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Study on Properties of Concrete using Rice Husk Ash and Fly Ash with Sisal Fiber as Partial Replacement of Fine Aggregate & Cement

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ABSTRACT

Concrete is the most widely used construction material in the world it is a mixture of cement, sand, coarse aggregate and water. Storage and safe disposal of industrial by product such as fly ash, SF and rice husk ash is a huge problem everywhere, reuse of these waste eliminates/reduce the problem. this experiment fine aggregate is replaced 0%,10%,20%,30% and 40% of its weight by rice husk ash and cement is replaced 20% of its weight by fly ash & SF in all concrete mix and there effects are studied.

In this experiment the compressive strength of the concrete is increased. The compressive strength of the concrete by replacing the 20% sand by RHS and 20% cement by the 19% fly ash & 1% SF the strength increases at 32.52 to 37.8 in M- 30 concrete. After adding the RHA the strength is Decreases. The flexure strength of the concrete by replacing 20% sand by RHS and 20% cement by the 19% fly ash & 1% SF the strength increases at 5.2 to 6.69 in M-30 concrete. After adding the RHA the strength is Decreases Thus, flexure strength is also increase by including the RHS. It also reduces the consumption of the cement. The split tensile strength of the concrete by replacing 20% sand by RHS and 20% cement by the 19% fly ash & 1% SF the strength increases at 3.09 to 4.49 in M-30 concrete. After adding the RHA the strength is Decreases. Hence by adding the fly ash with stone dust is also increase the tensile strength of the concrete. Hence saving in cost is two ways cost of sand and cement.

KEYWORDS: *Rice Husk Ash, Fly Ash, Sisal Fiber, Fine Aggregate, Compressive Strength, Tensile Strength and Flexural Strength*

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1. INTRODUCTION

Concrete is one of the oldest and most common construction materials in the world, its availability, long durability, and ability to sustain extreme environmental condition. Concrete structures are seen everywhere, such as buildings, roads, bridge and dams etc. The concrete having cement, sand and coarse aggregates mix up in an appropriate percentage in addition to water is called Plain cement concrete. As the demand for infrastructure in increasing in India, the demand for the concrete as a material of construction is considerably increasing. The production of Portland cement must increase in order to meet this elevating demand. However, the contribution of greenhouse gas emission from Portland cement production is about 1.35 billion tons annually or about 7% of the total Green House Gas (GHG) emissions to the earth's atmosphere. Furthermore, Portland cement is among the most energy-intensive construction materials, after aluminum and steel. It is also known that the production of each ton of Portland cement releases almost one ton of carbon dioxide (CO2) into the atmosphere. The production of Portland cement is also very energy intensive. Portland cement is the vast majority of cement used in construction work. Manufacturing of Portland cement consists of blending naturally occurring rocks of calcium carbonate, with the alumina, silica & iron oxides.

Concrete is a composite material which consists eccentrically of a binding medium. Concrete is no longer made of aggregate Portland cement and water only. Often but not always it has to incorporate at least one of the additional ingredients such as admixture or cementitious material to enhance its strength and durability within which are embedded particles or fragments of relative inert filler in Portland cement concrete. The binder is a mixture of Portland cement. The filler may be any of a wide variety of natural or artificial. Fine and coarse aggregate; and in some instances an admixture. Concrete is presently one of the most essential materials that have been used in the civil engineering construction works. When concrete is reinforced with steel, it has got a higher capacity for carrying loads. Concrete being a heterogeneous mix of several ingredients, the quality of the constituent material and their respective proportions inthe concrete, determine its strength and other properties.

The price of the building materials has reached an alarming rate of increase in the recent past. This has necessitated government, private and individuals to go for research of locally available materials to partially or fully replace the conventional materials. The increasing demand for cement and concrete is met by the partial replacement of cement. The entire idea of this thought is to guarantee that a normal common resident of India will actually want to possess a house. Concrete being a composite material unpredictably made out of a cover. Presently, Concrete isn't simply comprised of total, portland concrete and water. Frequently yet not generally it needs to join at any rate oneof the extra fixings like admixture or cementitious material to upgrade its solidarity and sturdiness. Inside which are installed particles or pieces of relative dormant filler in Portland concrete cement.

