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Investigation on Partial Replacement of Cement with Coir Fiber (CF) & Jute Fiber (JF) and with Addition of Admixture

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Abstract: ***The rising cost of cement as a construction materials concern. The reason to increase in cost is high demand of concrete and scarcity of raw materials. Hence the Experts are research on alternative waste materials, which are obtained from the industries, factories and agriculture waste etc. This paper aims to investigate on the compressive strength and tensile strength of*** M_{25} ***grade concrete, the partial replacement of cement with coir and jute fibers& addition of admixture have been taken to improve the workability of the concrete. Thirty cubes and thirty cylinders are tested at 7days curing as well 28days curing has been done. Their compressive and tensile strengths were evaluated with comparison of conventional concrete. Here we observed that, the compressive strength is increased at 6% of CF+JF concrete and tensile strength is increased at 4% of CF+JF concrete. These results show that the jute and coir fibers concrete can be used in reinforced concrete constructions. The utilizations of coir and jute fibers are eco-friendly.***

Keywords: Coir fibers, Jute fibers, admixtures, compressive strength, Tensile strength

I. INTRODUCTION

Human Activities on earth produces in considerable quantities of waste from industries and agricultural waste from rural and urban areas. This creates serious problems to the Envirmental health and also decreases the land fertility due to improper decomposing of solid waste. Now days the usage of concrete is very higher than earlier. Due to more usage of raw materials it causes the shortage. This causes the high cost of concrete and its raw materials like cement, sand and steel etc. Therefore the demand of the concrete and the required raw materials are very high. This causes the hike in the costs of cement, fine and coarse aggregates. To avoid this problem like hike of cost, shortage of raw materials, we have to use other alternative materials like steel fibers, coconut shells, Coir fibers and fly ash etc. And decrease the usage of raw materials and recycle the waste products obtained from the industries and agricultural waste. Use of the waste materials also reduces the problem of land-filling, environmental and health concern. In this paper, jute fiber (JF) and coir fibers (CF) are used as a partial replacement of cement with different percentages. We are using agricultural and industrial waste to improve the strength properties of concrete and to lead sustainable development. This environmental reason has generated a lot of concern in the construction world. The use of sugarcane baggage, wooden chips, plastic waste, textile waste, polyethylene, rice husk ash, rubber tyres, vegetable fibers, paper and pulp industry waste, groundnut shell, waste glass, broken bricks are some examples of replacing aggregates in concrete. The coconut fiber, termed as coir, when dried contains cellulose, lignin, and ash in varying percentage. In Asia, the construction industry is yet to realize the advantages of light weight concrete in high rise buildings. Coconut fibers are not commonly used in construction industry and are often dumped as agricultural waste.

II. EXPERIMENTAL STUDY

The experimental investigation was carried out on test specimens using M_{25} mix proportion with four variations of aspect ratio of coconut fibres and jute fibers with conventional concrete. To increase the workability, we need to add considerable amount of admixtures

A. Cement

Ordinary Portland cement grade 53, conforming to I.S 12269-1987[12] was used. Cement must develop appropriate strength. It must represent the appropriate rheological behaviour. Cement of KCP brand of 53 grade is used. Cement is Portl and Pozzolona cement and used for mix proportion of M_{25} grade. Supplementary cementations material is replaced with coir fiber and jute fiber at about

0%, 2%, 4% and 8% with cement. The text conducted on cement is initial setting time, final setting time, soundness, specific gravity test. Conducted tests for cement

Fig. 1 KCP cement

B. Fine Aggregate

Naturally occurred at locally available sand is used for the study. The Zone of sand is taken as Zone II. River sand was used as the fine aggregate, conforming to Zone-II as per I.S 383-1970[13].The sand was air dried and sieved to remove any foreign material, prior to mixing. Conducted tests for Fine aggregate

Fig. 2 River sand

C. Coarse Aggregate

20mm size coarse aggregate is used. The exposure of is mild and Zone II is adopted. Coarse aggregate consists of 50% of self-weight of concrete and 70% of volume of concrete and conducted tests for coarse aggregate

Fig. 3 Coarse aggregate

D. Coir Fibers

Coir fibers were collected from temples in the city to analyze the physical properties. The physical properties of Coir fiberare shown below. Conducted tests for coir fibers

Fig. 4 Coir fibers

Table-1 Properties of coir Fibers

Sno.	Parameters	Value/Results
1	Length/Breadth Ratio(L/B)	86
2	Fineness(Tex)	32
3	Tenacity(G/Tex)	18
4	Breaking Load(Kg)	
5	Extension At Break (%)	24
6	Density(G/Cc)	1.25
7	Porosity (%)	38
8	Moisture Regime At 65&RH(%)	10.1

