Non Destructive Analysis of Concrete using Coconut Husk

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Abstract— Concrete reinforcement technology is not new and fibers have been used for reinforcement since ancient times. Popular fibers are made up of steel and glass, while plastic and nylons have a limited use. Quantities, concentration, and dispersal influence the properties of fiber reinforced concrete. Fiber reinforced concrete is a type of concrete that includes fibrous substances that increase its structural strength and cohesion. Fiber reinforced concrete has small distinct fibers that are homogeneously dispersed and oriented haphazardly. Fibers used are steel fibers, synthetic fibers, glass fibers, and natural fibers. 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. In this project coconut fibers are added in concrete by weight of cement in the proportion of 0.5%, 1%, 1.5%, 2% and 2.5%. Nondestructive 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: Coconut Husk, Concrete, Rebound hammer test, compressive strength

I. INTRODUCTION

Concrete is a composite material composed of basic ingredients, cement, sand, aggregate and water. Often, additives and reinforcements (such as rubber) are used with concrete to reach the desired physical attributes of the completed fabric. When these elements are combined together, they constitute a liquid volume that is easily mounded into required form. When cement comes in contact with water, it start exothermic reaction which forms a hard matrix and binds the rest of the elements together into a durable rock-similar fabric, which holds many functions. Reinforcement usually adds rigidity and greatly resists cracking propagation. Thin fibers can cause very high tensile strength if used with proper ratio and provided they are mechanically well attached to the matrix, these can improve the concrete's overall properties greatly. Fiber reinforced concrete is defined as concrete, prepared with hydraulic cement, sand and aggregate and discontinuous discrete Fibers. The Fibers can be developed from natural stuff (e.g. Asbestos, sisal, cellulose) or a made up product like glass, steel, carbon, polymer (e.g. Polypropylene, keviar). The purposes of reinforcing the cement-based matrix with Fibers is to increase the tensile strength by holding up the growth of cracks and to increase the staying power by transmitting stress across a cracked section so that much larger deformation is possible beyond the peak stress (than without Fiber reinforcement). Fiber reinforcement improves the impact force, fatigue strength and also reduces shrinkage of concrete. The quantity of Fibers used is real low, typically 1 to 5 per cent by volume, and to render its effectiveness as reinforcement, the tensile strength, elongation at failure and modulus of elasticity of the Fibers should to be substantially higher than the corresponding attributes of the ground substance.

II. METHODOLOGY

OPC of grade 43 cement is used in this project along with natural crushed coarse aggregate and natural sand as fine aggregate, coconut husk fiber is used to reinforced the concrete and these fiber used in this is of length 40-50mm and in wet condition. Mix design of M40 concrete is done as per IS 10262: 2009, mix designation of concrete is given in table 1. 15*15*15 cm cubes is casted and curing is done in clean and at room temperature. On concrete cubes rebound hammer test is performed and to validate these results compressive strength test is performed, slump cone test is also performed on fresh concrete to check its workability.

Material	Content	Mix Name
--	00%	ST
Coconut Husk	0.50%	S1
	1.00%	S2
	1.50%	S3
	2.00%	S4
	2.50%	S5

Table 1: Mix Designation of Concrete

III. RESULT AND DISCUSSION

This section gives results and discussion of various experimental tests performed on concrete prepared with different fibers. The major property of concrete which governs its application in real life is its compressive strength. The concrete is required to have enough compressive strength so that it could efficiently support all the loads acting on it throughout the entire life of structure. In present scenario, there is a growing interest in non-destructive testing of material. Hence, in this dissertation, compressive strength of concrete is calculated through both conventional method of cube testing and rebound hammer test. A comparison of results obtained from both method is also done to check reliability of test results obtained from rebound hammer test.

A. Rebound Hammer Test

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 Fig. s which clearly show comparison of 7 days and 28 days is given in Fig. 1 and Fig. 2 shows the Fig. ical difference of compressive strengths.