The turn of events and exploration of materials and the strategy in structural designing was to discover most imported perspectives which are accessibility, climate similarity, and monetary imperatives. The determination of the development materials should just be made after a total audit of its drawn out exhibition, sturdiness in the design and climate similarity.

2. RESULTS AND DISCUSSION

In this stage the experimental work is Carrie out by using cement, fine aggregate, coarseaggregate, RHA, SF and Fly ash.

- The specimens were casted for M30 grade of concrete by replacing the fine aggregate 10%, 20%, 30%, and 40% by RHA and 20% cement is replaced by 19% fly ash and 1% sisal fiber.

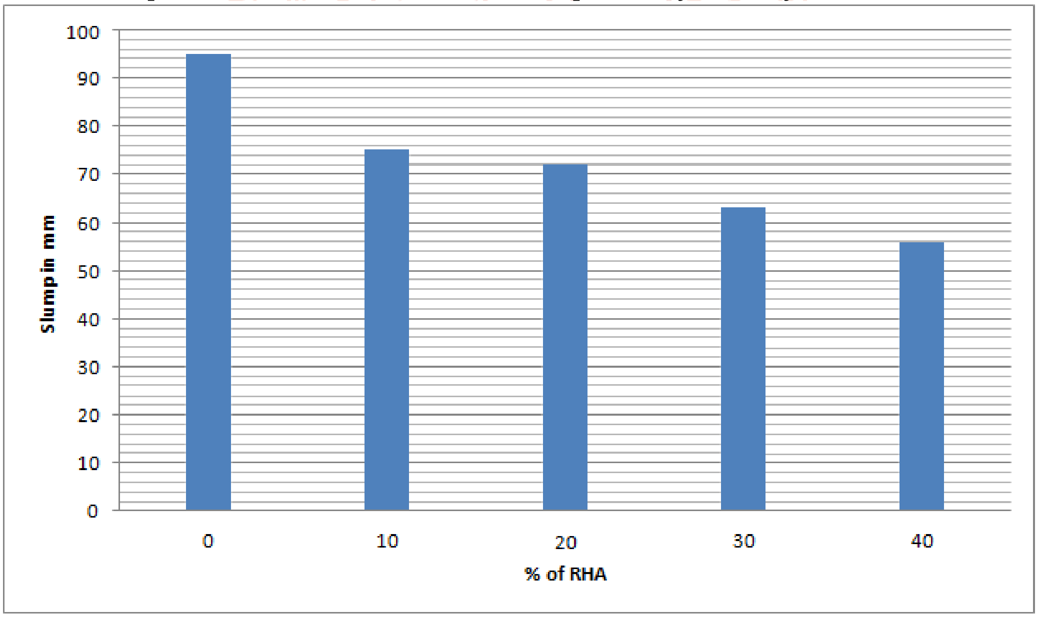
GRAPHICAL AND TABULAR PRESENTATION IS GIVEN BELOW WORKABILITY TEST

In this work the workability is tested by slump test. When the concrete is freshly mix thenit is tested by filling the fresh concrete in the slump cone. The workability is measured by removing the slump cone and measured the subsidence of the concrete this value is calledthe slump value of the concrete.

Table 5.1 Slump test for M30 concrete (with fly ash 19%, 1% SF & Cement 80%)

Designation	Ingredients					Slump Value in(mm)
	Coarse Aggregate	Fine Aggregate	RHM	Cement	Fly ash +sisal fiber	
	%	%	%	%	%	
M'1 - 0	100	100	0	100	0	95
M'1 - 10	100	90	10	80	19+1	75
M'1 - 20	100	80	20	80	19+1	72
M'1 - 30	100	70	30	80	19+1	63
M'1 - 40	100	60	40	80	19+1	56

Figure 5.1 Slumps of M-30 with 20% cement is replaced by 19% fly ash and 1% sisalfiber.



