

Analysis of Concrete using Jute Fiber by Non Destructive Testing

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Abstract— The characteristics of fiber reinforced concrete are changed by the alteration of certain factors: type and quantity of fibers, geometric configuration, dispersal, direction, and concentration. India is a developing country and in various developing countries like India economical construction along with economical construction material plays a vital role in the development of country. Waste material in construction can play tremendous role to make it economical and durable due to some of its specific properties relevant to construction materials. This study shows experimental study on utilization of jute fibers as fiber reinforcement in concrete. Jute fiber is a natural fiber. In this project jute fibers are added in concrete by weight of cement in the proportion of 0.5%, 1%, 1.5%, 2% and 2.5%. Non-destructive test like rebound hammer test is performed on concrete cubes after 7 and 28 days of curing and also to validate the results compressive strength is also performed on the concrete cubes.

Key words: Jute Fiber, Concrete, Rebound hammer test, compressive strength, workability

I. INTRODUCTION

India is one of the large jute producing country. Jute is an important bast fibre with a number of advantages. Jute has high specific properties, low density, less abrasive behavior to the processing equipment, good dimensional stability and harmlessness. Jute textile is a low cost eco-friendly product and is abundantly available, easy to transport and has superior drapability and moisture retention capacity. It is widely being used as a natural choice for plant mulching and rural road pavement construction. The biodegradable and low priced jute products merge with the soil after using providing nourishment to the soil. Being made of cellulose, on combustion, jute does not generate toxic gases. 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. 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.

II. METHODOLOGY

natural crushed coarse aggregate and natural sand as fine aggregate along with OPC cement of grade 43 is used, jute fiber is used in wet form and of length 40-50mm. according to IS 10262:2009 M40 concrete is designed for this project, 150*150*150 mm cubes is casted for this project to perform test like rebound hammer and to validate its results compressive strength test is performed, slump cone test is also performed on fresh concrete to check workability of the concrete mix. Mix designation of the concrete mix is given in table 1.

Material	Content	Mix Name
--	00%	ST
Jute Fibers	0.50%	T1
	1.00%	T2
	1.50%	T3
	2.00%	T4
	2.50%	T5

Table 1: Mix Designation of Concrete

III. RESULTS AND DISCUSSION

The rebound hammer test results for concrete prepared from coconut husk and jute fiber is given in this section. The rebound hammer gave the rebound number which was then correlated with correlation charts to give an estimate of compressive strength. It should be noted that this is only an estimate of compressive strength of concrete which also depends on various factors like condition of rebound hammer, temperature, pressure, usage etc. It is recommended to calibrate the rebound hammer test with previously known results on a sample or other. The compressive strength results based on rebound hammer for concrete prepared from coconut husk are shown in Table 2. The results in the form of Figs which clearly show comparison of 7 days and 28 days is given in Fig 1 and Fig 2 shows the Figical difference of compressive strengths. To validate these results compressive strength test is also performed on crushing strength testing machine and its results is given in table 3 and Fig 3-4 and comparison study is also done on the compressive strength result came out from rebound hammer test and also crushing strength testing machine and its comparison is given in Fig 5. To check workability of the concrete mixes slump cone test is performed on the fresh concrete mix, result of slump cone test is given in table 4 and Fig 6.

S. No.	Mix Name	Average Compressive Strength (Mpa)	
		7 Days	28 Days
1	ST	33.352	48.573
2	T1	35.155	50.11
3	T2	36.425	51.69
4	T3	34.475	49.88
5	T4	33.725	48.4
6	T5	32.645	47.68

Table 2: Results from rebound hammer test for Jute fiber

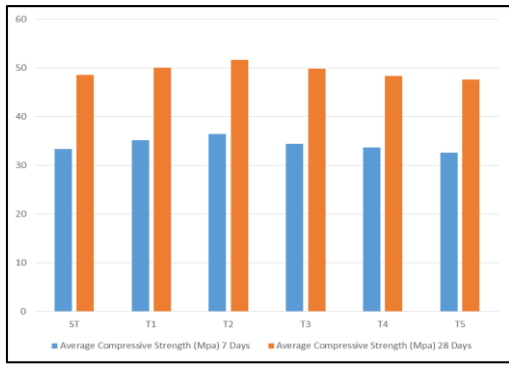


Fig. 1: compressive strength obtained from rebound hammer test for Jute fiber

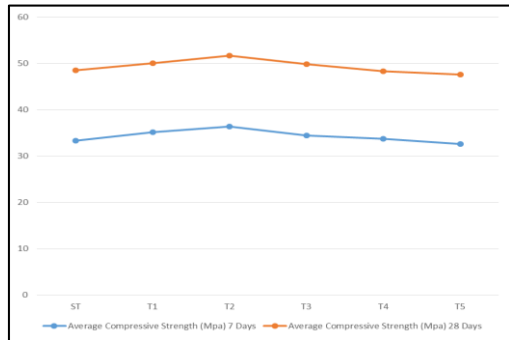


Fig. 2: Comparison of rebound hammer test results for Jute fiber

S. No.	Mix Name	Compressive Strength (Mpa)	
		7 Days	28 Days
1	ST	34.55	49.67
2	T1	37.05	51.87
3	T2	38.32	53.45
4	T3	36.37	51.64
5	T4	35.62	50.16
6	T5	34.54	49.44

