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AN EXPERIMENTAL INVESTIGATION ON STRENGTHENING PROPERTIES OF CONCRETE WITH PARTIALLY REPLACED CEMENT BY FLYASH AND RICE HUSK ASH

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ABSTRACT

In the ancient period, construction work was mostly carried out with help of mudstone from industry. Fly ash is a by-product of burned coal from power station and rice husk ash is the by –product of burned rice husk at higher temperature from paper plant. Considerable efforts are being taken worldwide to utilise natural waste and bye –product as supplementary cementing materials to improve the properties of cement concrete. Rice husk ash (RHA) and Fly ash (FA) is such materials. RHA is bye-product of paddy industry. Rice husk ash is a highly reactive

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pozzolanic material produced by controlled burning of rice husk. FA is finely divided produced by coal-fired power station. Fly ash possesses pozzolonic properties similar to naturally occurring pozzolonic material. The detailed experimental investigation done to study the effect of partial replacement of cement with RHA and FA on concrete. In this paperI started proportion form 30% FA and 0% RHA mix together in concrete by replacement of cement ,last proportion taken 0% FA and 30% RHA, with gradual increase of RHA by 1% and simultaneously gradual decrease of FA by 1%. It is observed that though the strength of RHA concrete goes on decreasing after the 15% addition of RHA, the composition of 10% RHA + 20% FA gives maximum strength results as well as shows the potential to be used as useful material for different building materials.

INTRODUCTION

Concrete as is well known is a heterogeneous mix of cement, water and aggregates. The admixtures may be added in concrete in order to enhance some of the properties desired specially. In its simplest form, concrete is a mixture of paste and aggregates. Various materials are added such as fly ash, rice husk, admixture to obtain concrete of desired property. . The character of the concrete is determined by quality of the paste. The key to achieving a strong, durable concrete rests in the careful proportioning, mixing and compacting of the ingredients.

The detailed experimental investigation done to study the effect of partial replacement of cement with RHA and FA on cement. In this project I started proportion form 30% FA and 0% RHA mix together in concrete by replacement of cement ,last proportion taken 0%FA and 30% RHA. Numerous tests are performed on wet concrete such as workability tests such as compaction factor test and slump test. The tests on hardened concrete are destructive test while the destructive test includes compressive test on concrete cube for size (150 x 150 x 150) mm. strength on concrete cylinder (150 mm ø x 300mm) as per IS: 516 – 1959, IS: 5816 – 1999 and IS: 516 – 1959 respectively.In actual practice, test on workability of wet concrete are carried out to ensure uniform quality concrete only.

MATERIAL METHODS

The work presented in this paper reports an investigation on the behaviour of concrete produced from blending cement with RHA and FA. The physical and chemical properties of RHA, FA and OPC were first investigated. Mixture proportioning was performed to produce high workability concrete (200- 240 mm

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slump) with target strength of 32.1 Mpa (M25) for the control mixture. The effect of RHA on concrete properties was studied by means of the fresh properties of concrete and the mechanical properties. I.e. Compressive strength, tensile splitting strength, flexural test was studied as the time dependent property The cement used was Ordinary Portland cement (43 Grade) with a specific gravity of 3.15. Initial and final setting time of the cement was 50 min and 365 min, respectively.

A. Cement

Table 1: Following are the Chemical properties of cement (OPC), Fly ash and Rice husk Ash.

Materials	SiO2	Al2O3	Fe2O3	CaO	MgO	LOI	SO3	K2O	Na2O3
Cement	19.71	5.20	3.73	62.91	2.54	0.96	2.72	0.90	0.25
Flyash	40	25	6	20	3.71	3.0	1.74	0.80	0.96
Rice husk Ash	78.21	(SiO2+ Al2O3+ Fe2O3) =82.64		0.99	4.89	--------	--------	---------	---------

B.Rice husk ash

Rice husk ash used was obtained from Ellora Paper Plant located in TumsarBhandara .The Specific gravity of rice husk ash is 2.10 and bulk density is

