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The Effect Of Rice Husk Ash And Foundry Sand On High Performance Concrete On Beam

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ABSTRACT: The Project Work is on the study of Concrete is one of the extensively used material all over the world. Strong material is a key factor in measuring strength of structure. The fact that India is developing nation having mega structure and line up in the strongest nations of the world. What if the concrete used is having a high strength and we are also able to save the material and make it ecofriendly. The project is to expedite the improvement of infrastructure with the help high performance concrete. increasing rate of urbanization and industrialization has lead to over exploitation of natural resources. Hence it is necessary to use alternate materials in concrete. This work presents benefits from various ratios of rice husk ash (RHA) on concrete indicators with proportions of 5,10,15,20, 25,30,35% RHA by the weight of cement in addition to this a constant amount of 35% waste foundry sand (WFS) by the weight of crushed stone sand has been replaced in the concrete and it has been compared with control concrete with no additives.

Keywords— Rice Husk Ash (RHA), compressive strength, split tensile strength

INTRODUCTION: Concrete is one of the essential building materials which is widely used in construction activity all over the world. It is a composite material consisting of cement, fine aggregate, coarse aggregate bonded together with fluid called water. It is estimated that about 25 billion tons of concrete is consumed globally every year or 3.8 tonnes per person in the globe. One of this rice husk ash (RHA) which is used in the partial replacement of cement. RHA is one of the waste materials which is produced in the rice growing region and it is obtained from burning of rice husk, which is by- product of rice milling. It is estimated that 1000 kg of rice grain produce 200kg of rice husk; after rice husk is burnt about 20 percent or 40 kg would become RHA. In order to reduce the usage of river sand, we can replace it with industrial by product that is waste foundry sand which is obtained in metal casting process. India is third largest in the production of waste foundry sand after China and USA. In Indian early there are 5000fundry industries and it is reported that the annual production is about 9.3 million metric tons in the year 2012-13 waste foundry sand produced from these foundries is about 1.7 MT per annum. When normal blending, placing, and hardening procedures fail to meet the needs of a specific project, high -performance concrete (HPC) may be used to obtain the desired result. One example of this phenomenon is concrete, which has better resistance to environmental influences, hence increasing its longevity and structural capability. High performance concrete (HPC) is formed using the same ingredients as normal concrete.

OBJECTIVE OF PROJECT:

- To find the strength and durability properties of rice husk ash (RHA) and waste foundry sand (WFS) in concrete.
- Rice husk ash (RHA) and foundry sand (WFS) is a waste material that can used to reduce environmental burden of solid waste.
- RHA can be used to reduce the amount of cement used which can lower carbon emission.
- Using foundry sand in concrete can reduce the amount of waste that ends up in landfills.
- RHA can be used to make light weight structural concrete, which can reduce self-load of structure.
- Reducing natural resource usage Of rice husk ash (RHA) and waste foundry sand (WFS) can be used in concrete to reduce the amount of natural resource.

EXPERIMENTAL MATERIAL USED:

MATERIALS: The cement used was ordinary Portland cement of 53 grade. The tests carried out are specific gravity 3.15, normal consistency 32, initial and final setting time are 48 and 255 minutes as per IS: 2269-2013. Fine aggregate was crushed stone sand confirming to zone II passing through 4.75 mm size sieve and having a specific gravity 2.68 with fineness modulus 2.60, bulk density of 1816 kg/m^3, water absorption 2%. Natural aggregate having 20mm down size, specific gravity 2.68, fineness modulus 4.83, water absorption 0.2%, impact value 27.01% and crushing value 25.28%was used as coarse aggregate.