E. Jute Fibers

Jute fibers were collected from temples in the city to analyze the properties. The physical properties of jute fiber are shown below. And jute fibers of certain aspect ratio are used.conducted tests for Jute fibers

Fig. 5 Jute fibers

Table 2 Properties of coir Fibers

S.No.	Parameters	value/results
1	Length	2-30 inches
2	Elasticity	not good and 1.5% elongation at break
3	Dimensional Stability	good
4	Moisture Regine	12.50%
5	Specific Gravity	1.35-1.48
6	Colour	yellowish and yellow, brown, holden colour
7	Heat Resistance	good
8	Diameter	15micron

F. Admixture

Water-reducing admixtures are used to reduce the quantity of mixing water required to produce concrete of a certain slump, reduce water-cement ratio, reduce cement content, or increase slump. Typical water reducers reduce the water content by approximately 5% to 10%. Concrete admixtures are used to enhance the properties of concrete for applications in concrete works with special requirements.

III. EXPERIMENTAL SETUP

In this experiment, 30 numbers of cubes and 30 numbers of cylinders were tested under CTM and UTM respectively, the size of the cube is 150mmX150mmX150mm, the size of cylinders is and 150 X 300 mm. The mix design was made using IS 10262-2009 for M_{25} grade concrete in which mix proportion 1:2:4 for 1m concrete. Water cement ratio used is 0.50. CF and JF was partially replaced in concrete by 0%, 2%, 4% and 8% by the weight of cement. Compaction of concrete specimen was done using and compaction and vibrator. The specimens were removed after 24hrs from the time of casting and kept in curing tank for 7, 28 days for cubes and 7, 28 days for cylinders. Compression test for cubes were conducted on compression testing machine (CTM) of capacity 2000KN. tensile test were conducted on universal testing machine (UTM) of capacity 600KN.

A. Compressive Strength

In this experiment, 30 numbers of cubes were tested under CTM (Compression Testing machine).

Fig. 6 Tested cubes

B. Tensile Strength

In this experiment, 30 numbers of cylinders were tested under UTM(universal Testing Machine)

Fig. 7 cylinders

IV. RESULT ANALYSIS

A. Comparative study of Compressive STRENGTH with Conventional Concrete Cubes

Table-3 Compressive Strength

Concrete (M25)	CF+JF content	Compressive Strength (avg of 3 specimens)	
Concrete (M25)		7 Days	28 Days
Conventional Concrete	0%	7.6	23.72
CF+JF Concrete And Admixture	2%	7.9	22.41
CF+JF Concrete And Admixture	4%	8.2	21.1
CF+JF Concrete And Admixture	6%	8.5	23.73
CF+JF Concrete And Admixture	8%	8.1	19.48

