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Comparative Studies of Strength Analysis on Different Fibre Reinforced Concrete with Conventional Concrete

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Abstract— This paper reports the study of compressive strength of concrete involving rice husk (RH) and fibre reinforced concrete in different proportions. The M-20 grades of concrete of cubes were made for the experiment. FRC and RH both were used from 5% to 15% at the interval of 5% by replacing Ordinary Portland Cement (O.P.C.). Steel fibres were used. The compressive strength of concrete of different proportion with 5%, 10% and 15% cubes were checked at 7 days and 28 days of curing period. The results show that concrete cubes having steel fibres showed better strength as compared to the RH concrete cubes and normal concrete cubes.
Keywords—Concrete cubes. Rice Husk (RH), Compressive Strength, Fibre Reinforced Concrete, Steel fibres

I. INTRODUCTION

Concrete is weak in tension and has a brittle character. Use of continuous reinforcement in concrete (reinforced concrete) increases strength and ductility, but requires careful placement and labour skill. Alternatively, introduction of fibres in discrete form in plain or reinforced concrete may provide a better solution. The modern development of fibre reinforced concrete (FRC) started in the early sixties. Addition of fibres to concrete makes it a homogeneous and isotropic material. When concrete cracks, the randomly oriented fibres start functioning, arrest crack formation and propagation, and thus improve strength and ductility. The failure modes of FRC are either bond failure between fibre and matrix or material failure.
Concrete is relatively brittle, and its tensile strength is typically only about one tenths of its compressive strength.
Regular concrete is therefore normally reinforced with steel reinforcing bars.

For many applications, it is becoming increasingly popular to reinforce the concrete with small, randomly distributed fibres.

Their main purpose is to increase the energy absorption capacity and toughness of the material, but also increase tensile and flexural strength of concrete.

Concrete containing hydraulicccement, water, fine or fine and coarse aggregate and discontinuous discrete fibres is called fibre-reinforced concrete (FRC).

It may also contain Pozzolanas and other admixtures commonly used in conventional concrete.

Fibres of various shapes and sizes produced from steel, plastic, glass, and natural materials are being used; however, for most structural and non structural purposes, steel fibre is the most commonly used of all the fibres.

There is considerable improvement in the post-cracking behaviour of concretes containing fibres. Although in the fibre-reinforced concrete the ultimate tensile strengths do not increase appreciably, the tensile strains at rupture do.

Compared to plain concrete, fibre reinforced concrete is much tougher and more resistant to impact.

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Figure 1: Fibre Reinforced Concrete

A. History of Rice husk

Rice is major food grain for the people of the southern and some of the northern states in India, and also for the people of at least 15 other countries in the world. Production of rice paddy is associated with the production of essentially two by products, rice husk and rice bran. Despite having so many well established uses of rice husk, little portion of rice husk produced is utilized in a meaningful way, remaining part is allowed to bum in open piles or dumped as a solid waste or it is used as a cattle feeding. Farmers are getting very less prices for their paddy harvested.

Figure 2-Rice husk

II. PROPOSED METHODOLOGY

In our proposed approach cubes are casted using Steel Fibres and Rice Husk concrete additives and simple conventional concrete cubes using appropriate proportion of materials after that the cubes are kept for curing period for 7 days, 14 days and 28 days. The cube are taken out from curing after its period gets over and is subjected to the compressive strength test and the values are taken for all cubes and by comparing their strength we get the desired result.

A. Procedure Adopted for casting cubes

Firstly calculate the various proportion weight for M20 (1: 1.5: 3) grade of concrete.

Then after calculating the weight of materials:

1) Spread measured quantity of sand on the platform.
2) Dump sand over the cement.
3) Dry mix the cement and sand thoroughly, add rice husk also.
4) Spread the measured quantity of course aggregate in another place of platform.
5) Spread the sand cement mixer.
6) Thoroughly mix the whole mass mix the whole mass at least 3 times by shoveling and turning over by twist from centre to side then back to the centre and again to the sides.
7) Make a hollow in the middle of the mixed material.
8) Add measure quantity of water & slowly turn the whole mixture over & over again until each aggregate is coated with sand-cement mortar & the mixture should be uniform & plastic.
9) Apply grease on the inner surface of moulds.
10) Fill 1/3 of the mould until the prepared mixture & tamp it for 25 times tamping.
11) Again fill the mould with 2/3 of the prepared mix & tamp it for 25 times.
12) Completely the mould & level it and (also tamp the third layer).
13) In the same way fill the other two moulds.

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Figure 3-Moulds prepared

III. RESULT AND DISCUSSION

FOR STEEL FIBRE CUBES-ADD STEEL 5%,10% AND 15%

FOR RICE HUSK CUBES-ADD RICE HUSKL 5%,10% AND 15%

A. Plain cube

Table 1: First Compressive Strength Test of Plain Cube after 7 Days

Mould Number	Load applied in (KN)	Compressive stress (N/sq. mm)
1.	160	16.0
2.	172	17.2
3.	169	16.9

Table 2: Second Compressive Strength Test of Plain Cube after 28 Days

Mould Number	Load applied in (KN)	Compressive stress (N/sq. mm)
1.	210	21
2.	217.6	21.76
3.	228	22.8

B. Fibre Reinforced cubes

Table 3: First Compressive Strength Test of FRC after 7 Days

Mould Number	Compressive stress (5% steel - N/sq. mm)	Compressive stress (10% steel - N/sq. mm)	Compressive stress (15% steel - N/sq. mm)
1.	17	17.35	17.22
2.	17.66	17.54	17.37
3.	18.32	18.27	18.10

