COMBINE EFFECT OF RICE HUSK ASH AND FLY ASH ON CONCRETE BY PARTIAL REPLACEMENT OF CEMENT

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ABSTRACT: Concrete is consumed at a rate of about 1000 kilogrammes per person worldwide, and it is generated in massive quantities of around 70-75 billion tonnes. To begin, the diverse features of rice husk ash, such as specific gravity, bulk density, and fineness, have been discussed. After that, standard durability and mechanical tests were conducted, with the results assessed. Water absorption and permeability tests, slump tests, initial and final setting time tests, and normal consistency tests were all part of the durability testing. Compressive strength was one of the mechanical tests. Just below the table, the results of each test have been listed.

Keywords: -.RHA (Rice husk ash) , .FA- FLY ASH

I. INTRODUCTION

Concrete constructed with Portland cement, water admixtures, and aggregates is the most abundant of all man-made materials in terms of volume. Historically, if new compounds were developed or waste materials collected in industry, they were added to the mix of concrete ingredients. Fly ash phosphogypsum, blast furnace slag, saw mill waste, rice husk, cotton, and other materials are common examples. The widespread urge to save resources and the environment will be reflected in a strong focus on the recycling of trash and by-products. Concrete materials can also be recycled, which has some potential. There have already been attempts to use municipal garbage and waste oil as partial fuel alternatives in the manufacturing of cement clinker.

WASTE MATERIALS PLAY A PART IN CEMENT CLINKER PRODUCTION:

- Many waste products include the essential components required to make cement clinker.
- Fly ash canals could be used as a raw material source.
- Limestone can be swapped out for lime sludge.
- Red mud, a byproduct of the alumina industry that is utilised as a raw ingredient in the manufacture of cement clinker.
- Clinker production uses phosphogypsum as a mineralizer.

WASTE MATERIALS ARE USED TO MAKE PORTLAND CEMENT:

• Fly ash concrete

• Slag cement from blast furnaces

• Cemen made of rice husks

II. RELATEDWORKS

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III. METHODOLOGY

Overview of the method:

In this study, rice husk ash was fixed with cement, aggregate, fly ash, and water in various ratios as part of a comprehensive laboratory experiment. to examine its many attributes. Research the viability of using RHA and FA as a partial replacement for cement in concrete mixes and ascertain the change in characteristics following the addition of RHA.
Experimental confirmation of the current RHA&FA concrete findings with other results from published research.
For convenience, the mix design for M20 grade concrete has been done in accordance with IS:10262, and research has been done on the effect of the RHA content on the mechanical properties of rubberized concrete starting at 0% RHA and going up to 30% RHA content (1982).
Examine the impact of partial cement replacement from RHA on the qualities of freshly-poured concrete (such as the slump test and vicat apparatus test) and hardened concrete (such as the compressive strength).

IV. MATERIALS USED

- Cement

Portland-pozzolana cement can be made by either intimately and consistently blending the predefined amounts of Portland cement clinker and pozzolana (15–35 percent by mass of Portland–pozzolana cement) or by integrating them together. fine pozzolana and Portland cement with a predetermined fineness. Compared to regular Portland cement, this produces less heat during hydration and has higher resistance to sulphate attack and chloride-ion penetration. In addition to conventional mass concrete constructions like dams, bridge piers, and thick foundations, it is particularly beneficial in maritime and hydraulic construction.

- RHA

A by-product of burning rice husk at a controlled temperature below 800 °C is known as rice husk ash (RHA). Approximately 25% of the ash produced by the process is extremely pozzolanic, consisting primarily of amorphous silica (85–90% of the total), with the remaining ash having about 5% of alumina. RHA has a variety of uses, including as a pozzolana in the building sector, a filler, an additive, an abrasive agent, an oil adsorbent, a component of sweeping systems, and a suspending agent for porcelain enamels. RHA can be used in place of certain cement in the construction sector. It can be employed to weatherproof. It is additionally utilised as an additive to strengthen concrete's resistance to chemical encroachment.

- Fly Ash.

In electric generating power plants, burning pulverised coal produces fly ash, a fine powder. Fly ash is a pozzolan, a substance made of alumina and siliceous material that, when combined with water, makes cement. Fly ash creates a substance that resembles Portland cement when combined with lime and water. This qualifies fly ash as a key component in a variety of building materials, including hollow blocks, mosaic tiles, and blended cement. Fly ash, when added to concrete mixtures, increases the concrete's strength and segregation, as well as making it simpler to pump.

- Aggregate

As fine aggregate, natural river sand with a maximum particle size of 4.75 mm was used.As coarse aggregate. It was wasted in accordance with Indian Standard IS: 383 (1970). According to IS: 2386, aggregate's physical characteristics were evaluated (1963). The table below lists the physical characteristics of both fine and coarse aggregate.