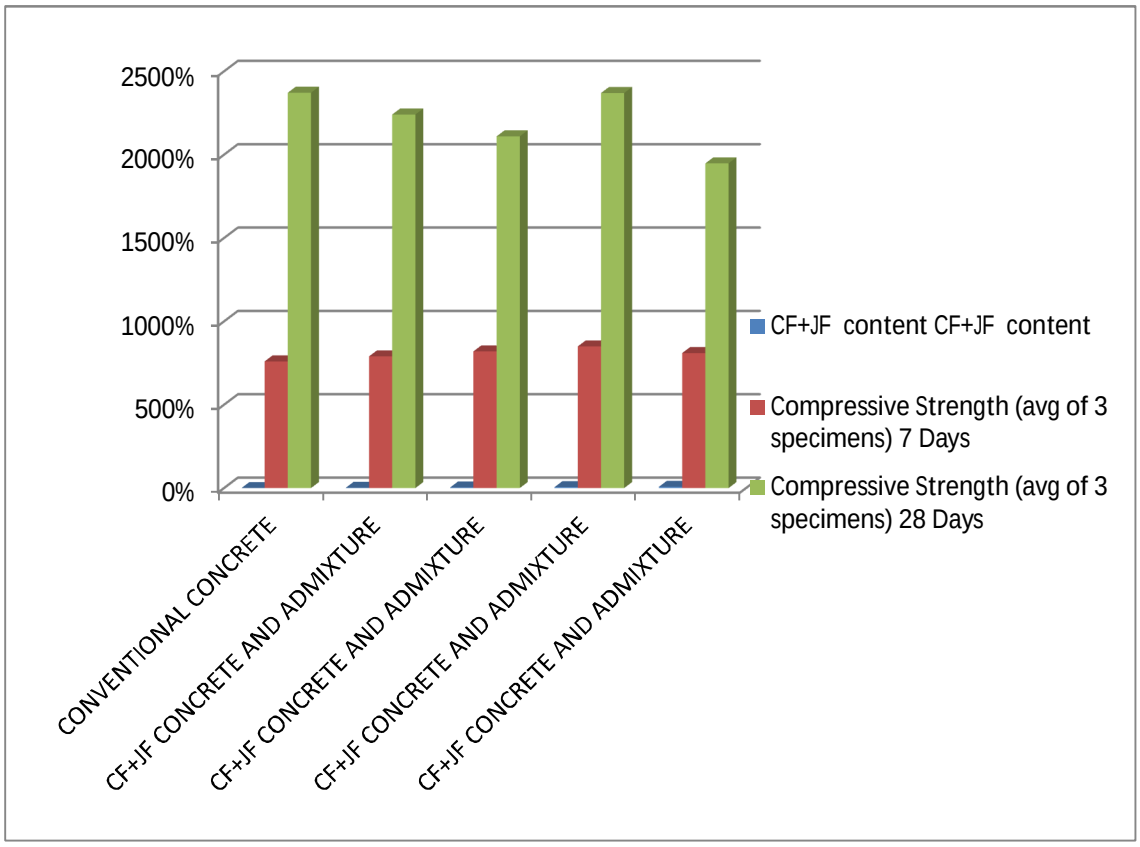

Fig. 8 variations of Compressive Strengths

The above table shows that the compressive strength of Coir fiber &Jute fiber concrete is decreased up 4% of CF+JF and suddenly increased at 6% of Coir fiber & Jute fiber and then again decreased its strength. Such that the Coir fiber & Jute fiber concrete attains the maximum strength at 6% of Coir fiber& Jute fiber. As compared to conventional concrete, the Coir fiber & Jute fiber concrete attains more compressive strength.

B. Comparative study of Tensile Strength with conventional concrete cylinders

Table-4 Tensile Strength

Concrete (M25)	CF+JF content	Tensile Strength (avg of 3 specimens)	
Concrete (M25)		7 Days	28 Days
Conventional Concrete	0%	1.73	2.32
CF+JF Concrete And Admixture	2%	1.68	2.21
CF+JF Concrete And Admixture	4%	1.74	2.56
CF+JF Concrete And Admixture	6%	1.58	2.37
CF+JF Concrete And Admixture	8%	1.53	2.3

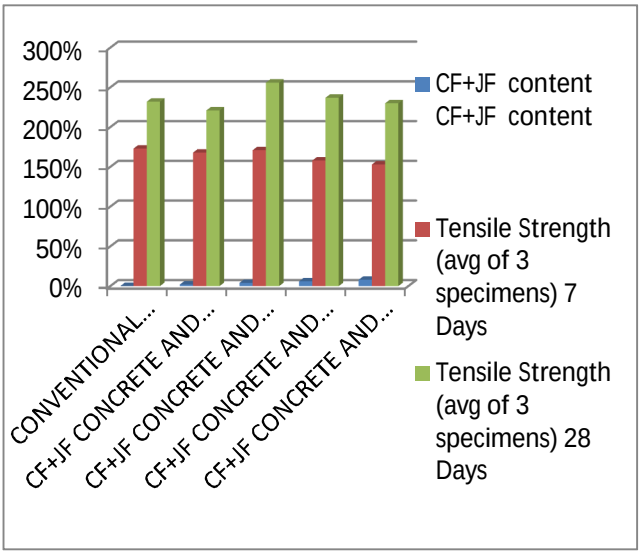

Fig. 9 Tensile Strength

The above table shows that the tensile strength of Coir fiber & Jute fiber concrete is decreased up 2% of Coir fiber & Jute fiber and suddenly increased at 4% of Coir fiber & Jute fiber and then again decreased its strength. Such that the Coir fiber & Jute fiber concrete attains the maximum strength at 4% of Coir fiber &Jute fiber. As compared to conventional concrete, the Coir fiber & Jute fiber concrete attains more tensile strength.

