron Slag with Cement

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ABSTRACT
Nowadays climatic change & environmental degradation are vital issues. Government and business sector have to use more eco-friendly awareness policies and practices. Now it is the crucial time to focus more on sustainable waste & construction materials such as greenhouse reducing agents ,energy saving equipment's ,and more to use renewable source of energy so that the resources and waste can be used more efficiently and recycled it in a new form. The optimum use of waste substances such as (blast furnace slag , rice husk ash , glass pieces or powder, silica fume, iron slag ,etc.) in concrete to boost the engineering financial environment , to gain more ecological benefits .therefore the use of wastes building and construction material is very helpful to achieve the new sustainable goals. So Rice Husk Ash, Silica Fume and Iron Slag can be used as a partial replacement material with cement concrete. In this paper present the experimental analysis on the partial replacement for rice hush ash, silica fume & iron slag with cement and also shown the characteristics of concrete are compressive and flexural strength.
***Keywords* —** Cement, concrete, Rice Hunk Ash, Silica Fume, Eco-friendly, Compressive Strength, Flexural Strength.

I. INTRODUCTION

In concrete production large quantity of resources such as fuel, sand, aggregates are required. Therefore to minimize these various waste or by product used in researches as potential alternatives in the construction of concretes and industry [1-2]. In fact use of by product waste such as glass, ash, beads, plastic, slag, etc. in construction is one of the major aims to reach the new goal of achieving sustainable developments [3-4].

Sustainable construction materials are that materials which can be reused ,recycled and be used again to fulfill the future demand it also helps in reducing the effects of harm full gasses such as co_2, greenhouse gasses, etc [5]. .Such waste materials have a lower environmental impact. Thermally efficient, can be operated with less fuels and energy and better than any conventional method. They are less toxic and can be recycled and reused less toxic emission and they are financially viable [6].

Therefore use of rice hunk ash in concrete can be a new scientific method in the field of concrete production. A large amount of agricultural wastes by product produced and it gives no economic value and burned without any commercial returns. And a very high cost in required in their disposal and also a reason for environmental pollution of both land and air. So by using such a waste as a concrete supplement of cement reduces the construction cost and improves the property of concrete [7]. The study concludes more on the concept of acceptable strength with the use of rice hunk ash and lime mix with cement for determining the optimum water cement mix to achieve good compressive strength.

II. RICE HUSK ASH

Rice husk debris (RHA) fillers are gotten from rice husks, which are typically seen as agrarian waste and an environmental risk. Rice husk, when expended in outside the rice plant, yields two sorts of flotsam and jetsam that can fill in as fillers in plastics materials. The rice paddy preparing adventures give the outcome rice husk. As a result of the extending pace of environmental defilement and the idea of practicality factor have made utilizing rice husk. The clarifications for the use of rice husk as a possibility for concrete in strong gathering are explained in the going with zones. To have a fitting idea on the introduction of rice husk in concrete, a point by point concentrate on its properties must be finished. Around 100 million tons of rice paddy make reactions are gotten the world over. They have a low mass thickness of 90 to 150kg/m^3. This results in a more vital estimation of dry volume. The rice husk itself has an unforgiving surface which is harsh in nature. These are therefore impenetrable to normal defilement. This would achieve unseemly expulsion issues. Among all dares to reuse this thing, cement, and strong gathering ventures are the ones who can use rice husk in a prevalent way.

Rice Husk Ash is an agricultural waste obtained from milling of rice. This is usually being thrown away to the landfill without further use, thus contribute to environmental pollution. Rice Husk Ash is a by-product from the burning of Rice Husk under controlled temperature and burning time. In the present investigation Rice Husk Ash was partially replaced in Portland cement at various percentages to study compressive strengths and split tensile strengths. The physical properties and chemical composition of rice husk ash [8].

Table 1. Physical Properties of Rice Husk Ash [8]

S. No.	Property	Test Result
1	Density	495 kg/m^3
2	Specific Gravity	2.53
3	Mean particle size	0.15-0.25µm
4	Colour	Grey
5	Min specific surface area	220m^2/kg
6	Particle shape	Spherical
7	Moisture contents (% by weights)	2.15

III. SIGNIFICATION OF THE WORK

Now a day mostly construction structure based on concrete so its demands increasing gradually, the use of rice hush ash, silica fume & iron slag as a partial replacement with cement leads to a great results in achieve new goals. Recent research find that concrete made by using rice hush ash are capable to gives good compressive strength and thermal insulation property [9-10]. The use of rice hush ash as greatly enhance the weight of concrete and helps in making light weight concrete. The major aim of this study is to achieve a good environment policies to reduce the disposal and burning of rice hush ash directly into the environment so it help in reducing greenhouse concentration.