RICE HUSK ASH: Rice Husk was burnt for approximately 60 hours in air under uncontrolled burning process. The temperature at the range of 400-600ºC Rice husk ash (RHA) is a by-product of burning rice husks, which are the outer covering of rice grains. RHA is pozzolanic ash that can be used in many applications, RHA can be added to cement as a replacement for clinker. It can improve the concretes resistance to corrosion and other harsh environmental conditions. RHA can be used as a filler in plastics to modify their properties. RHA can be used to make ceramics such as glass, whiteware, and refractory. RHA can be used as a bio adsorbent to remove heavy metals and refine vegetable oil. RHA is made up of mostly amorphous silica with a high specific surface area. The quality of RHA depends on several factors, including: silica content, silica crystallization phase, size and surface area of ash particles, carbon content, and fineness.

FOUNDRY SAND: Foundry sand is prepared by mixing mineral sand, clay, and water other additives may include cereals, ground pith sea Gil Sonite, fuel oil, wood flour, iron oxide, pearlite and molasses. Foundry sand has a specific gravity of 2.39 to 2.55 a bulk relative density of 2590 kg/m3, and an absorption of 0.45%, It has a low water absorption capacity and is subangular to round in shape. Foundry sand is made up of silica sand a thin film of burned carbon, residual binder, and dust, The chemical composition depends on the metal being moulded and the types of binder and combustible used. Foundry sand can be medium tan off white black or grey, depending on the type of binder used. 85% -95% Foundry sand is between 0.6 and 0.15 mm in size and 5-12% is smaller than 0.075mm. Foundry sand has a shear in resistance angle of 33 – 40 degrees. it has also had good durability characteristics, as shown by low micro-Deval abrasion and magnesium sulcate soundness loss tests.

Fine Aggregate: Normal river sand is used as fine aggregate of zone III. Sand passing through sieve no 4.75mm is used. The specific gravity is 2.63

Coarse Aggregate: The coarse aggregate of maximum size 20mm is used. Its specific gravity is 2.65.

Mix Proportion : The Mix Design of concrete as per IS: 10262-2009 has to be done to know the proportions of concrete. The water-cement ratio for all the mixes is taken as 0.5. Total six different mixtures of concrete were prepared in the laboratory. First is the conventional concrete without any additives. Next with the concrete containing rice husk ash in the varying percentages of 5, 10, 15, 20, 25%,30%,35% and with 35% waste foundry sand were casted. The details of mix proportion of all the concrete are in table 1.

Table.1 Mix Proportions of concrete

Notation	w/c	RHA %	WFS %	Constituents kg/m^3					
				Cement	F.A	C.A	Water	RHA	WFS
CC	0.5	-	-	383	545	1194	191	-	-
R5+WFS35	0.5	5	35	363.85	354.25	1194	191	19.15	190.75
R10+WFS35	0.5	10	35	344.7	354.25	1194	191	38.3	190.75
R15+WFS35	0.5	15	35	325.55	354.25	1194	191	57.45	190.75
R20+WFS35	0.5	20	35	306.4	354.25	1194	191	76.6	190.75
R25+WFS35	0.5	25	35	287.25	354.25	1194	191	95.75	190.75
R30+WFS35	0.5	30	35	268.1	354.25	1194	191	114.9	190.75
R35+WFS35	0.5	35	35	248.95	354.25	1194	191	134.05	190.75

EXPERIMENTAL INVESIGATION :

1. **SLUMP TEST**

The densities of the fresh concrete compositions decrease with increasing amount of curing water. This can be explained by the partial replacement of sand of the reference concrete by the internal curing water, in order to obtain 1 m3 of concrete. This test is done to determine the workability of the cement concrete. In this method the concrete was made to flow and the measurement was taken. The incorporation of both RHA and WFS decreases the slump value. As the RHA content Increases the slump value decreases this reduction in slump values are due to RHA contains macro and meso- pores inside and on the surface of the particles resulting in very large specific surface area and absorbs certain amount of mixing water resulting in decrease in free water and lowers the slump value. In addition to this presence of WFS will contain some number of clayey particles results in the reduction of slump value.

