

Experimental Study on Concrete When Cement is Partially Replace by Fly Ash, Wheat Straw Ash, Rice Husk Ash, Saw Dust Ash

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Abstract— Different materials with pozzolanic properties such as fly ash. Condensed silica fume, blast furnace slag and rice husk ash have played an important part in the production of high performance concrete. During the late 20th century, there has been an increase in the consumption of mineral admixture by the cement and concrete industries[4]. The increasing demand for cement and concrete is met by the partial replacement for energy intensive Portland cement. Pozzolanic materials have long demonstrated their effectiveness in producing high performance concrete. Artificial pozzolanas such as supplementary cementing material in many parts of the world[2]. This work evaluates the compressive strength of rice husk ash (RHA), Wheat Straw Ash (WSA), Fly Ash, (FA) as a partial replacement for OPC in concrete[1]. The main aim of this work is to determine the optimum % (10, 20, 30) of Rice husk ash (RHA), Wheat Straw Ash (WSA), Fly Ash, (FA), as partial replacement of cement for M40 grade of concrete[3]. In addition, results show that Rice husk ash (RHA), Wheat Straw Ash (WSA), Fly Ash, (FA), -/* (GP) as an artificial pozzolanic material has enhanced the durability of concrete.

Key words: Rice husk ash (RHA), Wheat Straw Ash (WSA), Fly Ash, (FA), cement replacement, concrete, Compressive strength

I. INTRODUCTION

There has been an alarming rate of increase in the price of building materials in the recent past. This has necessitated government, private and individuals to go in research for locally sourced materials to supplement (replace-fully or partially) the conventional materials[1]. The increasing demand for cement and concrete is met by the partial replacement of cement[4]. Concrete is a composite material which consists eccentrically of a binding medium[1]. 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[4]. This investigation targets to determine the optimum percentage (10, 20, 30%) of Rice husk ash (RHA), Wheat Straw Ash (WSA), Fly Ash, (FA) as a partial replacement of cement for M30 grade of concrete, and to determine its compressive strength.

II. METHODOLOGY

In this project Rice husk ash, wheat straw ash, Saw Dust ash, Fly ash and -/* are partially replaced by cement in concrete. Concrete of M40 grade is prepared according to IS 10262 : 2009 specification; 15 mixes are prepared containing different waste materials with different proportions; with Rice husk ash RHA10, RHA20 and RHA30 mix are prepared in which RHA shows Rice husk ash and 10,20,30

shows their replacement percentage; with Wheat straw ash WSA10, WSA20, WSA30 mix are prepared; with Saw dust ash SWA10, SWA20, SWA30; with Fly ash FA10, FA20, FA30 mix are prepared. 15 * 15 * 15 cm cube was casted for each mix containing different waste materials; for each mix 9 cubes were casted for 7, 14 and 28 days of curing. Each cube of different mixes goes for compression strength test and average of three cubes are taken as compression strength of concrete.

III. RESULT AND DISCUSSION

When concrete cubes of different mixes go through the Compression Strength Test it was analyzed that, all materials are useable because they give better results by replacing cement but if we see FA10, FA20, FA30, and SDA 30 mix gives best result in compressive strength. Results of all mixes are given in table 1.

S. No.	Mix	Compressive Strength		
		7 Days	14 Days	28 Days
1	FA10	30.16	32.71	37.23
2	FA20	28.46	32.14	36.92
3	FA30	27.22	31.54	37.12
4	RHA10	24.32	28.77	38.42
5	RHA20	19.34	24.56	30.86
6	RHA30	17.42	21.95	27.05
7	WSA10	22.32	26.77	31.42
8	WSA20	16.34	21.56	28.92
9	WSA30	15.42	17.95	25.05
10	SDA10	26.12	27.85	29.66
11	SDA20	25.64	27.36	28.21
12	SDA30	26.98	30.22	34.21

Table 1: Compressive strength of concrete cube with

Compressive different Mix strength of concrete cube is determined and it is found that all materials at any percentage of mixing up to 30% give satisfactory results where fly ash (FA) gives 37.23 N/mm², 36.92 N/mm², 37.12 N/mm² at 10, 20 and 30% replacement respectively, which is more than design strength where Rice husk Ash (RHA) gives 38.42, 30.86 and 27.05 for 10, 20 and 30% replacement respectively, which is more than 85% of designed F_{ck}. Where Wheat Straw Ash (WSA) does not give excellent result but it is satisfactory, it gives 31.42, 28.92 and 25.05 N/mm² at 10, 20 and 30% replacement respectively and Saw Dust ash (SWA) gives average result as compared to above materials it possesses 29.66, 28.21, 24.21 N/mm² at 10, 20 and 30% replacement respectively. All these results are of 28 days of curing. Compression strength test

is carried out after at 7th and 14th days of curing, it has been observed that 60% strength is gained by concrete cube at 7th day of curing and 80% strength is gain at 14 days of curing.

