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An Experimental Study on Addition of the Natural Fibers Into Concrete

[1] Rahul Kudtarkar, [2] Asst. Prof. Vaibhav R. Shirodkar
[1][2] Girijabai Sail Institute of Technology Karwar

Abstract:- **Concrete is a man made material used in construction of buildings, industrial structures, highway and bridges etc. which is a mixture of cement, aggregates and water in required proportion. The addition of coconut-fibers significantly improved many of the engineering properties of the concrete, compression strength and tensile strength. Basically natural fibers are of two types. Natural inorganic fibers such as Basalt, Asbestos…etc and the other are the natural organic fibers such as coconut, palm, kenaf, jute sisal, banana, pine, sugarcane, bamboo..etc. When coconut fiber was added to plain concrete, the compressive strength and tensile strength increased (by up to about 25%) as well as the energy-absorbing capacity, but there is an optimum weight fraction (0.5% by weight of cement) beyond which the compressive strength and tensile strength started to decrease again.**

Keywords: **Compressive strength, Split Tensile Strength, Coconut Fibers, Mix Proportion.**

I. INTRODUCTION

Utilization of natural fibers as a form of concrete enhancement is of particular interest to less developed regions where conventional construction materials are not readily available or are too expensive. Since concrete is weak in tension and flexure, most commonly, it is considerable efforts have been made world-wide to add various types of fibers to concrete so to make it more strong, durable and economical.

Natural fiber such as coconut fiber has certain physical and mechanical characteristics that can be utilized effectively in the development of reinforced concrete material. In most cases, these coconut fibers are dumped as agricultural waste, so can be easily available in large quantity hence making them cheap. In plain concrete and similar brittle materials, structural cracks develop even before loading due to drying shrinkage and other causes. When load is applied the internal cracks propagate and open up due to stress and additional cracks are formed. The development of this cracks is the cause of inelastic deformation in concrete. The addition of small closely spaced and uniformly dispersed fibers to concrete can act as a crack arrester and improves its static and dynamic properties. This is known as fiber reinforced concrete, which can also be defined as the concrete containing fibrous materials which increases its structural performance.

The objectives of present study are

1. To determine the improvement in tensile strength of concrete after addition of coconut fibers.
2. To compare the effect on workability and compressive strength due to the addition of coconut fibers.
3. To provide an alternative light weight material.
4. To evaluate the performance of coconut fiber reinforced concrete in reducing cracking.

II. MATERIALS AND METHOD

Cement : In this experiment, 43 grade ordinary Portland cement (OPC) with brand name Ultra tech cement was used for all concrete mixes. The testing cement was done as per IS 8112:1989. The specific gravity of cement was found to be 3.10.

Fine Aggregate : The sand used for the experimentation was locally produced and was confined to zone-II. The specific gravity of fine aggregate was found to be 2.61. The testing of fine aggregate was done as per IS 383:1970.

Coarse Aggregate : The coarse aggregate used in this experimentation where 20mm and 10mm size and was confirming IS 383:1970. The specific gravity was found to be 2.67.

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Water : The water used was clean and free from oils, salts and acids. The portable water available in the laboratory was used for the casting all specimen in this investigation. The quality of water was found to satisfy the requirement of IS 456:2000

Coconut Fiber : Coconut fiber which is obtained from the fibrous husk of the coconut from coconut palm which belongs to palm family. Average diameter of fiber 0.0220 cm the average length of fiber is almost 25 cm after analyzing and referring the journals fiber was cut to 2.5cm.

Mix proportion : M40 grade of concrete with the mix ratio (1:1.67:2.39) was adopted with and water cement ration was 0.45. The fiber quantity in concrete was varied in 0.5%,1%,1.5% by weight of cement.

2.1 Test for Fresh Concrete

Slum test : slum test is used in this study to investigate the workability of the fresh concrete according to IS: 1199-1959.

Compaction Factor : compaction factor test for fresh concrete is done to determine the workability of fresh concrete by compacting factor test as per IS 1199-1959. The apparatus is used compacting factor apparatus.

2.2 Test for Hardened concrete

Compressive Strength Test : For the compressive strength test, the specimens of size 15cm X 15cm X 15cm cylinder specimen of length 30cm and diameter 15cm where casted and tested on compressive testing machine of capacity 2000KN as per IS 516:1959.

