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RESEARCH ARTICLE

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EXPERIMENTAL INVESTIGATION OF COCONUT FIBRE CONCRETE

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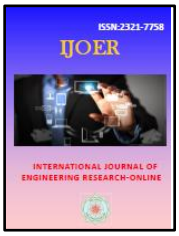


ABSTRACT

Coconut fibers are natural materials which are abundant in tropical areas. The West generated by industrial and agricultural processes has created problems of settlement and management which face serious challenges in the direction of environmental protection. A large amount of coconut fibers remains in the form of waste in the environment, so the use of these materials for construction will be an important step to improve sustainability and environmental fabrication. Apart from this, it will help to produce light weight and economically beneficial material in the construction field. The current study examined the suitability of the partial replacement of fine aggregate with coconut fibers. This paper reports the study of compressive strength, split tensile strength, flexible strength and workability of concrete. Volume mix grade of concrete was taken for the experimental study. Core fibers was used from 2.5% to 10% at the interval and replaced by fine aggregate. Strength was checked for 7 days and 28 days of curing period. A study was also done on economic aspects. The results obtained from above will be compared to conventional concrete of the same mixture.

Keyword: Compressive Strength, Experimental Investigation of Coconut Fiber Concrete, flaxural strength, Waste Disposal, Workability,

1. INTRODUCTION

Concrete is one of the most comprehensive and commonly used building materials in civil engineering worldwide. The common name of coconut fiber, the scientific name and plant family respectively are coir, *cocos nucifera* and Arecaceae respectively. Coconut fibers are agricultural waste products extracted from the outer shell of coconut and are available in large quantities in tropical areas, mostly in Africa, Asia and America. Core fibers are found between the hard inner cell and the outer coat of coconut. Concrete is a composite material made up of cement, fine aggregate, coarse aggregate and water mixed in a desired proportion based on strength requirements. Plain concrete is strong in compression and is weak in tension. Apart from this, coconut fibers are light from conventional coarse aggregate, resulting in concrete lightening. Therefore, to produce structural concrete in the construction industry, it can be used as a good replacement of coarse aggregate. In addition to the fibers in concrete, the crack will act as an inhibitor and tensile strength, cracking resistance, impact resistance and flexibility of concrete will be greatly improved. Reinforcement in concrete was released to increase tensile strength and flexibility of the members. Coconut Fiber Reinforced Concrete (CFRC) is an emerging area in the field of concrete technology. Typically, the use of economic ideas will direct the choice and quantity of fiber percentage. After the general increase in the population, the quantity and type of waste material have increased accordingly. Many of the non-wastewater waste materials will remain in the environment. Non-

wasting waste material causes waste disposal crisis, thereby contributing to environmental problems. The problem of waste accumulation exists throughout the world, especially in densely populated areas. Most of these materials are left in illegal form in stockpile, landfill or illegal areas.

2. MATERIALS AND METHODOLOGY

To study the effect of coconut fiber in the form of partial replacement of the fine aggregate in concrete, the cost of concrete, compressive strength of concrete and workability. The above 30 cubes of 150 mm was cast in the laboratory. Cubes using volume mix of 1: 1.5: 3 with different percentages of coconut fiber (0%, 2.5%, 5%, 7.5%, and 10%) to find the respective strength of conventional concrete at the end of 7 and 28 days of moist curing.

Materials used for the study

Cement: Cement In this experimental study, Pozzolana Portland Cement (P.P.C) of Prism brand obtained from single batches throughout the investigation was used. **Coarse Aggregate:** The coarse aggregate was locally available quarry, passing through 20mm sieve and retaining on 10mm sieve. **Water:** Water that is fit for drinking (potable) is used for mixing and curing. The water cement ratio (w/c) of 0.60 for volumetric ratio 1:1.5:3. **Coconut Fiber:** In this experimental study coconut fiber is provided by a local market from Allahabad, who sells different size of coconut fibere the size of core fiber used in this study 15 to 20mm and they provide tesile strengh in concreate. **Concrete:** Volumetric concrete mix isprepared in the ratio 1:1.5:3 Good stone aggregate and Natural River sand of Zone-II were used as coarse and fine aggregate respectively. Maximum size of coarse aggregate was 20 mm.

Methods that were followed for the Specimen Preparation

Volume Mix: Concrete was prepared volumetrically in the ratio 1:1.5:3, the water cement ratio was kept as 0.60.

Setting time: Concrete products were de- moulded 12 – 18 hours after the casting.

Mixing Process: The mixing is the most important process of concreting and is done as per the recommendations.

