

Evaluating the Performance of Jute Fiber in Concrete

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Abstract – The objective of these studies to investigate the properties of concrete by using of jute fiber. Different percentage of jute fiber is 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. As the different proportion of the jute fiber is mixed with concrete and cast cube. Final strength of cube were casted for 7 days and 28 days curing. Compressive testing machine is used for testing of the compressive strength of concrete cube. Improving the strength of the structure using Jute fiber as the raw material in construction .Jute fiber is 100% bio-degradable and recycle-ed and thus environmentally friendly with moisture content of 12.6%.Using of jute fiber as a natural fiber in concrete .Jute fiber increases the property of concrete such as compressive strength and bending strength, greater resistance to cracking and hence improved impact strength and toughness. This purpose, M20 grade concrete was selected. In concrete use of jute fiber in a suitable combination may potentially not only improve the overall property of concrete, but may also result in performance synergy.

Keywords: Natural fiber, Concrete, Compressive strength, Ultra Pulse Velocity

I. INTRODUCTION

The main object of this project to analyze the property of concrete use of natural fiber such as a jute fiber. Jute fiber has high impact strength besides having moderate tensile strength and flexural strength as compared to other lignocellulosic fiber. With using jute fiber in concrete, concrete gain high amount of tensile strength good fatigue and corrosion resistance. Jute fiber reduces plastic shrinkage and drying shrinkage. Addition of jute fiber in concrete enhances greater resistance to cracking.

A. Jute Fibers -

Jute fibers are extracted from the ribbon of the stem. When Harvested the plants are cut near the ground with an 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.

These fibers were designed, after millions year of evolution, to perform, in nature, in a wet environment. Nature is programmed to recycle jute, in the timely way, back to basic building blocks of carbon dioxide, and water through biological, thermal, aqueous, photochemical, chemical, and mechanical degradation. Presently, the application of natural fiber composites is fairly studied in conditions of dimensional constancy under moist and high thermal. Natural fibers like cotton, sisal, jute, abaca, pineapple and coir have already been studied like as reinforcement and filler in composites. Among the various natural fibers, jute fiber is considered as very high strength and stiffness.

Properties of the fiber are as follows:

Specific gravity	1460 kg/m ³
Water absorption	13 %
Tensile strength	400-800 Mpa
Stiffness	10-30 KN/mm ²

B. Types of Natural Fiber

1. Coir fiber
2. Jute fiber
3. Sisal fiber
4. Banana fiber
5. Sun hemp fiber
6. Kenaf fiber

C. Role of Natural Fiber

1. Crack resistance
2. Decrease plastic and drying shrinkage
3. Improve compressive and bending strength
4. Improve split tensile strength
5. Decrease workability



Figure 1: Jute Fiber

II. EXPERIMENTAL WORK

A. Materials

a. Cement

Cement	Jaypee PP cement
Specific gravity	3.150
Fineness of cement	1.13 %
Normal consistency	32 %
Initial setting time of cement	85 minutes
Final setting time of cement	320 minutes
Soundness of cement	2 mm
Compressive strength of cement (7 days curing)	340 kg/cm ²

b. Aggregate

The maximum nominal size of aggregate is taken as 20 mm.

Size	20 mm
Specific gravity	2.698
Bulk Density loose	1.380 kg/liter
Compacted dry	1.560 kg/liter
Surface moisture content	NIL
Water absorption	0.77%

c. Admixture

Admixtures are used to improve the behavior of concrete under a variety of conditions. Chemical admixtures reduced the cost of construction, modify properties of hardened concrete, ensure quality of concrete during mixing transportation placing curing and overcome during concrete properties.