In this study the waste materials used are in the form of rice hush ash, silica fume & iron slag is added in partial in cement and it is collected directly from the agricultural filed. Than it is burnt to find ash of rice husk and sieved from 90 micron sieve to achieve fineness similar to cement and others material also sieved from 90 micron sieve to achieve fineness similar to cement.

IV. EXPERIMENT WORK AND RESULT

The controlled burning and grinding of rice husk ash (RHA) have been utilized to optimize its use as a pozzolanic material in concrete. Incorporating RHA offers several advantages, including improved strength and durability properties, as well as environmental benefits such as waste material disposal and reduced carbon dioxide emissions. However, there has been limited research on the use of RHA as a supplementary material in cement and concrete production.

For instance, a recently published paper explored the production of RHA by burning rice husk in a drum incinerator. The study investigated the effect of particle size on the strength of RHA blended gap-graded Portland cement concrete. Given the scarcity of research in this area, the current study aims to examine the compressive strength of concrete containing residual RHA generated from burning rice husk pellets, as well as RHA obtained after grinding the residual RHA. The study specifically focuses on analyzing the impact of partially replacing cement with different percentages of ground RHA on the compressive strength of concrete. By conducting this research, a better understanding of the potential benefits and effectiveness of incorporating RHA in concrete production can be gained.

Compressive Strength

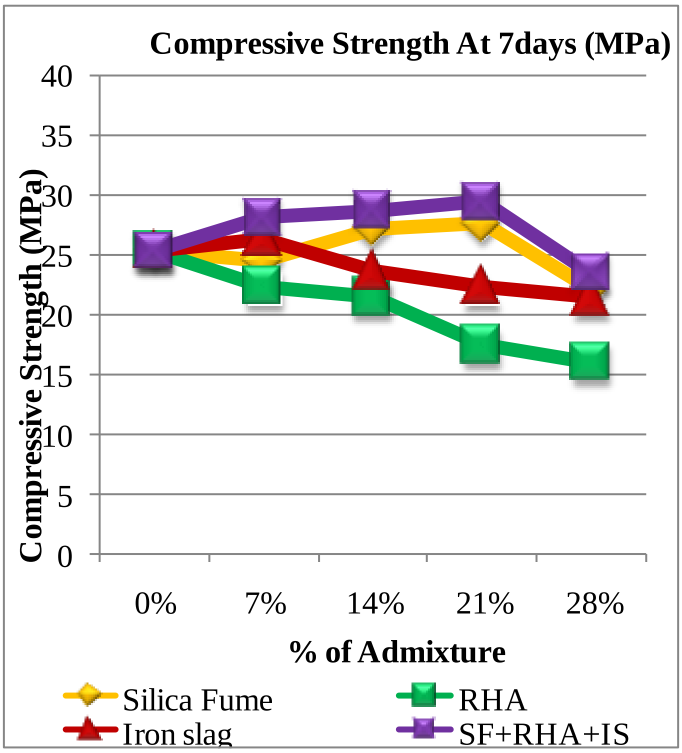

Fig. 1: Compressive strength of concrete after 7 days with varied percentages of mineral additive in place of cement