Even a small deviation can have a large influence on the workability of the wet concrete and so the properties and appearance of final composite 30 control specimens were cast to determine the compressive strength at 7 and 28 days respectively. The specimens were mix using a volume mix 1:1.5:3. Vibration of Moulds: In this process the moulds was vibrated in which the concrete mix was poured. The vibration process basically has two functions. It enables the mix to fill the mould completely and also helps in releasing the air trapped in the mix and allows compaction to take place. After the mould is completely filled, the excess concrete is removed which may interfere with de moulding when the concrete has set. The final towelling should be carried out when the concrete is green as it is easier to do this. De-Moulding: It took more time to de-mould, clean and re-apply release agent that it does to fill the mould. De-moulding should be carried out with lots of care. Concrete products should not be allowed to dry out after de-moulding before being put into curing. The mould was cleaned as early as possible after de- moulding it.

Release Agent: It was considered good to use little amount of release agent as possible. Only a thin film is necessary. Discoloration can be caused if there is an excess of release agent being collecting in the bottom of the mould. Release agent was applied by leavened sponges or cloths.

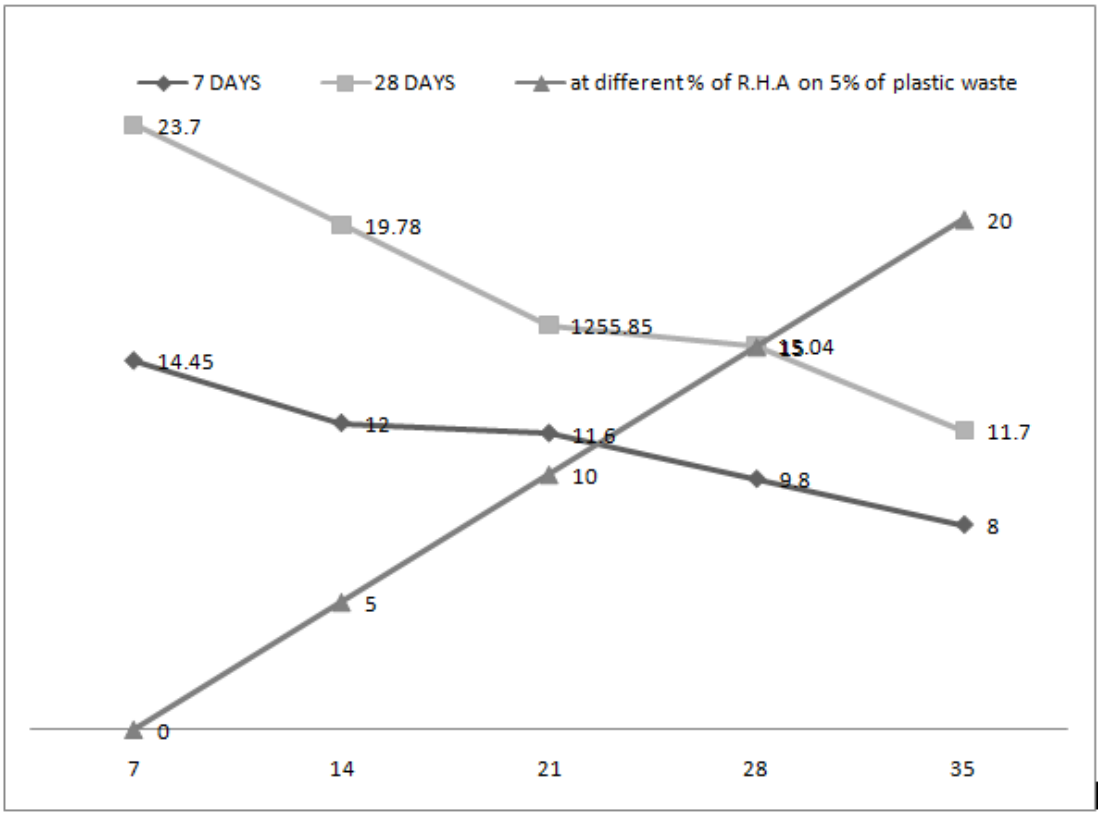
Curing: Concrete products with low water cement ratio can dry out rapidly before the complete hydration. The cement never achieves its full strength and thus the concrete properties are skeptically affected. To assure compete hydration, it was fundamental need that the products were kept damp immediately after de-moulding and during the period of curing. Several methods that are currently in use are storing it in a humid chamber or fog room, sealing in polythene bags, or by immersing it totally in the water.

3. RESULT

Compressive strength: Three set of cubes were casted for V1, V2, V3, V4, V5, with the replacement of aggregates by recycled coarse aggregate percentage 0, 2.5, 5, 7.5 and 10 for the time periods of 7 and 28 days with a water cement ratio of 0.60 and the results of the same are as follows.

