

A Comparative Study of Jute Fiber Concrete With Plain Cement Concrete

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Abstract- Today's developing world lays high emphasis on the waste management. Wastes generated through different source needs to be recycled & reuse to convert them into useful resources & hence needs to be treated well. Huge amount of waste generated through different sources are burden over our resources, occupying huge amount of land area and polluting our environment by emitting harmful gases. Construction industries provide a wide platform in reusing these waste materials as an alternative of some conventional materials. These materials inhibit identical properties as that of conventional materials and thus can be used as substitute materials in production of concrete. Jute fibers & other waste fiber were also found useful in providing tensile strength to concrete in previous studies. In present investigation, properties of plain cement concrete with Jute Fiber i.e. at 1%, 2% & 3% were investigated.

Keywords- Jute fiber, P.C.C, Fiber concrete, Natural fiber.

I. INTRODUCTION

From centuries back, the early people began to use composite materials and it all started with natural fibers. Later on, the natural fiber lost much of its absorption to the advantage of more durable construction materials like metals. During the last period, since the importance of the environmental aspect, there has been a renewed interest in the natural fiber taking into account the ecological advantages of using renewable resources. Natural fiber composites have found applications as nonstructural materials, especially in the packaging, transportation and building industries.

Concrete is an important construction material. Concrete is weak in tension. So, the improvement of the tensile strength of concrete is necessary. In conventional practice the horse hair, steel fiber etc are used to improve the characteristics of concrete. This research work mainly deals with fiber-reinforced concrete i.e. with jute as a fiber reinforcing material in concrete. Usage of natural fibers in a relatively brittle cement matrix has attained significant toughness and strength of the composite. In present investigation, properties of plain cement concrete with Jute Fiber i.e. at 1%, 2% & 3% were investigated.

II. EXPERIMENTAL INVESTIGATION

2.1 Materials and Method

- Cement used is "UltraTech 53 grade ordinary Portland cement" conforming to IS: 8112 was used. The cement was tested in accordance to test methods specified in IS: 4031 and results obtained are shown in Table 1.
- The material which is passing through 4.75 mm sieve is known as fine aggregate. Locally available natural river sand was used as the fine aggregate. The fine aggregate was used in this study conforming to IS: 383-1970.
- The material which is retained on 4.75 mm sieve is known as coarse aggregate. Locally available coarse aggregate having average size of 20 mm was used in this study confirming to IS: 383-1970.
- Jute fibers are extracted from the ribbon of the stem. When Harvested the plants are cut near the ground with a sickle shaped knife. The small fibers, 5 mm, are obtained by successively retting in water, stripping, beating, the fiber from the core and drying. A single jute fiber is a three dimensional composite composed mainly of lignin, cellulose, hemicelluloses with minor amounts of protein, extractives and inorganic.
- The quality of water is important because contaminants can adversely affect the strength of concrete and cause corrosion of the steel reinforcement. Potable tap water was used in this study for mixing and curing.

2.2 Mix Design

Mix design is the process of selecting suitable ingredients of concrete and determining their relative quantities for producing concrete of certain minimum properties as strength, durability and consistency etc., as economical as possible. The mix design has been done for concrete of grade M-20

2.3 Casting and Curing of Concrete Specimens

The concrete specimens such as cubes of size 150 mm × 150 mm × 150 mm, cylinders of 150 mm diameter and 300 mm height, prisms of size 500 mm × 100 mm × 100 mm are casted as per the standards with different jute contents such as 1%, 2%, and 3%.

The casted specimens are then cured for different periods of 7 and 28 days.



2.4 Testing of Concrete Specimens

After the curing period is completed, the specimens are tested for the following tests:

- a) Compressive strength of Concrete:
The concrete and JFC cube specimens of size 150 mm × 150 mm × 150 mm are tested for compressive strength as per Sec. 5 of IS:516 –1959.
- b) Flexural strength of Concrete:
The concrete and JFC prism specimens of size 500 mm × 100 mm × 100 mm are tested for the flexural strength as per Sec. 8 of IS: 516–1959.
- c) Split tensile strength of Concrete:
The concrete and JFC cylinder specimens of size 150 mm diameter and 300 mm height are tested for the split tensile strength as per IS: 5816 - 1999.

III. LITERATURE REVIEW

[1] **Mohammad Zakaria, Mashud Ahmed, Md. Mozammel Hoque and Shafiqul Islam (2016)** conducted an experimental investigation of the compressive, flexural, and tensile strengths of Jute Fiber Reinforced Concrete Composites (JFRCC) have been conducted. Cylinders, prisms, and cubes of standard dimensions have been made to introduce jute fiber varying the mix ratio of the ingredients in concrete, water-

cement ratio, and length and volume of fiber to know the effect of parameters

[2] **Priyanka Goel, Mohd. Usman, Sandeep Panchal (2017)** studied the effect of jute fiber reinforcement on the strength and ductility properties of concrete. Flexural and compression characteristics of the fiber reinforced concrete were measured experimentally.

[3] **Tara Sen , Ashim Paul(2014)** they carried out experimental investigation on the confinement strength and confinement modulus of concrete cylinders confined using different types of natural fiber composites and a comparative performance analysis with different artificial fiber based composite materials.

[4] **Bharti Sharma, Vijay Kumar Shukla, Amarnath Gupta (2016)** in this experiment they used coconut jute are used as fiber in M20 grade of concrete specially check their effect on flexural strength of concrete.

[5] **Pooja Warke and Shrinkhala Dewangan(2016)** conducted study to investigate the properties of concrete by using of jute fiber. Different percentages of jute fiber are used in concrete as 0.2%, 0.3%, 0.4% volume of concrete and analyze the property of concrete. The compressive test was carried out at concrete ages of 7 and 28 days.