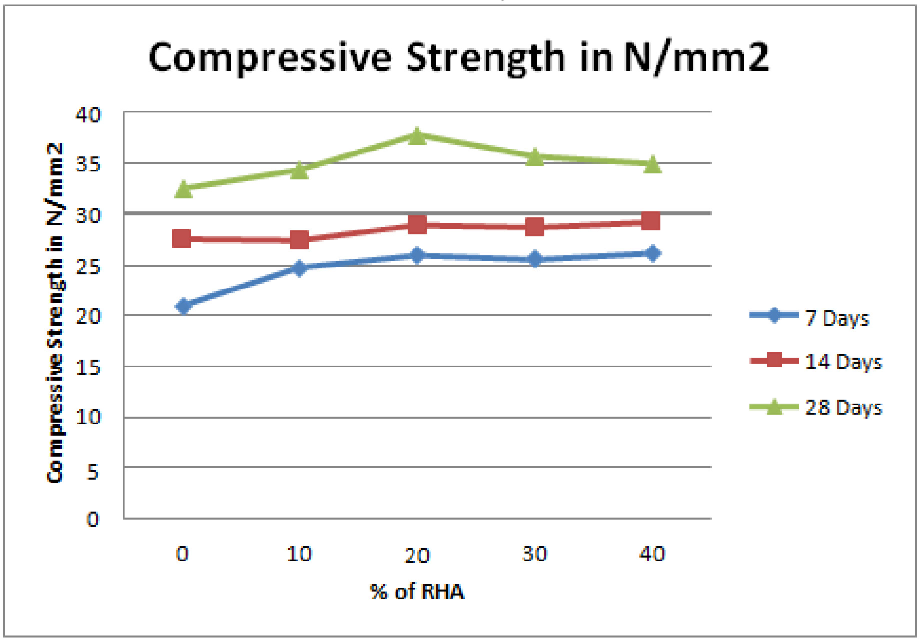
COMPRESSIVE STRENGTH TEST

In this study the designed concrete was subjected to various tests to estimate the strength andother properties of the casted concrete. The main aim of the study is to monitor the developed strength attained by the concrete at various testing days from curing. Generally proper casting and curing of concrete will increase the compressive strength of the concrete. For this project each test is carried out with 3 samples for every mix ratio and tested at required curing time. Then the average values are used for the investigations. The Compressive Strength values taken from experimental analysis are described below.

Table 5.2: Compressive Strength of M 30 concrete (with fly ash 19% + Sisal Fiber 1% 20% & Cement 80%)

Designation	RHA	M30 Grade of Concrete CompressiveStrength in N/mm2			Sand	Cement	Fly ash +sisalfiber
	%	7 Days	14 Days	28 Days	%	%	%
M'1 - 0	0	21.02	27.55	32.52	100	100	0
M'1 - 10	10	24.72	27.42	34.36	90	80	19+1
M'1 - 20	20	25.96	28.9	37.8	80	80	19+1
M'1 - 30	30	25.55	28.66	35.66	70	80	19+1
M'1 - 40	40	26.14	29.21	34.96	60	80	19+1

Figure 5.2 Graph of Compressive Strength at 7, 14and 28days (with fly ash 19% + Sisal Fiber 1% from 20% Cement)