Table1 slump test

Trial	W/C Ratio	Quantity of water in mix (lit)	Slump value in mm
1	0.45	1.960	10
2	0.50	2.185	30
3	0.55	2.403	70
4	0.60	2.620	125

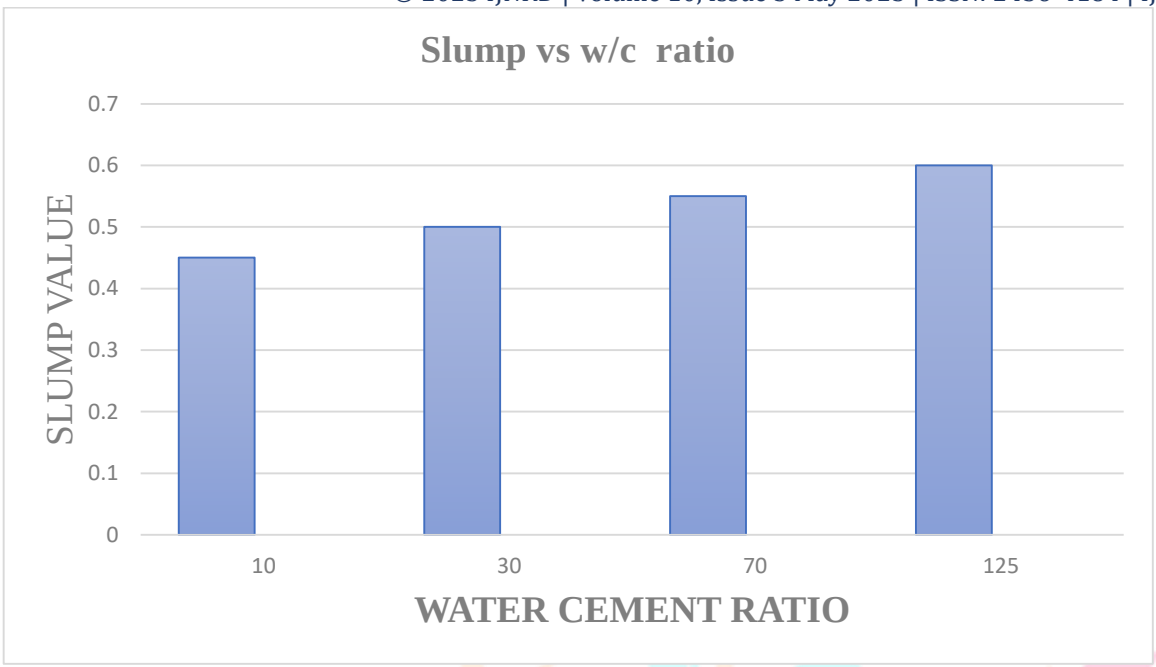

Fig ,1 Slump ratio graph

COMPRESSIVE STRENGTH TEST:

The compressive strength of both control concrete and the concrete which is replaced by RHA and WFS at curing period of 7, 14, 28 days result in table. As the percentage of RHA increases the strength decreases this is because increase in RHA slows down the hydration process and also delays pozzolanic activity. Foundry sand contains clay particles which influences in the reduction of strength in addition with RHA.

Table 2 Results of Compressive Strength Test

Sl.No	Concrete type	Percentage of RHA	Percentage of Foundry sand	Number of specimens	Compressive strength MPa		
					7 Days	14 Days	28 Days
1	CC 0%	-	-	9	25.08	26.89	30.76
2	R5FS35	5	35	9	26.79	28.26	30.23
3	R10FS35	10	35	9	28.1	30.79	34.76
4	R15 FS35	15	35	9	23.28	25.33	27.11
5	R20FS35	20	35	9	20.89	22.13	23.56
6	R25FS35	25	35	9	22.33	24.19	26.92
7	R30FS35	30	35	9	26.85	29.15	31.17
8	R35FS35	35	35	9	27.14	32.18	34.96

SPLIT TENSILE AND FLEXTURAL STRENGTH TEST:

The tensile strength is useful to estimate the load under which cracking will develop. The figure 3 shows the split tensile strength for both types of concrete. The improvement in the strength is because of the sufficient water for the hydration process and the pozzolanic action of RHA and also the reaction of waste foundry sand which contains large amount of silica content which produces C-S-H gel.