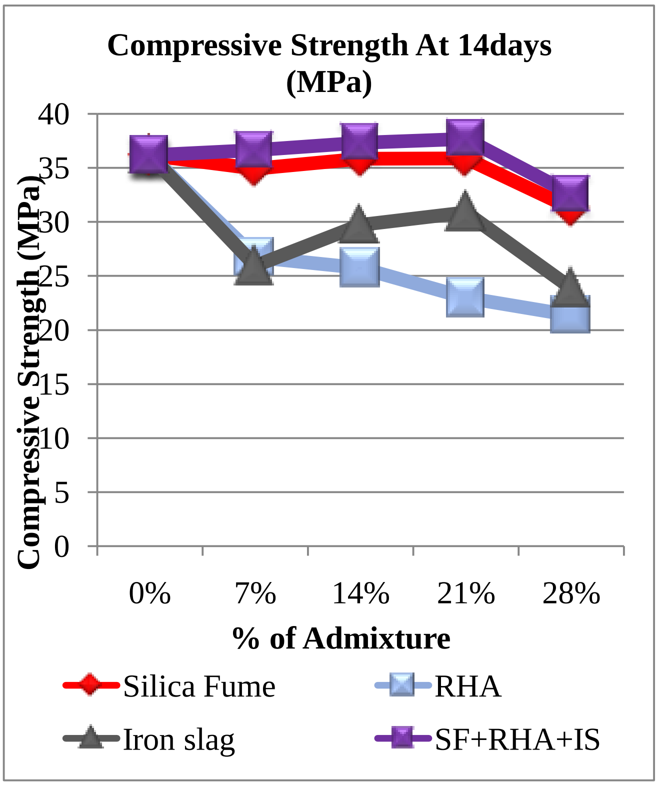

Fig. 2: Compressive strength of concrete after 14 days with varied percentages of mineral additive in place of cement

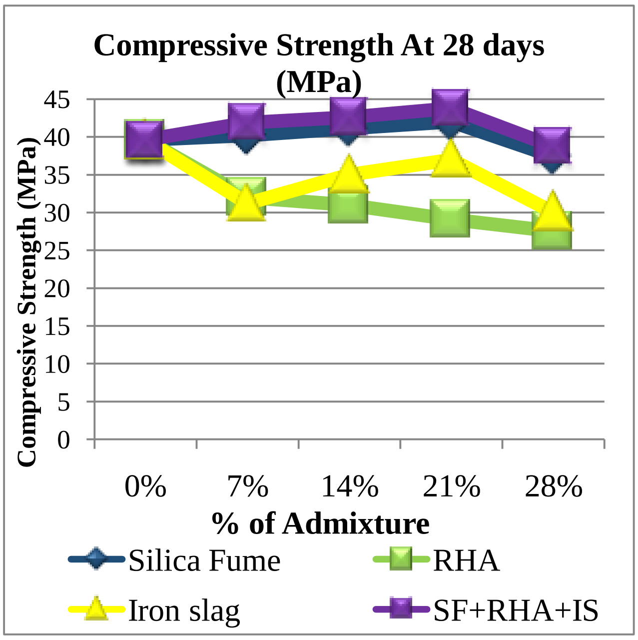

Fig. 3: Compressive strength of concrete after 28 days with varied percentages of mineral additive in place of cement

In Figure 1, 2 and 3 showed the compressive strength at 7, 14 and 28days with varied percentage of replacement of rice husk ash (RHA), silica fume, iron slag.

Flexural Strength

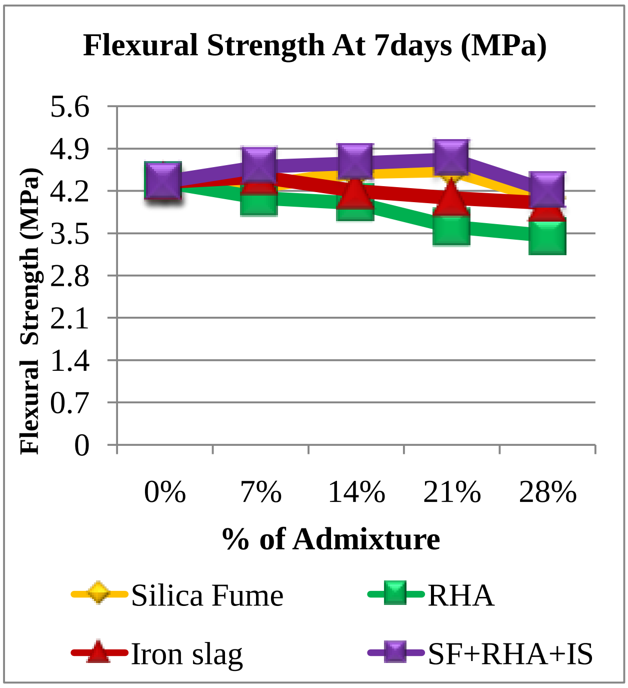

Fig. 4: Flexural strength of concrete after 7 days with varied percentages of mineral additive in place of cement