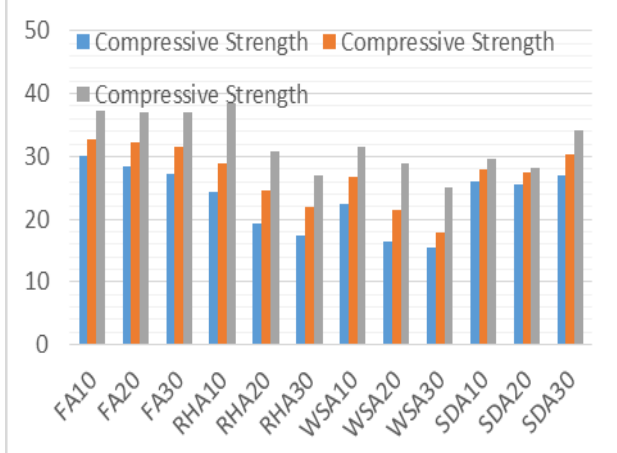


Fig. 1: Bar Chart for Compressive strength of Concrete

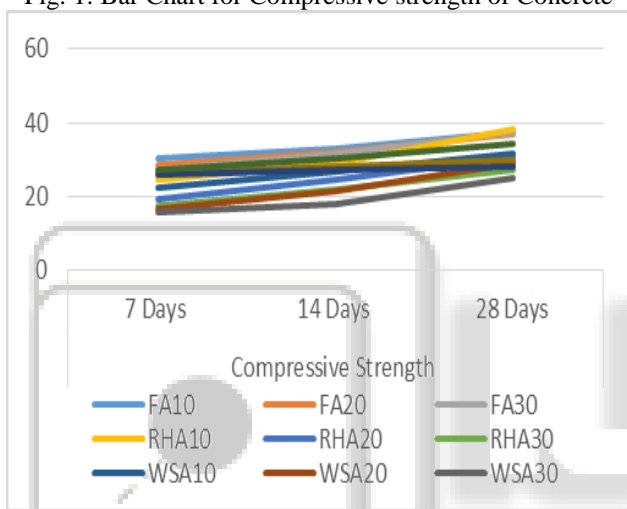


Fig. 2: Line Chart for Compressive Strength of

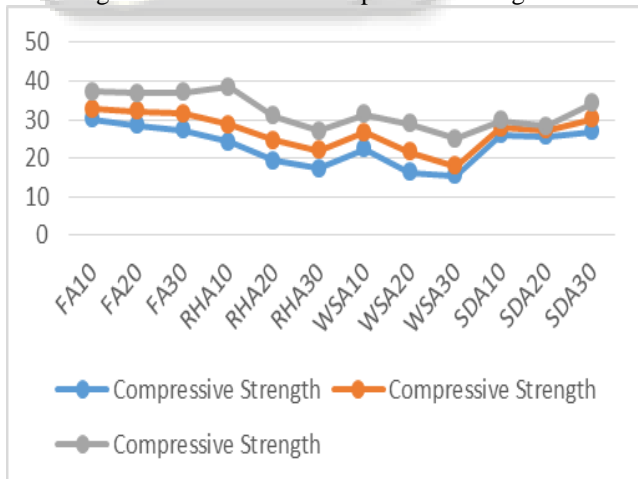


Fig. 3: Line Chart for Compressive Strength of

IV. CONCLUSION

The result of study shows that there are good prospects of using Rice husk Ash (RHA), Fly Ash (FA), Wheat Straw Ash (WSA), Saw Dust Ash (SWA) as a pozzolana combination with ordinary Portland cement (OPC) in the Concrete Blocks. 15*15*15cm concrete cubes are casted and its compressive is determined. The combination of 10%, 20% and 30% cement replacement Mix is prepared by using

all WSA, RHA, FA, GP, and SWA for 0.4 water cement ratio. It shows that compressive increase with curing time.

The compressive strength of concrete with fly ash gives tremendous results. Its FA10 and FA30 mix gives 42.9 and 42.77 N/mm² compressive strength respectively which is awesome. Where Rice Husk Ash RHA10 mix gives excellent compressive strength i.e. 44.2 N/mm². Wheat straw ash gives average results, their all mix are above 85% of specified strength as recommended by IS 15658 : 2006. Saw Dust Ash SDA30 mix posses good compressive strength i.e. 39.6 N/mm². All mix gives more than 85% compressive strength so all waste mix can be used for paver blocks. As if u want to select only one material then I will suggest fly Ash with FA30 mix on the basis of compressive strength because here 30% cement is saved and also it gives better result as compare to others, along with FA30 mix RHA30, FA20, SDA30 Mix also gives better results and they are also applicable.

- All result mention above are of 28 days curing.

From the study conducted, it was clearly shown that Rice husk ash(RHA), Wheat Straw Ash (WSA), Fly Ash, (FA) are pozzolanic material and can contribute to the sustainability to the construction material.

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