Property	MaterIal	
	Fine aggregate	Coarse aggregate
Bulk density (kg/m3)	173 1	1547
Specific gravity	2.55	2.88
Fineness modulus	3.48	6.84
Water absorption (%)	0.42	1.54

Table 3.1

- Combination Ratio

1. In the workability test and VICAT apparatus test, three types of mixes were taken into consideration in which RHA replaced cement to the extent of 10, 20, and 30% of its total weight.

2. For the compression test, three types of mixes with RHA replacing 15, 20, and 30% of the cement's total weight were taken into consideration.

V. TEST RUN

A test-run programme

1. Test of workability (slump test).

2. Cement consistency is tested using the VICAT instrument.

3. Cement's initial and ultimate setting times are tested using the VICAT equipment.

4. concrete's compressive strength.

1. SLUMP TEST

The slump test determines how fluid new concrete is before it settles. It is done to examine whether freshly poured concrete is workable and, consequently, if concrete flows easily. It can also be used as a sign of a batch that was not properly blended. Due to the straightforward gear and straightforward process, the test is well-liked.

Figure 5.1: Processes involved in slump test

2. Cement consistency is tested using the VICAT instrument.

To determine how much water should be added to cement to achieve standard consistency or normal consistency, the consistency of cement test is conducted. Cement's typical consistency ranges from 25 to 35 percent. To create a paste of cement, add 25–35% water by weight of cement to reach the desired consistency.

3. Cement initial and ultimate setting time VICAT device test

Cement's initial setting

It is the period of time that passes from the point at which water is added to cement to the point at which the paste begins to lose its flexibility. OPC cement should take less than 30 minutes.

Cement's final setting period

It is the amount of time that has passed between the addition of water to the cement and the point at which the cement paste has become sufficiently firm to withstand a specific amount of pressure. For OPC cement, it shouldn't be longer than 600 minutes. The OPC initial setting time minimum is 30 minutes, and the OPC final setting time maximum is 600 minutes.

Figure 5.2: Initial and Final setting time test

4. COMPRESSIVE STRENGTH DETERMINATION:

PREPARE SPECIMEN:

Fresh concrete is created by combining the right proportions of cement, water, and aggregate as determined by the calculations for the mix design, which is then poured into moulds. Molds measuring 15x15x15 cm are referred to as TS 500 and DIN. It is necessary to prepare three samples. Two equal parts of the cubes are filled. When placing, every effort should be made to prepare the specimen in a manner that is close to the real placement conditions in the site. After being placed in moulds for two days, the specimens are then dried in a moist setting, such as a curing room, water, or a wet blanked. The cubic specimens are prepared for the compression test after 7, 14, and 28 days. Cubes offer this together with our capping.

COMPRESSION TEST

to ascertain the compression strength for cure times of 7, 14, and 28 days. Different cubes were created and tested using varying amounts of rice husk ash in relation to the weight of cement. For each M-20, five concrete cube specimens with a composition of 15%, 20%, and 30% flyash and rice husk ash were constructed. Concrete that has been hardened is used for the compression strength test because it is simple to conduct and best reflects the characteristics of concrete. On occasion, flexure-tested beam components are used to assess the compressive strength of concrete. The cube specimen measures 150 mm in all directions.

Fig. 5.3 COMPRESSION TEST

VI. RESULTS

Effect of rice husk ash on concrete made of cement (lab report)

6.1 RICE HUSK ASH (RHA) GENERAL PROPERTIES:

1. SPECIFIC GRAVITY:

o Pycnometer (M1) empty weight: 324.5g

o Pycnometer weight plus RHA(M2): 355.9 g

Weight of the pyrometer plus RHA plus water (M3): 856.3 g

o Pycnometer and water weight (M4): 871.7 g

Calculation:

Specific gravity of rha:M2-M1/(M2-M1)-(M4-M3)

Rha has a 1.96 specific gravity.

2.BULKDENSITY

o The calibrated container weighs 47g when empty.

o Container weight plus RHA: 96.6g

o Container volume: 100 cm3.

Calculation:

RHA's bulk density is (96.6-47)/100, or.496 g/cm3.

RHA's bulk density is 496 kg/m3.

3. RHA'S FINENESS

RHA sample weight: 100g

40g of mass passes a 90-micron sieve.

o RHA fineness is 60 percent

Effect on cement and concrete:

6.2 WORKABILITY:

SLUMPTEST:

0-25mmSLUMP	*LOW WORKABILITY*
25-75mmSLUMP	*MEDUIM WORKABILITY*
75-100mmSLUMP	*HIGH WORKABILITY*

FIGURE 6.1- SLUMP TEST

- <u>For**M20 GRADE OPC,0% RHA:**</u>

Table 6.1

WATERCONTENT	SLUMP (mm)
0.45	0
0.55	42
0.60	95

Workability is highest at water content of 0.60

- **For same water content at different replacement%:**

Table 6.2

%REPLACEMENT	WATERCONTENT %	SLUMP (mm)
0	0.50	13
10	050	5
20	0.50	3
30	0.50	0
40	0.50	0

As the amount of RHA rises, the mix's workability significantly decreases.

