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Experimental Investigation of Coir Fiber in Concrete

K. Porulselvi[1], C. Sivasanthosh[2], I. Michael Raj[3]
[1,2,3] Assistant Professor, Department of Civil Engineering, Christ The King Engineering College, Coimbatore, TN, India.

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Abstract: *It's an experimental study on coir fiber using in concrete. The aim of theprojectistoincreasethestrengthofconcreteandmaintaincheapcost.Thehighcost of conventional construction material affects the economics of the structure. Coir fiber are the natural materials which is abundantly available in tropical region .which will increase the strength of concrete by producing infinite variance in strength compared to normal concrete. The coir fiber by adding 5%, 10%, 15% and 20% in concrete. The strength characteristics such as compressive strength and split tensile strength of concrete mixes are found for 7 days,14 days and 28 days of curing period and results are analyzed and compared with the regular (conventional)mix. Result data clearly shows percentage increases in compressive strength for M20 grade of concrete in 7 days and 28 days with respect to the variations in % addition of coconut fibers in structural concrete to enhance the mechanical properties of concrete. 20% gives optimum compressive strength.*

Key Word: *Coir Fiber, Construction materials, Concrete, Compressive strength.*

I.INTRODUCTION

With the quest for affordable housing system for both the rural and urban population in India, various proposals focusing on cutting down conventional building material costs have been put forward. One of the suggestions in the fore front has been the sourcing, development and use of alternative, non-conventional local construction materials including the possibility of using some agricultural wastes as construction materials. Mostly these coconut fibers are dumped as agricultural waste, so that it is easily available in large quantity and also cheap. The purpose of this is to conduct experimental studies for enhancement of properties of concrete by coconut fibers determined by compressive strength and tensile strength.

II.MATERIAL AND METHODS

Back ground of coir fiber

Coconut fiber is extracted from the outer shell of a coconut. The common name, scientific name and plant family of coconut fiber is coir, Cocosnucifera and Arecaceae (Palm), respectively. There are two types of coconut fibers, brown fiber extracted from matured coconuts and white fibers extracted from immature coconuts. Brown fibers are thick, strong and have high abrasion resistance. White fibers are smoother and finer, but also weaker. However, steel reinforcement is still expensive for many people who want to build earthquake resistant houses. To overcome the difficulty, an economical but safe constructional material is needed. Natural fibers can be one possible material, as they are cheap and locally available in many countries. In this present work, the natural Coirfiber using in concrete. Natural fibers such as jute, sisal, pineapple, abaca and coir have been studied as a reinforcement and filler in composites. Growing attention is nowadays being paid to coconut fiber due to its availability. The coconut husk is available in large quantities as residue from coconut production in many areas, which is yielding the coarse Coir fiber. Coir is a lingo-cellulose natural fiber. It is a seed-hair fiber obtained from the outer shell, or husk, of the coconut. It is resistant to abrasion and can be dyed. Total world Coir fiber Production is250,000 tonnes. The Coir fiber industry is particularly important in some areas of the developing world. Over 50% of the Coir fiber produced annually throughout the world is consumed in the countries of origin, mainly India. Because of its hard-wearing quality, durability and other advantages, it is used for making a wide variety of floor furnishing materials, yarn, rope etc. However, these traditional coir products consume only a small percentage of the potential total world production of coconut husk.

Figure1.1 coirfibre

Why Coir fiber?

The addition of coconut fiber in concrete improves various engineering properties of concrete. Coconut fiber is treated as natural fiber before using in concrete. Addition of coconut fiber improves the compressive strength, flexural strength

and split tensile strength of concrete.

Objectives

The prime objectives of the study:

- Minimizing the cost incurred in the traditional material used in concreting.
- To utilization of coir fiber is make better air penetration.
- It provide high water holding capacity
- The utilization of coir fibre to make it cost effective and eco friendly.

Scope of study

- To make use of waste material in construction
- To protect environment from waste deposits and from causing pollution.
- To study the strength characteristics of concrete using coir fiber.