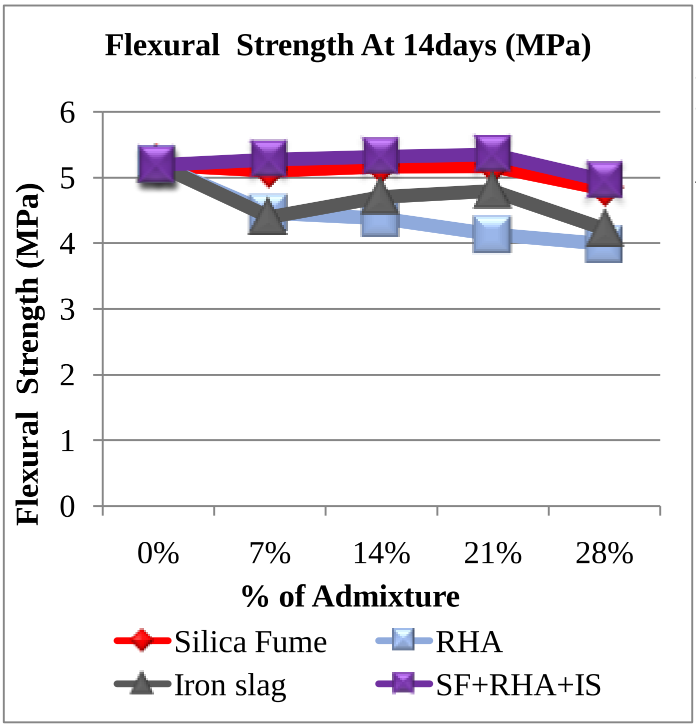

Fig. 5: Flexural Strength of Concrete after 14 Days with Various% of Mineral Admixture in Place of Cement

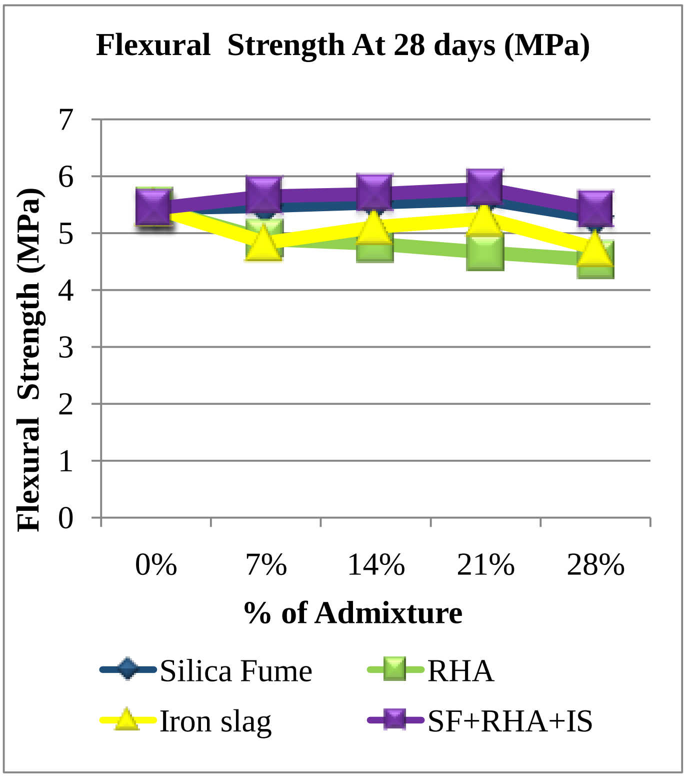

Fig. 6: Flexural strength of concrete after 28 days with various percentages of mineral additives in place of cement

In Figure 4, 5 and 6 showed the flexural strength at 7, 14 and 28days with varied percentage of replacement of rice husk ash (RHA), silica fume, iron slag.