Table 3 Results of Split Tensile Strength

Sl.no	Concrete type	Percentage of RHA	Percentage of foundry sand	Number of specimens	Split Tensile Strength MPa	
					7 Days	28 Days
1	CC	-	-	6	1.6	1.95
2	R5FS35	5	35	6	1.76	2.26
3	R10FS35	10	35	6	2.10	2.41
4	R15FS35	15	35	6	2.12	2.55
5	R20FS35	20	35	6	2.15	2.78
6	R25FS35	25	35	6	2.48	2.83
7	R30FS35	30	35	6	2.69	2.93
8	R35FS35	35	35	6	2.71	2.96

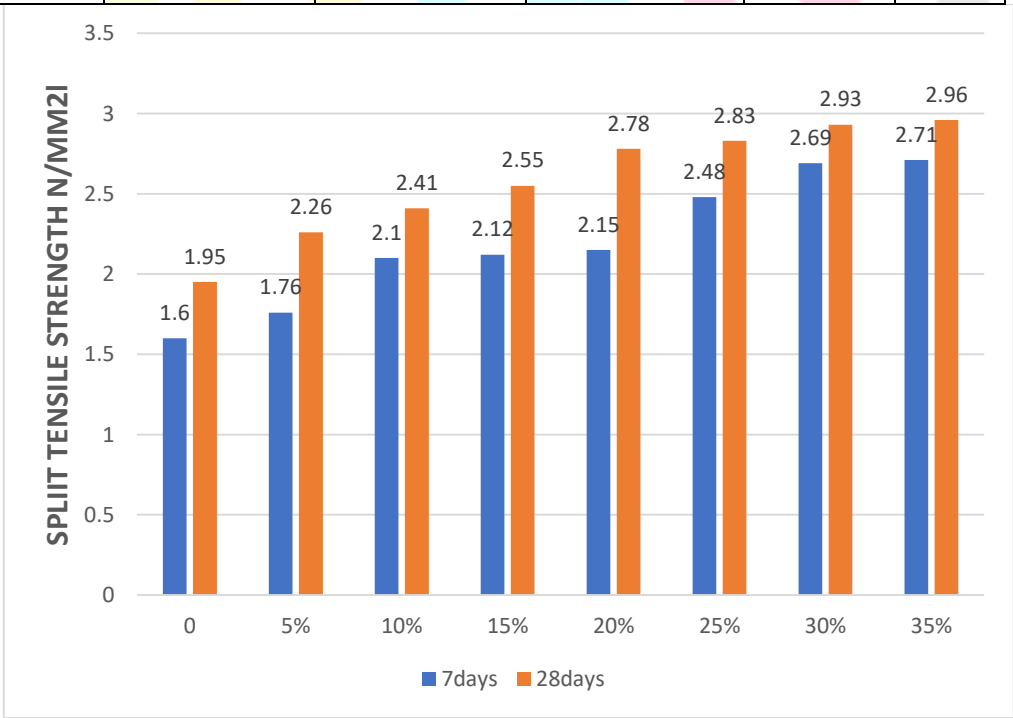

Table 7.4 Result of Flexural strength test

Sl.no	Concrete type	Percentage of RHA	Percentage of foundry sand	Number of specimens	Flexural Strength MPa	
					7 Days	28 Days
1	CC	-	-	6	2.85	3.15
2	R5FS35	5	35	6	3.1	4
3	R10FS35	10	35	6	3.43	4.55
4	R15FS35	15	35	6	3.66	4.75
5	R20FS35	20	35	6	3.75	4.54
6	R25FS35	25	35	6	3.96	4.78
7	R30FS35	30	35	6	4.32	4.98
8	R35FS35	35	35	6	4.75	5.25