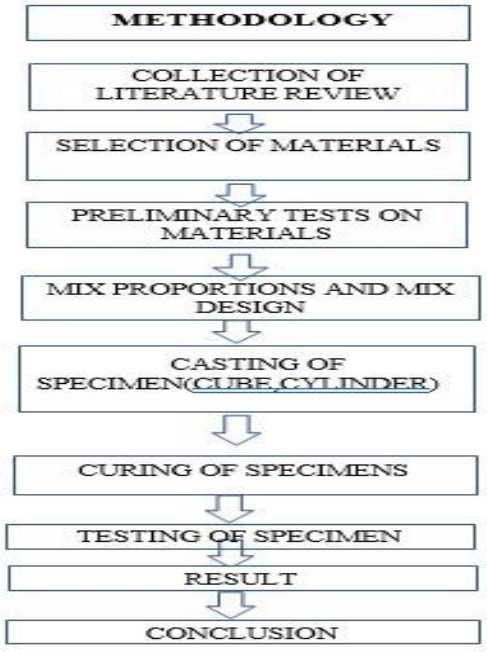
Advantages of coir fiber

- **LowCO_2emission.**
- Low investment at low cost.
- Provide good insulation against temperature and sound.
- High water-holding capacity.
- Better air penetration.
- Biodegradable

Disadvantages of coir fiber

- Poor fire resistance
- Lower impact strength
- Poor moisture resistance
- Variable quality, influenced by weather

Experimental Procedure:



Material Used:

Cement

OPC of 53 grades in one lot was procured and stored in air tight container. The cement used was fresh i.e. used within three months of manufacture. It should satisfy the requirement of IS 12262. The properties of cement are determined as per IS4031:1968&resultsaretabulated.

S.NO	PROPERTY	VALUE
1	Fineness	10%

2	Initial setting time	16mints
3	Final setting time	24hrs
4	Standard consistency	29%
5	Specific gravity	3.15

Table1 properties of cement

Fine aggregate

Fine aggregate generally consist of naturals and or crushed stone. Manufactured sand is a substitute of river sand for construction purpose. The crushed sand is of cubical shape with grounded edges washed and graded to as a construction material. The size of M sand is less than 4.75mm.

Coarse aggregate

The course aggregate is strongest and porous component of concrete.Presence of course aggregate reduces the drying shrink age and other dimensional changes occurring on account of movement of moisture. The course aggregate used to passes in 19mm and retained in 11.4mm sieve. It is well graded and cubical in shape.

Material test

Fine aggregate

Determination of specific gravity of fine aggregate

S.NO	W1 (kg)	W2 (kg)	W3 (kg)	W4 (kg)	Specific gravity
1.	655	980	1700	1500	2.6
2.	655	990	1720	1530	2.16
3.	655	980	1700	1510	2.4
Mean Specific gravity	=2.3				

Table2specific gravity

Determination of Fineness Modulus of Fine aggregate

S.NO	**IS sieve in mm**	**Aggregate in mm**	**Weight retained in mm**	**% of weight retained**	**Cumulative percentage of weight Retained**	**Percentage of passing**
1	4.75	4.75	30	3	3	97
2	2.36	2.36	14	1.4	4.4	95.6
3	1.18	1.18	44	4.4	8.8	91.2
4	600	600	194	19.4	28.2	71.8
5	300	300	246	24.6	76.8	23.2
6	150	150	150	15	95.9	4.1

Table3finenessmodulusofaggregate

Coarse aggregate

Determination of Specific Gravity For coarse aggregate

S.NO	**W1(kg)**	**W2(kg)**	**W3(kg)**	**W4(kg)**	**SPECIFICGRAVITY**
1	0.655	1.66	2.34	1.72	2.82
2	0.655	1.65	2.38	1.691	2.84
3	0.655	1.64	2.30	1.67	2.76
MEANSPECIFIC GRAVITY=					2.80

Table4 specific gravity of coarse aggregate

Shape test

Elongation index:

S.NO	PASSING	RETAINED	LENGTHOFGAUGE	WEIGHT OFFRACTION200 PASSIN kgm	WEIGHT OF AGGREGATE IN EACH FRACTION LENGTH GAUGE
1	63	50	81	0.233	0.233
2	50	40	58.50	-	0.169
3	40	31.5	40.5	-	0.184
4	25	20	32.4	0.340	0.340
5	20	16	25.4	0.195	0.195
6	16	12.5	20.2	0.119	0.119
7	12.5	10	14.2	0.020	0.020

Table 4.5 Elongation index

- Elongation index =0.887/1.250*100
  =70.96%

Flankiness index:

S.NO	AGGREGATEPASSING	AGGREGATERETAINED	THICKNESS OFGAUGE	WEIGHTOFTHE FRACTION	WEIGHTOFTHEAGGREGATE INEACHFRACTION PASSING
1	63	50	33.90	16.5	16.5
2	50	40	27	-	125
3	40	31.5	19.50	930	930
4	31.5	25	16.50	12.40	12.40
5	25	20	13.50	405	405