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0.781 g/cc RHA, produced after burning of Rice husk (RH) has high reactivity and pozzolanic property. Indian Standard code of practice for plain and reinforced concrete, IS 456- 2000, recommends use of RHA in concrete but does not specify quantities. Chemical compositions of RHA are affected due to burning process and temperature. Silica content in the ash increases with higher the burning temperature. As per study by Houston, D. F. (1972) RHA produced by burning rice husk between 600 and 700°C temperatures for 2 hours, contains 90-95% SiO_2, 1-3% K_2O and < 5% unburnt carbon. Under controlled burning condition in industrial furnace, Studies have shown that RHA resulting from the burning of rice husks at control temperatures have physical and chemical properties that meet ASTM (American Society for Testing and Materials).Standard C 618-94a. Studies have shown that to obtain the required particle size, the RHA needs to be grown to size 45 μm – 10 μm. [5] discussed about amplifier power relation, impedance , T π and microstripline matching networks.

C.Flyash

Fly ash used was obtained Koradi Power Plant Nagpur. Fly ash is one of the residues generated in the combustion of coal. Fly ash is generally captured from the chimneys of power generation facilities, whereas bottom ash is, as the name suggests, removed from the basis; it was 1%-1.6% of cement weight. The aim of keeping the amount of plasticizer constant is to neglectcommonly used to supplement Portland cement in concrete production, where it can bring both technological and economic benefits, and is increasingly finding use in synthesis of geopolymers and zeolites.

D.Aggregate

Good quality river sand was used as a fine aggregate. The fineness modulus, specific gravity and dry density are 2.32, 2.68 and 1690 kg/m3. Coarse aggregate passing through 20mm and retained 10mm sieve was used.Its specific gravity and dry density was 2.7 and 1550 kg/m3.

E. Chemical Admixture

A commercial AC- Green Slump-GS-02 black cat Chemical Limited and Glenium-AG-30 JP – BASF Const. Chemical Limited type hyper plasticizer was used to maintain the workability of fresh concrete. The dosage of hyper plasticizer was kept constantmass. .

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Experimental Programme

Experimental programme comprises of test on cement, RHA, FA, cement concrete with partial replacement of cement with RHA and FA.

A.RICE HUSK ASH

Rice husk can be burnt into ash that ful fills the physical characteristics and chemical composition of mineral admixtures. Pozzolonic activity of rice husk ash (RHA) depends on (i) silica content, (ii) silica crystallization phase, and (iii) size and surface area of ash particles. In addition, ash must contain only a small amount of carbon.The optimized RHA, by controlled burn and/or grinding, has been used as a pozzolanic material in cement and concrete. Using it provides several advantages, such as improved strength and durability properties, and environmental benefits related to the disposal of waste materials and to reduced carbon dioxide emissions.

1. Normal Consistency = 17%

2. Initial and Final Setting time = 195min. and 265min.

3. Compressive Strength = 11 N/mm^2

4 . Specific Gravity = 2.09

B. ORDINARY PORTLAND CEMENT

OPC 43 grade cement is used for this whole experimental study. The physical test results on OPC are as follows.In which the composition and properties is in compliance with the Indian standard Organization.

C. TEST ON CONCRETE

An M25 mix is designed as per guidelines in IS 10262, 1982 based on the

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preliminary studies conducted in the constituent materials. Tests on fresh concrete are obtained as follows.

1) Slump Test=55mm

2) Vee-Bee = 13sec.

3) Compaction factor =0.95

4) Flow Test =78 %.

D. Mixture Proportioning

The mixture proportioning was done according the Indian Standard Recommended Method IS 10262-1982.The target mean strength was 32.1 Mpa for the OPC control mixture, the total binder content was 435.45 kg/m ,fine aggregate is taken 476kg/m andif any, the influence of plasticizer on the properties of hardened concrete.coarse aggregate is taken 1242.62kg/m the water to binder ratio was kept constant as 0.44, the Superplasticizer content was varied to maintain a slump of (200-240 mm) for all mixtures. The total mixing time was 5 minutes, the samples were then casted and left for 24 hrs before demoulding They were then placed in the curing tank until the day of testing Cement, sand, Fly ash, Rice husk ash and fine and coarse aggregate were properly mixed together in accordance with British Standard Code of Practice (BS 8110)19 in the ratio 1:1.1:2.85 by weight before water was added and was properly mixed together to achieve homogenous material. Water absorption capacity and moisture content were taken into consideration and appropriately subtracted from the water/cement ratio used for mixing. Muthadhi et al. 9 reported the blending of rice husk ash (RHA) in cement is recommended in most international building codes now. Hence, cement was replaced in percentages of 0, 1,2,3,4, 5 up to 30% with rice husk ash and fly ash and 150 × 150 × 150mm3, Beam and Cylinder moulds were used for casting. Compaction of concrete in three layers with 25 strokes of 16 mm rod was carried out for each layer. The concrete was left in the mould and allowed to set for 24 hours before the cubes were de moulded and placed in curing tank. The concrete cubes were cured in the tank for 7, 14, 28 and 90day.