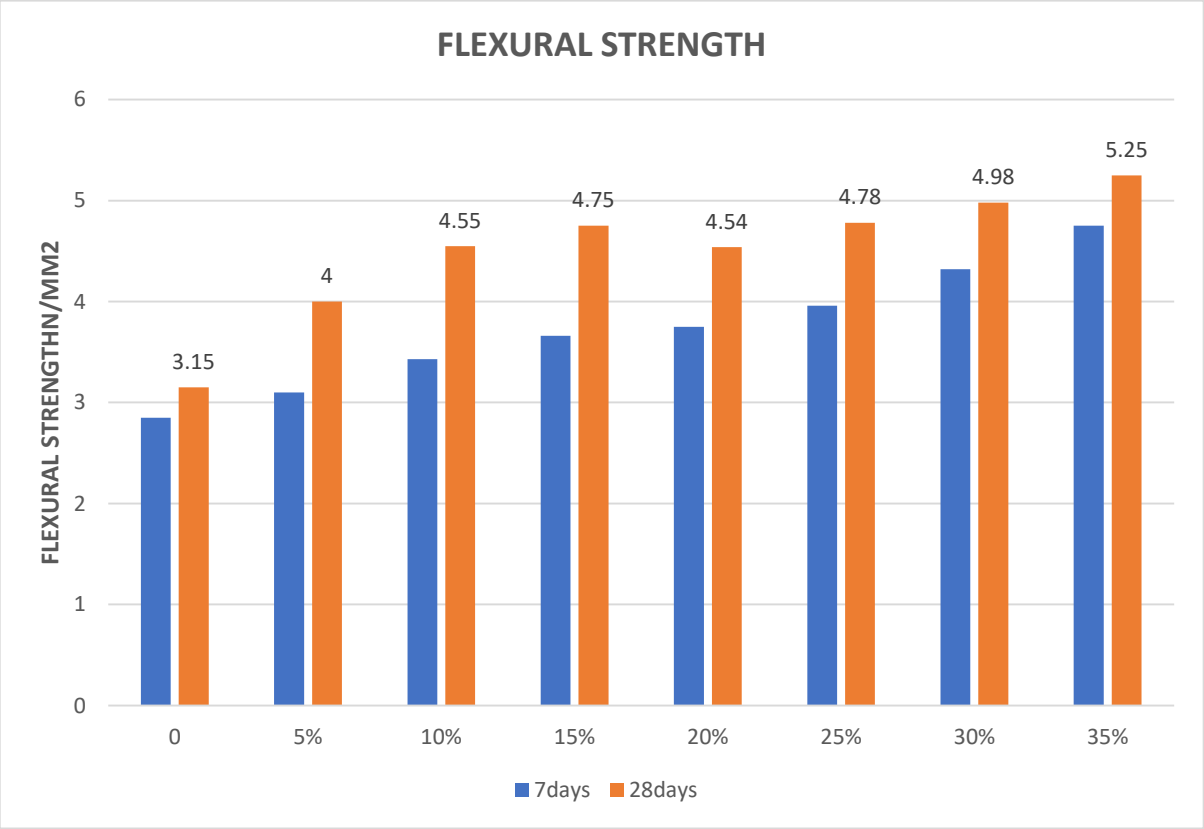

Fig 4 flexural strength graph

CONLUSION: In this experimental investigation flexural performance of high-performance concrete beam using Rise husk ash (RHA) and Foundry sand (FS) was found. Two different materials are replacing of cement and fine aggregate used in beams varied for concrete efficiency.

- The gradual decrease in the compressive strength as the percentage of replacement increases at 7 and 28 days.
- The gradual increases in spilt tensile strength as the percentage of replacement increases at 7 and 28 days.
- The maximum compressive strength is obtained at 35% replacement of cement by RHA and fine aggregate by FS.
- The maximum Split tensile strength is obtained at 35% of replacement of cement by RHA and fine aggregate FS.

- The reduction in these values is due to presence of very fine particles in both RHA and WFS which are accountable for filling the void spaces in concrete.
- This is due to increased RHA content results in improper pozzolanic action and slows down hydration process in concrete.
- To provide economical construction material.
- Safeguard the environment by utilizing agro waste properly

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