For various percentage (percent) replacements, discover high workability water content by:

- **10%REPLACEMENT**

Table 6.3

WATERCONTENT	SLUMP (mm)
0.54	10
0.50	25
0.65	40
0.70	100

For a high workable mix, a water content of 0.70 is necessary.

- **20%REPLACEMENT**

Table 6.3

WATERCONTENT	SLUMP (mm)
0.50	7
0.60	13
0.70	42
0.80	86

0.80water content is required for high workable mix.

- **30%REPLACEMENT**

Table 6.4

WATERCONTENT	SLUMP (mm)
0.50	0
0.60	6
0.70	21
0.85	82

For a high workable mix, 0.85 water content is necessary.

6.3 NORMAL CONSISTENCY TEST:

- **FOR M20 GRADE OPC**

Table 6.5

WATER CONTENT	INITIAL READING	FINAL READING	HEIGHT NOT PENETRATED (mm)
0.30	0	9	9
0.31	0	6	6

Normal consistency of 43 grade OPC=31%

- **10%REPLACEMENT**

Table 6.6

WATER CONTENT	INITIAL READING	FINAL READING	HEIGHT NOT PENETRATED (mm)
0.31	0	40	40
0.40	0	25	25
0.42	0	11	11
0.43	0	5	5

Normal consistency at 90% OPC and 10% RHA= 43%

- **20%REPLACEMENT**

Table 6.7

WATER CONTENT	INITIAL READING	FINAL READING	HEIGHT NOT PENETRATED (mm)
0.43	0	38	38
0.47	0	35	35
0.52	0	22	22
0.55	0	15	15
0.56	0	12	12
0.58	0	9	9
0.59	0	7	7

Normal consistency at 80%OPC and20%RHA=59%

- **30%REPLACEMENT**

Table 6.8

WATER CONTENT	INITIAL READING	FINAL READING	HEIGHT NOT PENETRATED (mm)
0.55	0	38	38
0.65	0	25	25
0.70	0	16	16
0.75	0	11	11
0.80	0	6	6

Normal consistency at 70% OPC and 30% RHA= 79%

6.4 INITIAL &FINAL SETTING TIME

• FOR M20 GRADE OPC

Table 6.9

TIME (min)	DEPTH NOT PENETRATED (mm)
5	0
10	0
20	0
30	0.5
40	0.5
50	1
60	1
70	5

Initial setting time:70min

Final setting time:135min.

- **10%REPLACEMENT**

Table 6.10

TIME (min)	DEPTH NOT PENETRATED (mm)
5	0
10	0
20	0
30	
40	0.5
50	1
60	1
80	2
100	3.5
110	4
120	5

Initial setting time: 120 min

Final setting time:135min

- **20% REPLACEMENT**

Table 6.11

TIME (min)	DEPTH NOT PENETRATED (mm)
10	0
20	0
30	0
40	0
50	0
60	0.5
80	0.5
100	1
120	2.5
140	3
160	4
170	4.5
180	5

Initial setting time: 180min
Finalsettingtime:480min

- **30% REPLACEMENT**

Table 6.12

TIME (min)	DEPTH NOT PENETRATED (mm)
10	0
20	0
30	0
40	0
60	0
80	0.5
100	1
120	1
140	1.5
160	2
180	3
200	3
220	3.5
230	4
240	4.5
250	5

Initial setting time: 250min

Final setting time:>8hours

6.5 Values determined from compression test

TABLE 6.13 DAYS CURING

%Repla cement	Fly ash		Rice husk ash		mix	
Mass (kg)	`Strength (N/mm^2)	Mass (kg)	Strength (N/mm^2)	Mass (kg)	Strength (N/mm^2)	
0	8.450	29.648	8.450	29.648	8.450	29.648
15	8.250	24.280	7.650	7.412	7.700	10.020
20	8.200	23.100	7.800	6.104	7.850	10.090
30	8.100	20.000	7.350	4.360	7.800	9.156

TABLE 6.14 DAYS CURING

%Repla cement	Fly ash		Rice husk ash		mix	
Mass (kg)	`Strength (N/mm^2)	Mass (kg)	Strength (N/mm^2)	Mass (kg)	Strength (N/mm^2)	
0	8.450	29.648	8.450	29.648	8.450	29.648
15	8.250	24.280	7.650	7.412	7.700	10.020
20	8.200	23.100	7.800	6.104	7.850	10.090
30	8.100	20.000	7.350	4.360	7.800	9.156

TABLE 6.15 DAYS CURING

Age in days	%0freplacement	Fly ash N/mm2	Rice husk ash N/mm2	mix N/mm2
7	15	24.280	7.650	7.850
14	20	31.210	14.039	16.130
28	30	34.880	20.140	26.592

TABLE 6.16 HIGHEST COMPRESSIVE TEST

Age in days Age in days	%0freplacement	Flyash N/mm2	Rice husk ash N/mm2	mix N/mm2
7	15	24.280	7.650	7.850
14	20	31.210	14.039	16.130
28	30	34.880	20.140	26.592

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