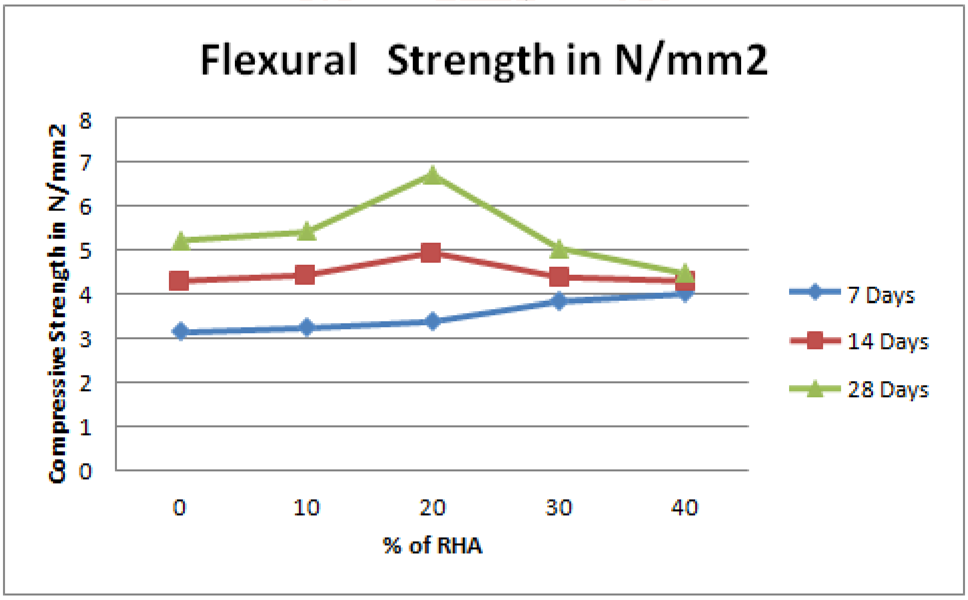
FLEXURAL STRENGTH

Flexural strength also called as modulus of rupture. In concrete flexure is the bending moment caused by the applied load, in which a concrete beam has compression at top andtensile stress at the bottom side. Beams on testing will fail in tension due to its property and shear will appear on concrete. In this experimental works totally 45-beams of size 700 x 100 x 100 mm are casted of M30 grades concrete. Concrete by replacing the fine aggregate 10%, 20%, 30%, and 40% by RHA and 20% cement is replaced by 19% fly ash and 1% sisal fiber. Values of both design mixes. The flexural values of various mixesare displayed in Table 4.5.

Table 5.3: Flexural strength of M 30 concrete (with fly ash 19% + Sisal Fiber 1% 20% & Cement 80%)

Designation	RHA	M30 Grade of Concrete FlexuralStrength in N/mm2			Sand	Cement	Fly ash +sisalfiber
	%	7 Days	14 Days	28 Days	%	%	%
M'2 – 0	0	3.12	4.28	5.2	100	100	0
M'2 - 10	10	3.22	4.41	5.39	90	80	19+1
M2 - 20	20	3.36	4.92	6.69	80	80	19+1
M2 - 30	30	3.82	4.37	5.02	70	80	19+1
M'2 - 40	40	3.98	4.28	4.45	60	80	19+1

Figure 5.3 Line Graph of Flexural strength at 7, 14and 28days(with fly ash 19% + Sisal Fiber 1% from 20% Cement)