IV. RESULT

Taking the compressive test, split tensile strength and flexural test on plain cement concrete. And taking these test after adding the jute fiber in 1%, 2%, 3% proportion. All readings are noted and compare them in the form of graph shown below.

Table 1: Compressive strength & Flexural strength test result for M20 (P.C.C) & Jute Fiber Concrete.

Description	Fiber Content (in %)	Compressive Strength (in MPa)				Flexural Strength (in MPa)			
		7days	Avg. for 7 days	28 days	Avg. for 28 days	7days	Avg. for 7 days	28 days	Avg. for 28 days
P.C.C	0	15.10	16.49	22.90	22.41	2.9	3.0	4.0	4.26
P.C.C	0	16.06		21.22		3.1		4.3	
P.C.C	0	18.31		23.11		3.0		4.5	
JFC – A1	1	17.90	17.54	24.23	25.53	3.6	3.6	4.9	4.56
JFC – A2	1	16.12		25.54		3.5		4.5	
JFC – A3	1	18.60		26.82		3.7		4.3	
JFC – B1	2	16.90	15.88	24.65	23.44	3.1	2.86	4.1	3.76
JFC – B2	2	15.65		23.56		2.9		3.9	
JFC – B3	2	15.10		22.12		2.6		3.3	
JFC – C1	3	14.57	14.44	20.99	21.66	2.7	2.53	3.6	3.30
JFC – C2	3	15.01		21.61		2.5		3.3	
JFC – C3	3	13.88		22.40		2.4		3.0	

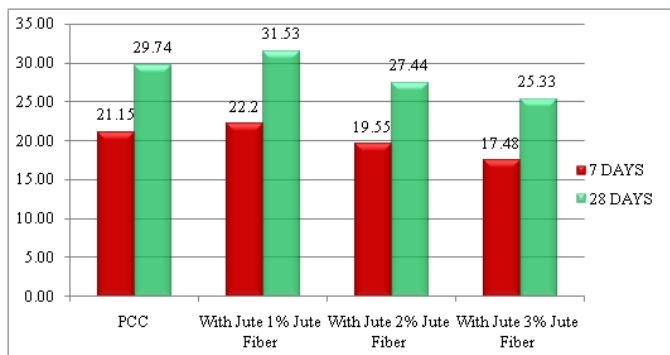


Fig 1. Comparison of compressive strength

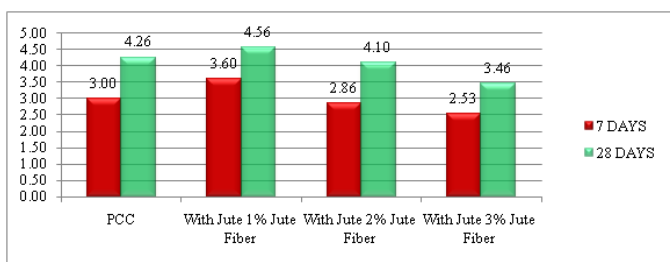


Fig 2. Comparison of Flexural strength

Table 2 :split tensiletest result for M20 (P.C.C) & Jute Fiber Concrete.

Description	Fiber Content (in %)	Split Tensile Strength (in MPa)			
		7days	Avg. for 7 days	28 days	Avg. for 28 days
P.C.C	0	2.08	1.99	3.45	3.48
P.C.C	0	1.97		3.32	
P.C.C	0	1.94		3.68	
JFC – A1	1	2.43	2.41	3.62	3.41
JFC – A2	1	2.49		3.21	
JFC – A3	1	2.33		3.42	
JFC – B1	2	2.63	2.58	3.90	3.72
JFC – B2	2	2.51		3.54	
JFC – B3	2	2.60		3.73	
JFC – C1	3	2.31	2.22	3.25	3.28
JFC – C2	3	2.22		3.48	
JFC – C3	3	2.13		3.12	

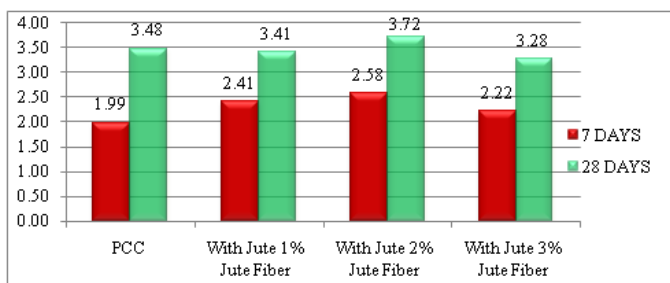


Fig 3. Comparison of split tensile strength

V. CONCLUSION

The influence of volume fraction of jute fibers on mechanical properties such as compressive strength, flexural strength and split tensile strength of concrete of mix proportion 1:1.5:3 with w/c ratio as 0.5. Based on the experimental analysis, the following conclusions are made

- (1) Compressive strength of cement mortar decreases with increase in jute loading.
- (2) For a constant w/c ratio i.e. 0.5, increase in the content of jute fibers, the workability of concrete decreases. Admixtures are required to enhance the workability properties of JFC.
- (3) Early age of compressive strength of concrete i.e. at 7 and 28 days, decreases with increase in jute content.
- (4) Flexural strength and split tensile strength of concrete increases up to 1% of jute loading and decreases with further increment.
- (5) Hence, it is proved that modified replacement proportion is beneficial to use in practice as it gives workable concrete with more compressive, flexural and tensile strength.
- (6) It was observed that it is difficult to mix or spread jute in concrete also it is difficult to maintain water cement ratio.

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