Table 1: Compressive Strength of Coir Fiber Concrete (W/C=0.60)

S. No.	Cube Designation	Water Cement Ratio	Different % age of coir fibre	Average Weight (kg)	Average Compressive Strength At 7 days(N/mm^2)	Average compressive strength At 28 days(N/mm^2)	% Change in Strength
1	V1	0.55	0%	8.45	14.14	23.7	referral
2	V2	0.60	2.5%	8.43	15.56	23.11	-2.49%
3	V3	0.60	5%	8.28	10.66	15.55	-34.38
4	V4	0.60	7.5%	8.23	8.59	11.77	-50.33
5	V5	0.6	10%	7.43	6.29	6.81	-71.26

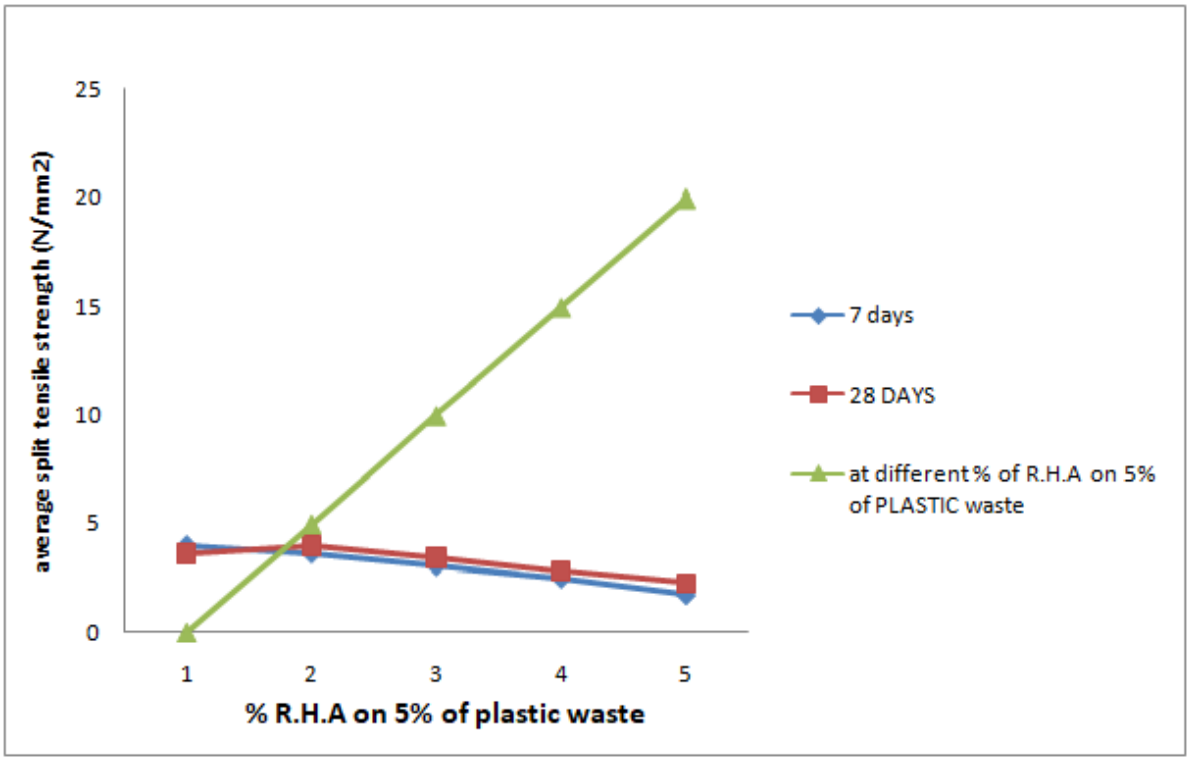


Flexural strength:

Three set of beams were casted for V1, V2, V3, V4, V5, with the replacement of aggregates by recycled coarse aggregate percentage 0, 2.5, 5, 7.5 and 10 for the time periods of 7 and 28 days with a water cement ratio of 0.60 and the results of the same are as follows

Table 2: Flexural strength of coir fiber concrete (W/C=0.60)

S. No.	Cube Designation	Water Cement Ratio	Different % age of coir fibre	Average flexural strength At 7 days	Average flexural strength At 28 days	% Change in Strength
1	V1	0.55	0%	0.16	0.22	Referral
2	V2	0.60	2.5%	0.11	0.18	-18.18
3	V3	0.60	5%	0.07	0.16	-26.36
4	V4	0.60	7.5%	0.06	0.17	-20.90
5	V5	0.60	10%	0	0	-100