S. No.	Mix Name	Average Compressive Strength (Mpa)	
		7 Days	28 Days
1	ST	33.352	48.573
2	S1	34.692	48.983
3	S2	26.142	46.423
4	S3	25.292	43.273
5	S4	24.472	42.873
6	S5	23.572	42.223

Table 2: Results from rebound hammer test for coconut husk

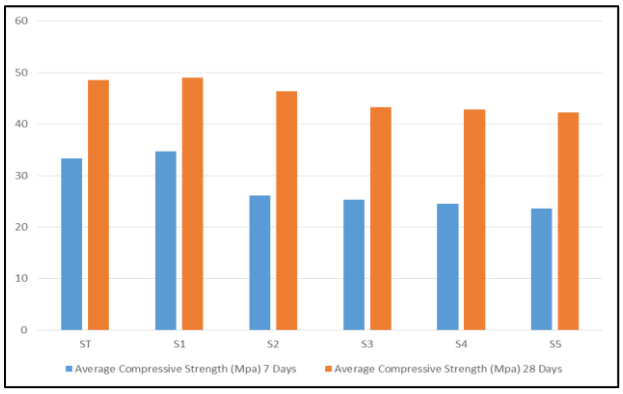

Fig. 1: Compressive strength obtained from rebound hammer test for Coconut husk

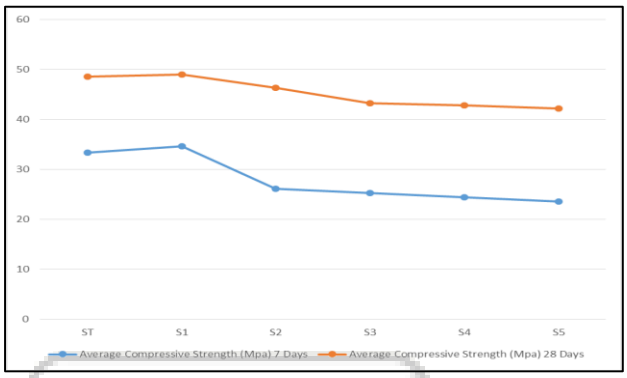

Fig. 2: Comparison of rebound hammer test results for coconut husk

B. *Compressive Strength Test*

In addition to compressive strength from rebound hammer, the compressive strength is also obtained from testing of cubes by crushing them in compression testing machine. Table 3 shows compressive strength results and it has been observed that likewise rebound hammer test, compressive strength also gives results in same pattern, but compressive strength test by crushing strength machine give higher than rebound hammer test.

S. No.	Mix Name	Compressive Strength (Mpa)	
		7 Days	28 Days
1	ST	34.55	49.67
2	S1	35.89	50.08
3	S2	27.34	47.52
4	S3	26.49	44.37
5	S4	25.67	43.97
6	S5	24.77	43.32

Table 3: compressive strength test result obtained from cube testing for coconut husk