Spilt Tensile Strength of concrete : For the tensile strength the cylindrical specimens of size15cm diameter and length 30cm where cast spilt tensile test obtained by testing the specimen on CTM of capacity 2000KN as per IS 5816:1999

Mix proportion and water cement ration : A constant mix proportion of 1: 1.67:2.39 was used for all the sample tested. The water cement ration adopted was 0.45 and was kept constant for all the mixes.

III. FIGURES AND TABLES

Table 3.1 : Result of workability test.

Sl. No	Percentage of Fiber	Slump Value (mm)	Compaction Factor
1	0	110	0.85
2	0.5	105	0.82
3	1	95	0.80
4	1.5	90	0.78

Tabel 3.2 : Comparison of strength for 7,14 and 28 days

% of fibers	Compressive Strength in days		
	7 days	14 days	28 days
0	20.76	33.53	40.34
0.5	23.25	35.36	41.89
1	25.62	36.67	42.09
1.5	21.64	34.68	40.15
% of fibers	Split Tensile Strength in days		
	7 days	14 days	28 days
0	1.28	1.88	2.34
0.5	1.47	1.96	2.42
1	1.78	2.88	3.33
1.5	1.40	1.92	2.76

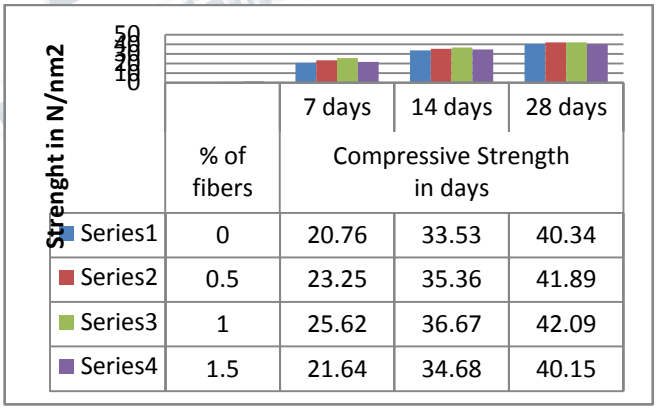

Fig 3.1 Comparison of Compressive Strength for 7,14 and 28 days

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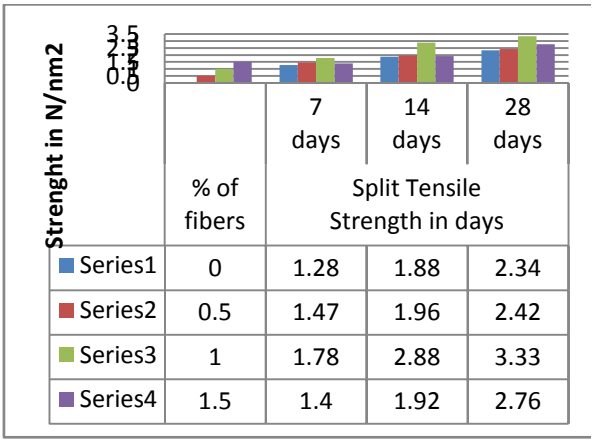

	% of fibers	Split Tensile Strength in days		
		7 days	14 days	28 days
Series1	0	1.28	1.88	2.34
Series2	0.5	1.47	1.96	2.42
Series3	1	1.78	2.88	3.33
Series4	1.5	1.4	1.92	2.76

Fig 3.2 Comparision of Split Tensile Strength for 7, 14 and 28 days

IV. CONCLUSION

The properties of Coconut fiber reinforced concrete compressive strength and split tensile strength of concrete is investigated experimentally using the standard procedures –

1. Maximum compressive strength is obtained with increase in the % of coconut fiber up to addition of 1% by weight of cement is 42.09N/mm^2.
2. Maximum Tensile Strength obtained with increase in the % of coconut fiber up to addition of 1% by weight of cement is 3.33 N/mm^2.
3. It is found that the compressive strength and tensile strength is the highest at 1% addition of fibers and reduces when % of fiber added exceeds beyond 1%.
4. The workability of coconut fiber has been found decreases with increase in coconut fiber replacement.
5. The result suggest that short coconut fibers are more effective in enhancing the performance of concrete.

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