Admixture used in concrete:-

Sikkament FF (D)

Sikkament FF (T)

In all, 4 batches of concrete were made of M20 grade with a constant W/C and admixture content, by varying the proportions of jute fibers. They are designated as follows: Mix proportion for M20 grade of concrete by using IS 456:2000 and IS 10262:2009 and IS 2386

Taken water cement ratio 0.50%

Cement	334 kg/m ³
Coarse aggregate	1273.98 kg/m ³
Fine aggregate	881.7 kg/m ³
Water	150 liter

B. Designation of Trial Mixes

SN	Mix Designation	Jute fiber %
1	M1	0%
2	M2	0.2%
3	M3	0.3%
4	M4	0.4%

III. RESULT AND DISCUSSION

In all, 4 batches of the concrete were made (4 of M20 grade) with a constant W/C and admixture content, by varying the proportions of jute fibers of compressive strength of concrete at 7 days and 28 days.

S N	MI X	GRA DE	3 Days Compressive strength	7 days Compressive Strength	28 days Compressive Strength
1	M1	M20	5.56	13.87	21.3
2	M2		9.78	21.5	25.6
3	M3		9.03	19.7	23.8
4	M4		6.70	15.08	21.4

Compressive strength of concrete is tested on cube at different percentage of jute fiber content in concrete by weight of cement. The strength of concrete has been tested on cube at 3 days, 7 days and 28 days. 7 days test has been conducted to check the gain in initial strength of concrete at 7 days curing and 28 days. 7 days strength test has been conducted to check the gain in initial strength of concrete. 28 days test gives data of final strength of concrete at 28 days curing. Compression testing machine is used for testing the compressive strength of concrete.

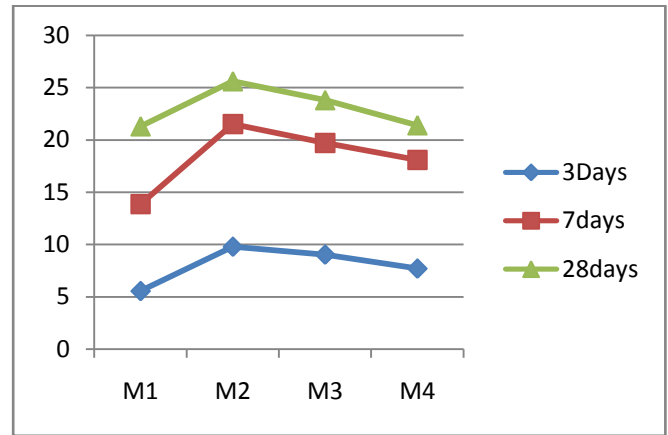


Figure 2: compressive strength test at 3 days, 7 days & 28 days.

A. Ultra Pulse Velocity

The concrete performance is influenced by some building variable, such as: the water/cement ratio, the aggregate type and size, the humidity and the cement type. This variables affect directly the compressive strength and make difficult the identification of the concrete properties. Focusing on it, the ultrasonic tests allow estimating a correlation between the variables and the compressive strength

MIX	Reading before compressive strength (km/sec)	Reading after compressive strength (km/sec)
M1	4	2.1
M2	5.7	3.4
M3	5.8	4.1
M4	6.7	4.7

CONCLUSION

The following conclusions have been drawn from the above observations:

1. With the inclusion of jute fiber the compressive strength of concrete gradually increases up to a certain limit but the gradually decreases.
2. The addition of jute fibers increased compressive strength higher with the 0.2% fiber-cement ratio and little decreases compressive strength with 0.3% fiber-cement ratio and 0.4% fiber cement ratio of compressive strength little decreases as compared to 0.3% of fiber-cement ratio.
3. As the percentage of jute fiber cement ratio increases, sudden failure, brittle failure and cracking is avoided.
4. With increasing of fiber cement ratio is tending to no voids in concrete through thoroughly compacted and proper binding of fiber cement and aggregate.
5. By the ultra pulse velocity it is obtained fiber has crack resisting properties after the crack grate bonding which gives the excellent grade quality of concrete.
6. Thus we found out by Ultra pulse velocity, higher percentage of jute fiber-cement ratio gives greater value of ultra pulse velocity before and after compressive strength of concrete.
7. Fiber -cement ratio of 0.2% gives highest compressive strength and 0.4% fiber cement ratio gives highest ultra pulse velocity value (km/sec).

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