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Strength Characteristics of Coconut Fiber reinforced concrete

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Abstract – *This paper presents the possibility of utilizing coconut fiber as a supplementary reinforcement material in concrete. Various fibers are used in concrete. Coconut fibers are easily available in large quantity and are also cheap. In this study experimental investigations are carried out to know the workability, compressive strength and split tensile strength of coconut fiber reinforced concrete. the cement was partially replaced with six percentages say 0%, 1%, 2%, 3%, 4%, 5% of coconut fiber by weight of cement. the compressive strength and split tensile strength of cured concrete is evaluated for 7days, 28 days. these results show that coconut fiber can be used In construction or not.*

Key Words: **Reinforcement, coconut fiber, concrete, compressive strength, split tensile strength.**

1. INTRODUCTION

As we know that concrete is the widely used construction material throughout the world. Concrete is weak in tension and flexure so it is reinforced with steel bars. Various types of fibres were used in concrete to make more strong, durable and economical. Naturally available fibre such as coconut fibre having physical and mechanical characteristics that can be used in the development of reinforced concrete material. These coconut fibres are easily available in large quantity with low cost. The goal of this paper is to study the properties of concrete by adding coconut fibres and to determine the compressive strength and split tensile strength of concrete after addition of coconut fibres. To know the performance of coconut fibres in concrete to reduce cracking. Utilisation of these fibres in concrete leads to and effective solid waste management technique. The introduction of fibres is a solution to develop concrete with enhanced compressive strength and split tensile strength. NFRC (Natural Fibre Reinforced Concrete) is the one of the FRC (Fibre Reinforced Category). Using of FRC is gradually gaining acceptance from civil engineers. In recent years research and development of fibres related to construction industry have grown rapidly. Coconut fibre is more ductile among all natural fibres and has the potential to be used as the reinforcing material in concrete. It is biodegradable soothe impact on the environment will be minimum.

The aim of this study was to identify the improvement in strength characteristics of concrete with the addition of oil coated coconut fibre so as to decrease the water absorption. Coconut fibre with a tensile strength of 21.5 Mpa is the toughest among all natural fibres. They are capable of taking strains 4 to 6 times higher than other fibres.

2. METHODOLOGY

2.1 MATERIALS:

The following materials were used for preparing the concrete mix of M20.

- OPC (Ordinary Portland Cement) of 53 grades
- Fine aggregate i.e. sand
- Aggregate
- Coconut fibers
- Water

➢ **OPC**: Ordinary Portland Cement of grade 53 cement was used in this study.

➢ **Fine aggregate**: The fine aggregate was natural river sand which is freely available. The sand is passes through a 4.75 mm sieve and contained more than 5% coarse particles so that it reduces the porosity of the final mass and considerably increases its strength usually.

➢ **Coarse aggregate**: it is the important constituent material in concrete. It occupies 60 to70% of concrete. For this study locally available crushed stone aggregates of size 20 mm are used and the various tests are carried out on the aggregates as per IS 2386-1963(IV).

➢ **Coconut fibers**: these are collected from the local temples, cleaned, sundries and removed dust particles to analyze its properties. Coconut fiber has high water absorption. Due to this property, the coconut fibers of 6 mm in length were pre soaked in water for 24 hours.

Fig -1: Coconut Fiber

The following tests are performed on concrete blocks reinforced with coconut

- Workability
- Compressive strength
- Split tensile strength

Two cubes of size 150 X 150 X 150 mm and two cylinders of size 150 X 300 mm for each mix were casted and tested for compression and split tensile strength for 7 days, 28 days. After casting the specimens were tested with the help of compression testing machine.

3. EXPERIMENTAL STUDY

The method used in this study was basically experimental. It involved field and laboratory tests. This analysis was carried out at TKREC (Teegala Krishna Reddy Engineering College)

In this study, two cubes was cast for each of ordinary Portland cement as a control mix and for each of replacement by coconut fibre. Therefore, for each batch 11 cubes were cast. For compressive strength,150 mm cubes were cast and five specimens were tested for each age in a particular mix (the cubes were crushed at 7 days and 28 days respectively). All freshly cast specimens were left in the moulds for 24 hours before being moulded and then submerged into water for curing until it is time to be tested.