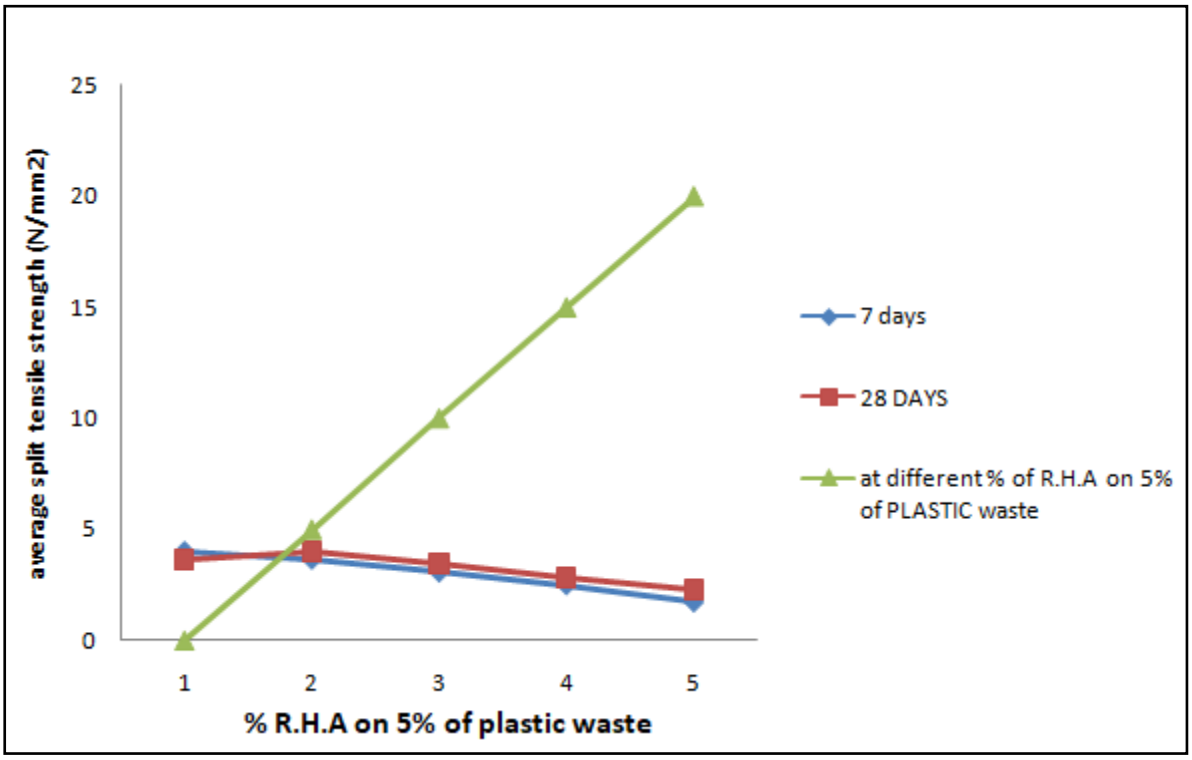


Split tensile strength:

Three set of cylinder were casted for V1, V2, V3, V4, V5 with the replacement of fine aggregates by coir fibre with the percentage 0, 2.5, 5, 7.5 & 10 for the time periods of 7 & 28 days with a water cement ratio of 0.60 and the results of the same are as follows:

Table 3: Split tensile strength of coir fibre reinforced concrete (W/C=0.60)

S. No.	cylinder Designation	Water Cement Ratio	Different % age of coir fibre	Average Weight	Average Split tensile Strength At 7 days	Average Split tensile strength At 28 days	% Change in Strength
1	V1	0.55	0%	1.5	2.96	3.59	Referral
2	V2	0.60	2.5%	1.42	1.88	2.17	-39.55
3	V3	0.60	5%	1.56	1.70	1.98	-44.94
4	V4	0.60	7.5%	1.30	1.23	1.79	-50.13
5	V5	0.60	10%	1.22	0.85	1.13	-62.95



Workability:

Three set of cubes were casted for V1, V2, V3, V4, V5, with the replacement of aggregates by recycled coarse aggregate percentage 0, 2.5, 5, 7.5 and 10 for the time periods of 7 and 28 days with a water cement ratio of 0.60 and the results of the same are as follows.

Table 3: Workability of core fiber concrete

Percentage of core fiber	Workability
0%	
2.5%	
5%	
7.5%	
10%	

CONCLUSION

From the experimental work carried out on "Coconut fiber", the following conclusion can be drawn:

1. Compressive Strength of coconut fibre concrete gets reduced by almost 72% with the addition of coconut fibre as compared to that of referral concrete.
2. Split Tensile Strength of coconut fibre concrete gets reduced by almost 62% with the addition of coconut fibre as compared to that of referral concrete.
3. Flexural Strength of coconut fibre concrete gets reduced by almost 27% with the addition of coconut fibre as compared to that of referral concrete.
4. Workability of coconut fibre concrete gets reduced due to absorption of water by coconut fibers.
5. Coconut Fibre concrete is not suitable for heavy concrete structures however it can be used for temporary structures and at rural areas.

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