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Table No. 2 Table for compressive strength, Flexural strength, Split tensile strength

MIX			STRENGTH AFTER CURING IN DAYS in N/mm2					
SR.NO.	MIX PROPORTION FLYASH BY % CEMENT	RICE HUSK ASH BY %CEMENT	7DAYS	14 DAYS	28 DAYS	90 DAYS	FLEXURAL STRENGTH N/mm²	SPLIT TENSILE STRENGTH N/mm²
1	**Control mix**		24.54	26.76	40.50	45.18	10.51	6.4
2	10	0	19.8	24.50	34	40.40	10.51	3.1
3	9	1	30.50	35.52	33.75	36.00	10	3.20
4	8	2	20	25.64	37.70	42.64	10	3.20
5	7	3	22.19	26.30	36	40.85	11.25	3.65
6	6	4	35.12	43.52	44	48.85	12	3.62
7	5	5	43.52	44	45	53.32	13.74	3.52
8	4	6	42.62	42	44	49.75	12.2	3.2
9	3	7	35.51	42.23	44.46	53.37	11.22	3.54
10	2	8	40.43	42.61	44.02	51.54	10.95	3.53
11	1	9	33.70	40.86	42.65	52.41	8.2	3.62
12	0	10	26.60	28.42	28.83	35.10	9.0	3.21

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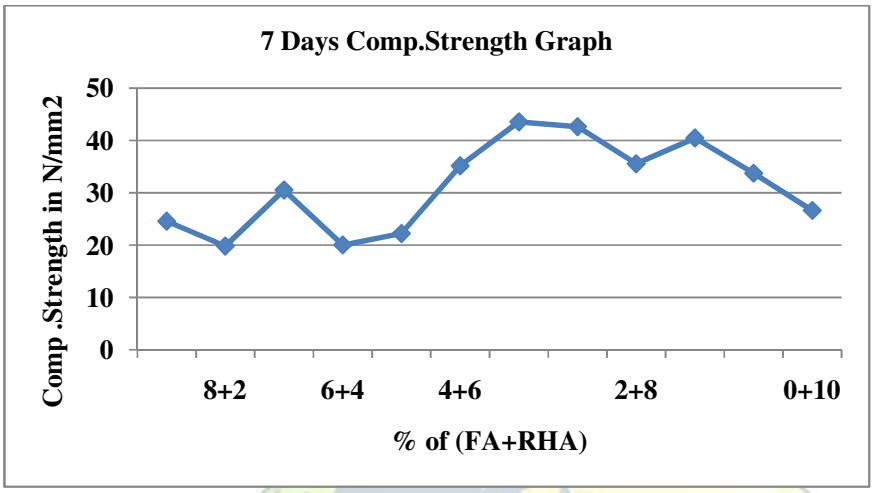