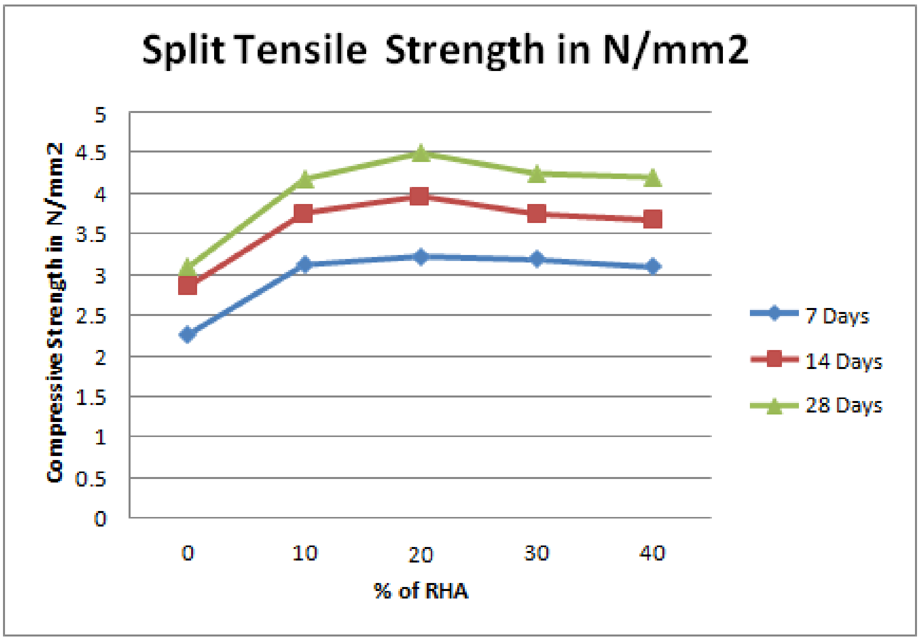
SPLIT TENSILE STRENGTH TEST

The split tensile strength of concrete is tested by casting cylinder of size 150mm x 300mm and is continuously cured for 28 days testing. Totally 15 cylinders were casted for normal M30 grade. Concrete by replacing the fine aggregate 10%, 20%, 30%, and 40% by RHA and 20% cement is replaced by 19% fly ash and 1% sisal fiber. Values of both design mixes. The flexural values of various mixes are displayed in Table 4.5.

Table 5.4: split tensile strength of M 30 concrete (with fly ash 19% + Sisal Fiber 1% 20% & Cement 80%)

Designation	RHA	M30 Grade of Concrete Split TensileStrength in N/mm2			Sand	Cement	Fly ash +sisalfiber
	%	7 Days	14 Days	28 Days	%	%	%
M'3 - 0	0	2.26	2.85	3.09	100	100	0
M'3 - 10	10	3.12	3.75	4.17	90	80	19+1
M'3 - 20	20	3.22	3.96	4.49	80	80	19+1
M'3 - 30	30	3.18	3.74	4.24	70	80	19+1
M'3 - 40	40	3.09	3.66	4.19	60	80	19+1

Figure 5.4 Line Graph of Split Tensile Strength at 7, 14and 28days(with fly ash 19% + Sisal Fiber 1% from 20% Cement)



3. CONCLUSIONS

The strength analysis is carried out which is explained in the following given points:

- The compressive strength of the concrete by replacing the 20% sand by RHS and 20% cement by the 19% fly ash & 1% SF the strength increases at 32.52 to 37.8 in M-30 concrete. After adding the RHA the strength is Decreases..
- The flexure strength of the concrete by replacing 20% sand by RHS and 20% cement by the 19% fly ash & 1% SF the strength increases at 5.2 to 6.69 in M-30 concrete. After adding the RHA the strength is Decreases Thus, flexure strength is also increase by including the RHS. It also reduces the consumption of the cement.
- The split tensile strength of the concrete by replacing 20% sand by RHS and 20% cement by the 19% fly ash & 1% SF the strength increases at 3.09 to 4.49 in M-30 concrete. After adding the RHA the strength is Decreases.
- Hence by adding the fly ash with stone dust is also increase the tensile strength of the concrete. Hence saving in cost is two ways cost of sand and cement.
- The RHA is to be used as partial replacement of the natural sand.
- Increase in strength up to 1% is due to utilization of water present in fiber for chemical reaction at time of curing and less concentration of fibre created densely compacted medium in cement concrete. The addition of the fibre in small amounts will increase the tensile strength. Addition of fibres not only increases tensile strength but also increases bond strength, decreases permeability. Toughness of concrete also increases by the addition of the fibre.
- The use of the RHA, Fly ash and SF also saves the environmental pollution or solves thedisposal problems.
- The use of RHA, Fly ash and SF in this study also saves the costly cement and sand. This is great saving in the construction material and also reduces the cost of construction.

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