Table 3: compressive strength test result obtained from cube testing for jute fibers

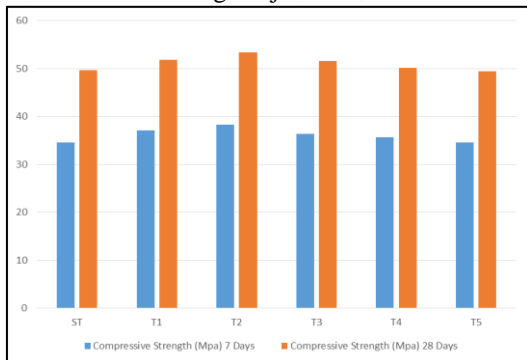


Fig. 3: Compressive strength results for jute fibers

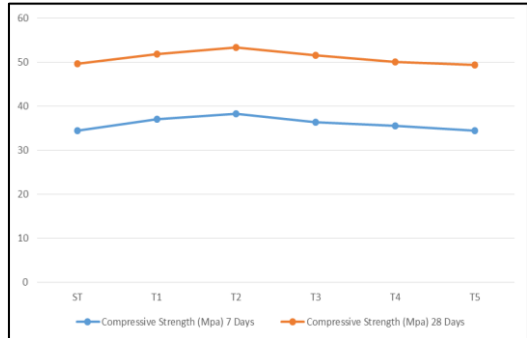


Fig. 4: compressive strength result for jute fibers

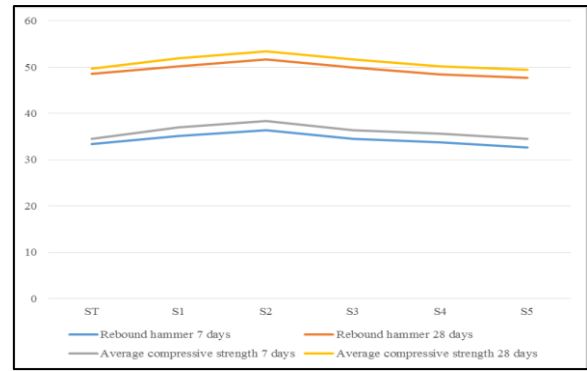


Fig. 5: Comparison of results for jute fiber

S. No.	Mix Name	Slump (mm)
1	ST	93
2	S1	75
3	S2	71
4	S3	64
5	S4	63
6	S5	60

Table 4: Slump test results for jute fiber

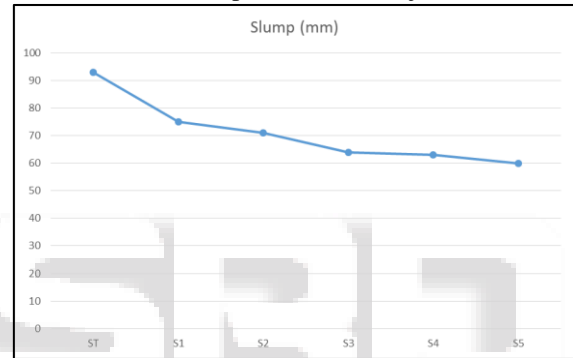


Fig. 6: Slump test results for jute fiber

IV. CONCLUSION

Study has been carried out on the concrete cubes which contains jute fiber from 0.5% to 2.5% by weight of cement, it has been observed that Jute fibers also increases the compressive strength of the concrete, when jute fiber added in concrete, concrete compressive strength is going on increases when jute fiber is added as fiber reinforcement, optimum percentage which is obtained by adding jute fiber is 1.00%, but its 0.5%, 1.5% and 2% mix give better compressive strength than conventional concrete, optimum percentage mix i.e. T2 possess compressive strength is 51.69Mpa. All these result is obtained by performing one of the non-destructive test method i.e. rebound hammer test, and all these results is validate by compressive strength test by crushing strength machine, which gives higher values of compressive strength as compare rebound hammer test. Slump cone test is also performed on the fresh concrete to evaluate the workability of the concrete, results shows that both of the fiber decreases the workability of the concrete, so that to match up the workability of the concrete superplasticizer can be added.

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