V. CONCLUSIONS

Compressive Strength

- At 7 days, maximum compressive strength is 29.4 MPA until 21% combine addition, at which point compressive strength starts to decline due to combined addition of variable% of (SF+IS+RHA) when replacement of cement occurs.
- Compressive strength resulting from the combined addition of increasing percentages of (SF+IS+RHA) as cement replacement occurs at 14 days reaches a high of 37.67 MPA up until the combined addition of 21%, at which point compressive strength starts to decline.
- At 28 days, the maximum compressive strength is 43.8 MPA up to a combined addition of different percentages of (SF+IS+RHA) when cement replacement occurs. After that, the compressive strength starts to decline

Flexural Strength

- Flexural strength reaches a high of 4.718 MPA at 7 days due to the combined addition of varied percentages of (SF+IS+RHA) when cement replacement occurs, but starts to decline at 21% combination addition.
- Flexural strength reaches its peak at 14 days due to the combined addition of varied percentages of (SF+IS+RHA) when cement replacement takes place, and it remains there until 21% of the combined addition, at which point it begins to decline
- Flexural strength reaches its peak at 28 days due to the combined addition of varied percentages of (SF+IS+RHA) when cement replacement takes place, and it remains there until 21% of the combined addition, at which point it begins to decline.

REFERENCES

[1] Mehtab Alam and Hemant Kumar Sain, "Partial Replacement of Cement with Kota Stone Slurry Powder and Coal Ash in High Performance Concrete", Design Engineering, PP. 1094-1102, 2021.

[2] Mehtab Alam and Hemant Kumar Sain, "An Experimental Study on Partial Replacement of Cement with Kota Stone Slurry Powder and Coal Ash in High Performance Concrete", International Journal of Engineering Trends and Applications (IJETA), V. 8(6), pp. 12-18, 2021.

[3] Shoyab Khan, Hemant Kumar Sain, "A Review on Partial Replacement of Cement with Brick Dust", Journal of Emerging Technologies and Innovative Research (JETIR), V. 9(8), PP. 219-221, 2022.

[4] Khalid Hussain, Hemant Kumar Sain, Shruti Bhargava , “Experimental Investigation on Flexural Behaviour of Fibre Reinforced Metakaolin Concrete and Steel Fibre Reinforced Concrete”, International Journal of Engineering Trends and Applications (IJETA), V. 8(6), PP. 23-30, 2021.

[5] Saini, Y., & Soni, D. K., “Stabilization of Clayey Soil by Using Stone Slurry Waste and Cement: Review”, International Journal of Advanced Technology in Engineering and Science, Vol. 5(1), pp. 343-349, 2017.

[6] Er. Amit Kumar Jangid, Er. Jitendra Khatti and Dr. Ajay Bindlish, “Stabilization of black cotton soil by 15% kota stone slurry with wooden saw dust”, International Journal of Advance Research in Science and Engineering, Vol. 7, pp. 108-114, 2018.

[7] Amit Kumar, Kiran Devi, Maninder Singh and Dharmender Kumar Soni, “Significance of Stone Waste in Strength Improvement of Soil”, Journal of Building Material Science, Vol. 1 (1), pp. 32-36, 2019.

[8] Insha Ali, Dr. Esar Ahmad, "An Experimental Investigation on Partial Replacement of Cement with Rice Husk Ash and Fine Aggregate with Steel Slag", International Journal of Engineering Research & Technology (IJERT), Vol. 9 Issue 08, August-2020.

[9] Mukesh Yadav, Hemant Sain, Anil Sharma, "Strength Of Concrete Grade M30 & M35 by Partial Replacement Of Cement With Paper Ash And Fly Ash", International Journal of Management, Technology And Engineering, Vol. 8, Issue. 5, pp. 496-509, 2018.

[10] Hament Sain, Sitender Chhillar, Sarjeet Singh Yadav, "Utilization of Sugarcane Bagasse ash in Concrete as Partial Replacement of Cement", Journal of Emerging Technologies and Innovative Research (JETIR), Vol. , Issue. , pp. 126-129, 2019.

[11] Nikhil Goyal, Hemant Kumar Sain, Mohsin Khan Agwan, "Analytical Study on Fiber Reinforced Concrete Using Different Types of Virgin Polypropylene Fiber in Preparation of Concrete Sample", International Advanced Research Journal in Science, Engineering and Technology, Vol. 9, Issue. 9, pp. 59-64, 2022.

[12] Hemant Kumar Sain, Basant Kumar Meena, "An experimental analysis on concrete containing GGBFS and meta kaolin with CCR", AIP Conference Proceedings 2901(1), 050008, pp. 1-13, 2023.

[13] Hemant Kumar Sain, Vishakha Sharma, Bazila Nisar, "Effect of Rock Cracks on RC Structures", AIP Conference Proceedings 2901(1), 050005, pp. 1-5, 2023.