Figure 1Compressive Strength of Cubes at 7 Days

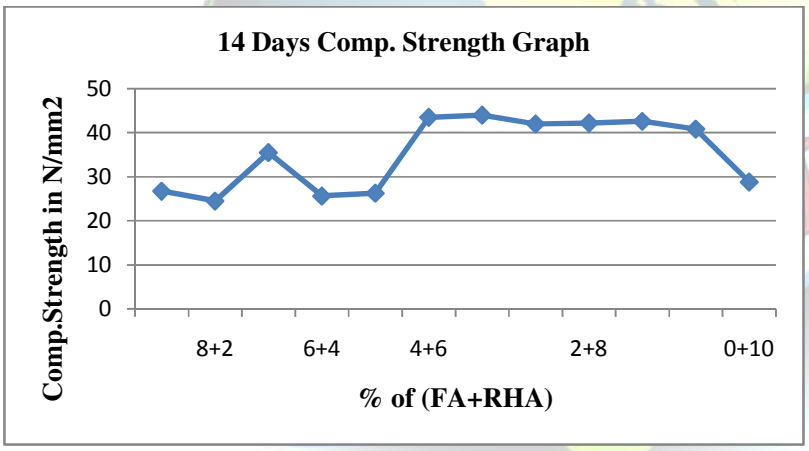

Figure 2 Compressive Strength of Cubes at 14 Days

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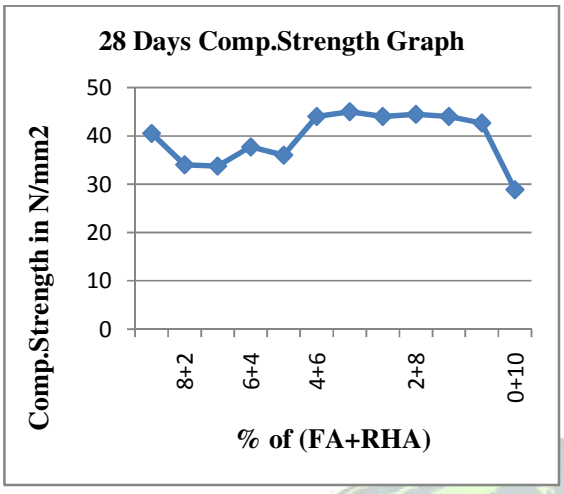

Figure 3 Compressive Strength of Cubes at 28 Days

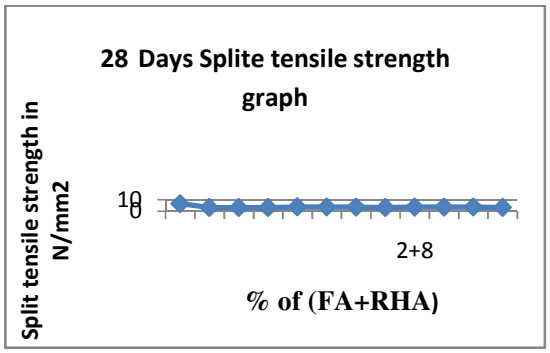

Figure 5 Split tensile Strength of Cylinders at 28 Days

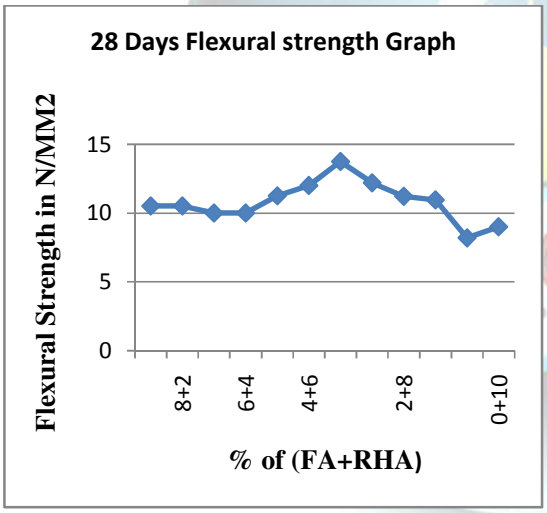

Figure 4 Flexural Strength of Beams at 28Days

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Conclusion

1.Compressive strength increases with the increase in the percentage of Fly ash and Rice Husk Ash up to replacement (21%FA and 9% RHA) of Cement in Concrete for different mix proportions.

2.The workability of RHA concrete has been found to decrease with increase in RHA replacement.

3.It was found that rice husk when burned produced amount of silica (more than 80%). For this reason it provides excellent thermal insulation.

4.Rice husk ash contains more silica, and hence we prefer rice husk ash use in concrete than silica fume to increase the strength.

5.Through Rice husk ash is harmful for human being, but the cost of rice husk ash is zero and thus we prefer RHA use in concrete as compared to silica fumes.

6.The workability of RHA concrete has been found to decrease but FA increases the workability of concrete.

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