V. CONCLUSIONS

In the present works, the coir fibers and jute fibers are used as partial replacement of cement by its weight. And it shows the effects of strength in both the compression and tensile were studied as follows:

A. As compared to conventional concrete, the coir fiber& Jute fiber concrete attains more strength in both compressive and tensile.
B. As the percentage of coir & jute fiber increased in concrete the density of concrete is decreased which make light weight concrete and reduce the dead weight of structure also.
C. Coir & jutefibers are by- product whose cost is less than other fiber like steel fiber, Glass fiber, synthetic fiber etc. Which makes the economical structure with advantage of increase the compressive and flexural strength of Concrete at certain amount of Coir & jute fibers

D. The coir fiber& Jute fiber concrete attains the maximum compressive strength at 6% and Maximum Tensile strength at 4% of Coir fiber& Jute fiber

E. Here we observed that preferable amount of coir and jute fibers were 6% in compressive and 4% in Tensile strength

VI. ACKNOWLEDGMENT

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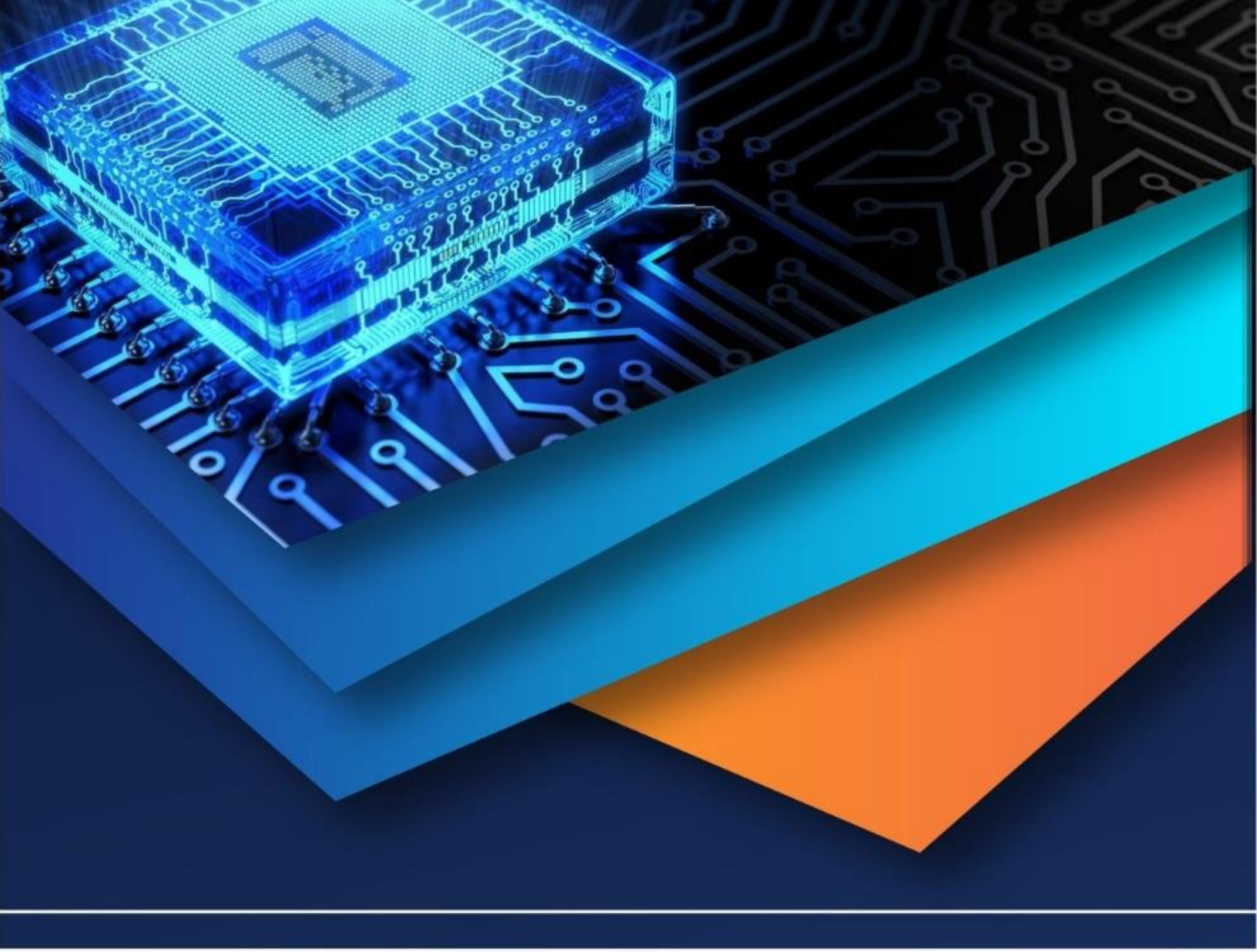

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