Table6 Flankiness index

Flakiness index =2740/ 3000*100
= 91.33%

Coir fiber:

Locally available waste materials were collected from different and properly shaped in the form of fibers. Uniform length of fibers was obtained by using cutting machine. Typical properties of fiber shown in table

Pro pertiesof Coir Fiber

PROPERTIESOFFIBRE	
Diameterin mm	0.48
Aspectratio	104.2
Specificgravity	0.87
Waterabsorptionin%	104.2
Densityinkg/m^3	2057

Table7 properties of fibre

III.RESULT

Production of quality concrete requires meticulous care exercised at every stage of manufacture of concrete. It is interesting to note that the ingredients of good concrete and bad concrete are the same. If meticulous are is not exercised and good rule are not observed the resultant concrete is going to be of bad quality with the same material if intense care is taken to exercise control at every stage it will result in good concrete. Therefore it is necessary for us to know what are the important points to be followed in each stage of manufacture of concrete for producing good quality concrete.

- Preparation of mould
- Batching
- Mixing
- Placing
- Compacting Curing
- Finishing

The mould specification is

S.NO	Specimen	Size(mm)
1	Cube	150 x150x 150
2	Cylinder	300 x150

Table8 mould specification

Measurement of work ability

Slump test value of concrete

S.NO	Percentage of fish scale added	Slump value(mm)
1	0	27
2	5	30
3	10	31
4	15	33
5	20	32

Table9 slumptest value

Compaction factor test

Degree of compaction called compaction lector was measured by the density ratio the ratio of the density actually achieved in the test to the same concrete fully compacted. Standard compacting factor testing apparatus was used for this test, In practical, Compaction factor is calculated as.

Compacting factor= (weight of partially compacted concrete)/ (weight of fully compacted concrete)

Compaction factor values of concrete

S.NO	Percentage of fish scale added	Compaction factor
1	0	0.78
2	5	0.79
3	10	0.80
4	15	0.81
5	20	0.82

Table10 compaction factor value

Testing of specimen

Compressive strength test

Compressive Strength Test is the most common test conducted on hardened concrete, partly because it is an easy test to perform, and partly because most of the desirable characteristic properties of concrete are qualitatively related to its compressive strength.

Formula

Compressive Strength = load / area, Area = LxB

Where

L =Length

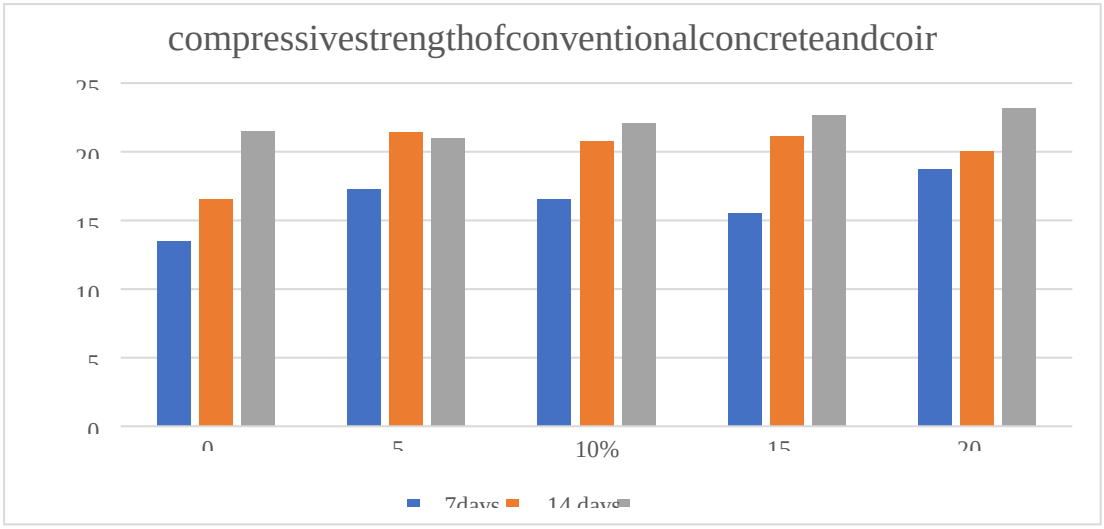
B =Breadth

Size of specimen= 150mmX150mmx150 mm Area =22500mm^2

Compressive Strength

Table11CompressiveStrengthofConventionalConcreteandCoirfibre

Description	CuringDays	%Coirfibre				
		0%	5%	10%	15%	20%
Compressive Strength(N/mm^2)	7	13.5	17.26	16.55	15.56	18.76
	14	16.6	21.42	20.76	21.16	20.05
	28	21.49	21.01	22.09	22.65	23.22