3.1 SLUMP CONE TEST

The degree of workability of the concrete was measured by slump cone test

Fig-2: Slump cone test

Freshly mixed concrete was placed in the mould in three layers, each layer being prodded separately 25 times with 6 mm diameter rod. when the mould was filled and prodded the top surface was level-off and the mould was lifted at once. Immediately the slumping action of the concrete was measured by the taken the difference in height between the top of the mould and the top the slumped mass of the concrete.

3.2 COMPRESSIVE STRENGTH

The compressive strength was measured by breaking the concrete cube specimen in a compression testing machine. The compressive strength was calculated from the failure load divided by the cross sectional are resisting the load and reported in Mpa. During this study concrete cubes of size 150 X 150 X 150 mm was cured after 24 hours of casting. These specimens were cured and crushed in the testing machine for each replacement at each interval of 7 and 28 days. The specimens were tested for compressive strength by applying increasing compressive load until failure occurs.

Fig-3: Compressive strength test

3.3 SPLIT TENSILE STRENGTH

In split tensile strength test, a sample is typically pulled to its breaking point to determine the ultimate tensile strength of the material. Five sets of cylinders with two cylinders in each set were tested for tensile strength. One set of cylinders is

plain cement concrete and another set cylinders is different volume fraction in coconut fiber.

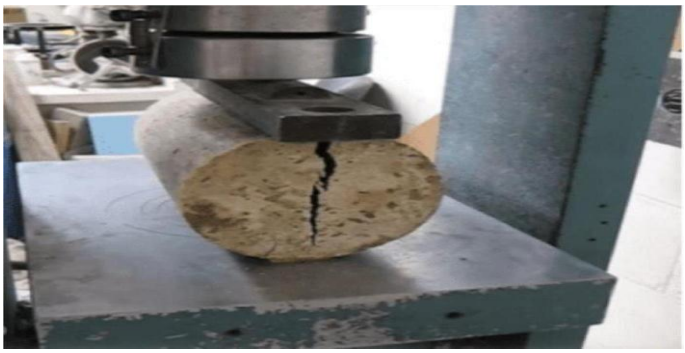

Fig-4: Split tensile strength test

4. RESULTS AND CONCLUSION

4.1 SLUMP COMPARISION BETWEEN FRESH CFR CONCRETE AND OPC CONCRETE

S.No	% of replacement	Slump value
1	0%	75
2	1%	79
3	2%	77
4	3%	74
5	4%	73
6	5%	72

Table-1: Slump cone test result

The concrete with 100% cement exhibits higher slump compared to one with coconut fiber replacement. It was observed that higher the amount of percentage coconut fiber replaced, the lower the slump. At a given water cement ratio, the small addition of coconut fiber (1 to 2%) improved the workability of concrete by reducing tendency towards bleeding and segregation.

It means that coconut fiber increases the setting time.

4.2 COMPRESSIVE STRENGTH OF CFR CONCRETE

The results of the compressive strength of concrete produced during this study at various percentages of coconut fiber at 7 days and 28 days were as shown in table 2.

S.No	% of replacement	Compressive strength N/mm2	
		7 days	28 days
1	0%	13.33	20.21
2	1%	14.24	21.80
3	2%	12.33	19.06
4	3%	11.80	18.64
5	4%	10.27	17.89
6	5%	9.35	17.21

Table-2: Compressive strength test result

It was observed that compressive strength values increase with increase in curing days but the values decrease with the percentage coconut fiber replacement. The initial strength values of the concrete are very low compare with the concrete of only OPC but the strength of 1% and 2% coconut fiber are closer to that of concrete with only OPC at 28 days. And it also reported that compressive strength decreased with the increase in the fiber content.

4.3 COMPARISION OF SPLIT TENSILE STRENGTH OF CONVENTIONAL CONCRETE WITH COCONUT FIBER CONCRETE

The following table shows the comparison of split tensile strength of conventional concrete with coconut fiber concrete.

S.No	% of replacement	Split tensile strength N/mm2	
		7 days	28 days
1	0%	2.18	2.67
2	1%	2.39	2.82
3	2%	2.12	2.53
4	3%	1.77	2.24
5	4%	1.59	2.02
6	5%	1.48	1.92

Table-3: Split tensile strength result

The table which show the comparison of the split tensile strength of conventional concrete with the coconut fiber concrete. It has been clearly indicated that the increase in addition of coconut fiber in concrete.

5. REFERENCES

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