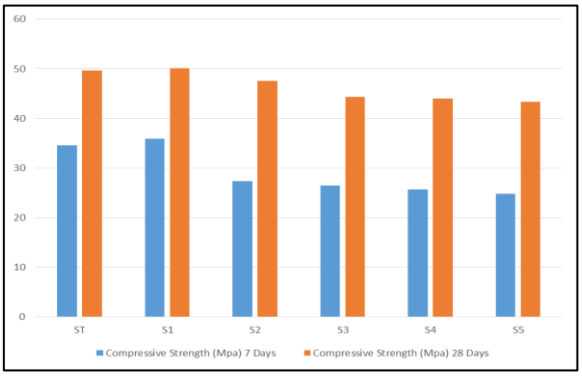

Fig. 5: Compressive strength results for coconut husk

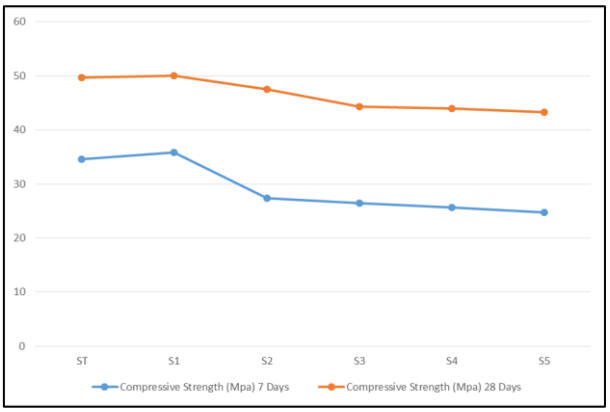

Fig. 6: Compressive strength result for coconut husk

C. *Comparison of NDT results with conventional results*

The comparison of non-destructive testing results with that of conventional concrete is given in this section. The comparison of concrete with coconut fiber is shown in Fig. 9. The comparison shows that results of NDT are in excellent agreement with that of conventional testing method based on concrete cubes.

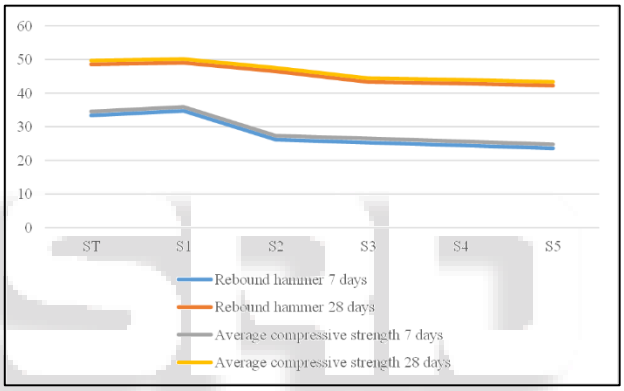

Fig. 9: Comparison of results for coconut husk

D. *Slump Cone Test*

The slump test results are obtained by testing the concrete in slump test apparatus. The slump test result for coconut husk based concrete is shown in Table 4 and Fig. 11.

S. No.	Mix Name	Slump (mm)
1	ST	93
2	S1	87
3	S2	86
4	S3	73
5	S4	67
6	S5	64

Table 4: Results from rebound hammer test for coconut husk

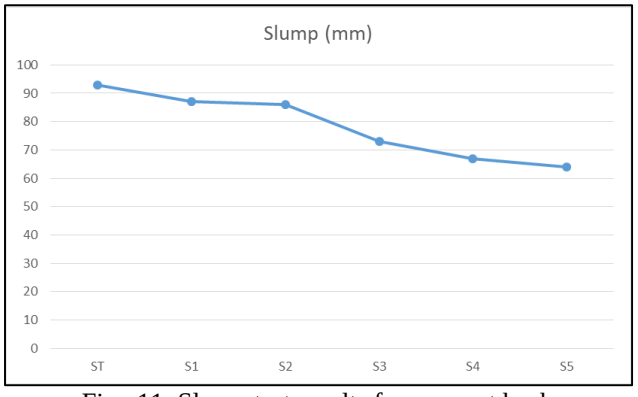

Fig. 11: Slump test results for coconut husk

IV. CONCLUSION

Study has been carried out on the concrete cubes which contains coconut husk from 0.5% to 2.5% by weight of cement, it has been observed that coconut husk increases compressive strength when coconut husk is added as reinforced fiber in concrete up to 0.5%, then coconut husk decreased compressive strength when it is compared to normal concrete. Normal concrete gives compressive strength 48.57Mpa after 28 days of curing, 0.5% mix of coconut husk possess compressive strength of 48.98Mpa after 28 days of curing. Optimum percentage of coconut husk which can added in concrete as reinforcement is 0.5%, but designed concrete is M40 so that all the mixes of the coconut husk is useable. 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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