Bar chart for Compressive Strength of Conventional Concrete and Coirfibre

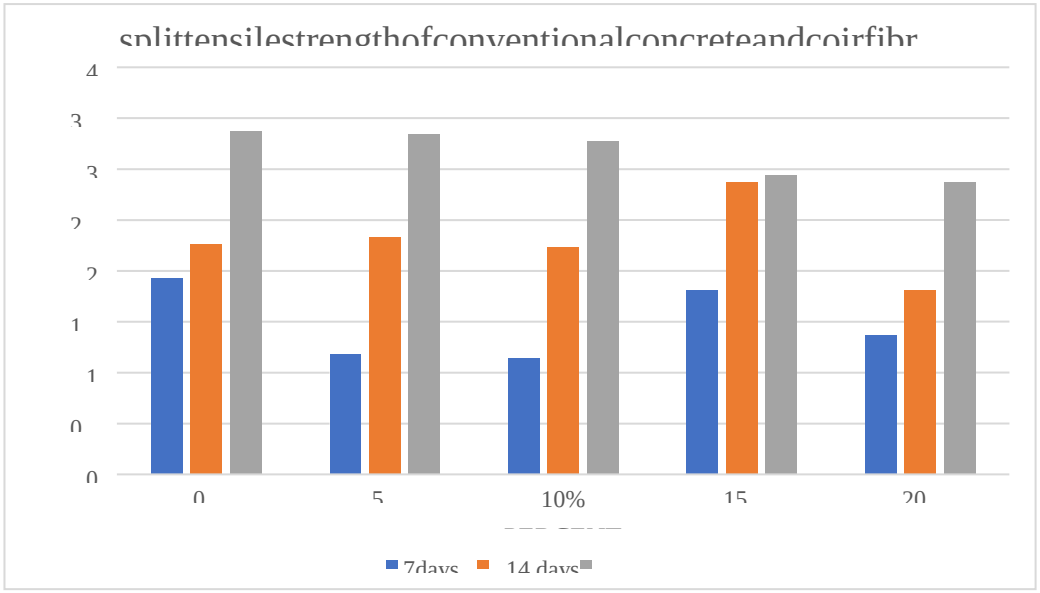
Split tensile strength test

The concrete cylinders of 150 mm diameter and 300mm height were cast for finding the split Tensile Strength. The prepared cylinders were cured in water for 7,14 and28 days. The cured specimens were taken out and dried. After drying, the specimen is placed horizontally between the loading surface of the compression testing machine and the load is applied until the failure of the cylinder along the vertical diameter the test setup for split tensil The split tensile strength of concrete cylinder specimens was investigated by measuring the load and it was calculated by using the equation.

Formula

Split Tensile Strength=load/area Area=πxDxL
Where D = diameter, L =Length
Split Tensile Strength of Conventional Concrete and Coirfiber

Description	CuringDays	%Coirfibre				
		0%	5%	10%	15%	20%
Split TensileStrength(N/mm^2)	7	1.93	1.18	1.14	1.81	1.37
	14	2.26	2.33	2.23	2.87	1.81
	28	3.37	3.35	3.28	2.94	2.87



BarchartforSplitTensileStrengthofConventionalConcreteandCoirfibre

IV.CONCLUSION

The compressive strength and split tensile strength of coir fiber reinforced concrete has been tested and the tested results shown that the strength of coir fiber reinforced concrete is increased gradually when we increase the percentage of fiber. It has been clearly noted that adding fiber up to 20% slightly increases the strength. Workability of the concrete is reduced when compare with the normal concrete. For 5% and 10% of the coconut fibers compressive strength increased respectively. From the 15% of fiber reinforced concrete the fibers are not From uniformly distributed in the mix and balling forms. The bond between the matrixes is very higher than the normal concrete. Density of the coconut fiber concrete is less (i.e light weight concrete). Evaporation losses are less, cracks are less after application of the compressive load (i.e micro cracks are reduced). Ductility and durability of concrete of the concrete are increased. Addition ofthe5% of coconut fibers is more suitable for the concrete. It is concluded that coir fibre reinforced concrete is more effective than conventional concrete.

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