Table 4: Second Compressive Strength Test of FRC after 28 Days

Mould Number	Compressive stress (5% steel - N/sq. mm)	Compressive stress (10% steel - N/sq. mm)	Compressive stress (15% steel - N/sq. mm)
1.	32.6	30.16	26.70
2.	29.10	27.18	28.10
3.	30.11	26.60	25.95

C. Rice Husk Cube

Table 5: First Compressive Strength Test of Rice Husk Cube after 7 Days

Mould Number	Compressive stress (5% Rice husk -N/sq. mm)	Compressive stress (10% Rice husk -N/sq. mm)	Compressive stress (15% Rice husk -N/sq. mm)
1.	16.93	17.27	17.0
2.	17.35	17.31	17.11
3.	18	17.90	17.68

Table 6: Second Compressive Strength Test of Rice Husk Cube after 28 Days

Mould Number	Compressive stress (5% Rice husk -N/sq. mm)	Compressive stress (10% Rice husk -N/sq. mm)	Compressive stress (15% Rice husk -N/sq. mm)
1.	26.6	26.1	25.89
2.	25.9	25.8	25.50
3.	27.11	26.05	26.10

IV. CONCLUSIONS

From the above analysis it is concluded that:

A. The strength of FRC is more than nominal concrete and Rice Husk.
B. The durability of FRC is more than nominal concrete and Rice husk.
C. The crack formation is low in FRC then nominal concrete and Rice husk.

Therefore the FRC is better option used in concrete for better strength than nominal concrete and rice husk concrete.

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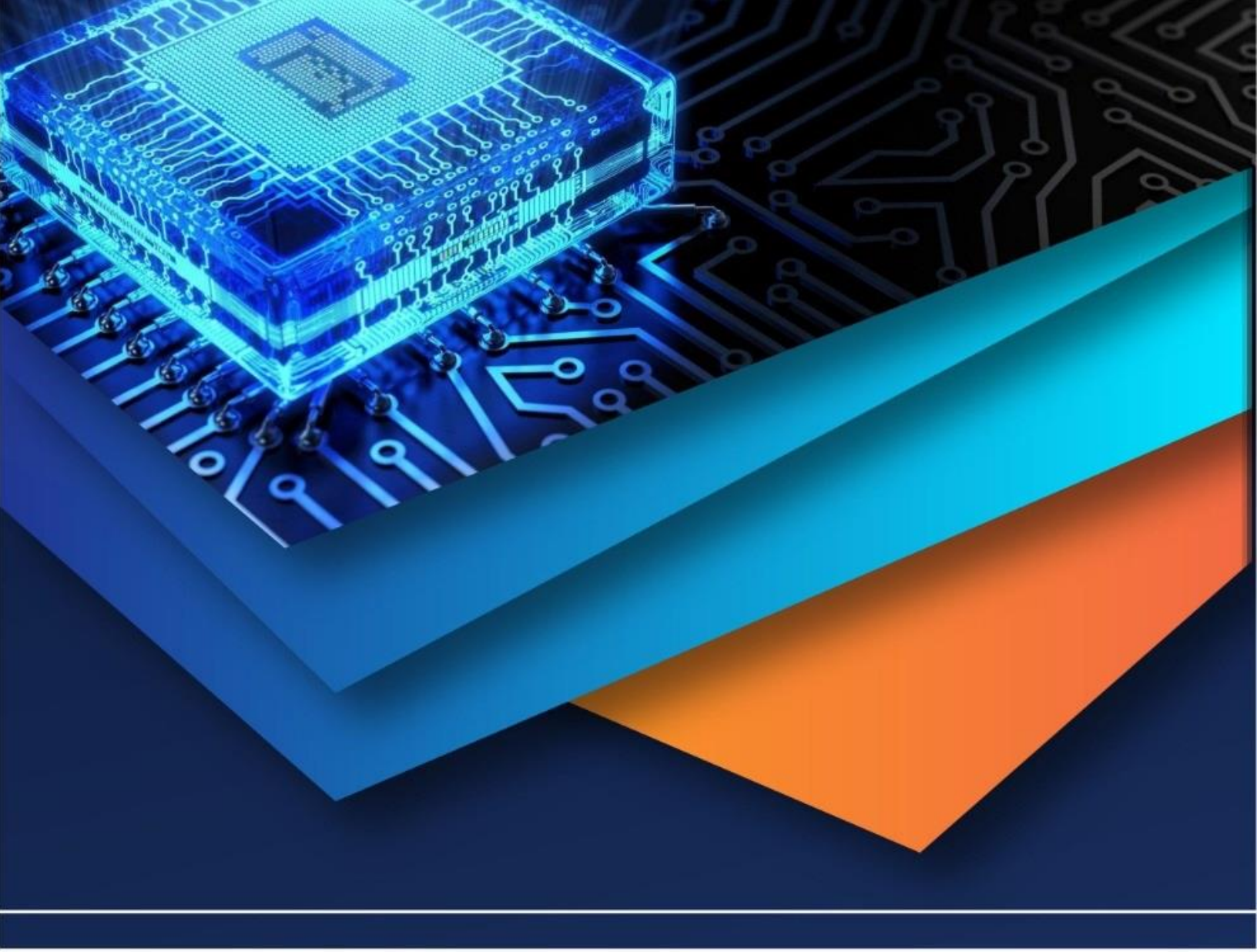

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