

# EXPERIMENTAL STUDY ON CONCRETE USING COCONUT SHELL AND COIR FIBER BY PARTIAL REPLACEMENT METHOD

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## ABSTRACT

This paper presents an experimental study on coconut shell and coir fibre using partial replacement method. The aim of the project is to increase the strength of concrete and maintain cheap cost. Every construction industry totally relies on cement, sand and aggregate for the production of concrete. The high cost of conventional construction material affects the economics of the structure. With increasing concern over the excessive exploitation of natural aggregates, synthetic light weight aggregate production from environmental waste in viable new source of structure aggregate materials. Nowadays ,most of the reduce the cost of construction as well as increase the strength. Coconut shell and coir fibre are the natural materials which is abundantly available in tropical region .The replacement method by using coconut shell as coarse aggregate and coir fibre as fine aggregate by replacing 5%,10%,15% and 20%.The strength characteristics such as compressive strength ,split tensile strength and flexural 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.

## 1. INTRODUCTION

Approximately,10 million cubic metres concrete is being produced yearly.Concrete is a composite material made of fine and coarse aggregate and bound together with the cement,water that hardens over time.Cement used isPPC of grade 53 is taken for testing in work.Cement is used right from ancient periods in construction industry.In the most general sense of the world,cement is a binder,a substance which sets and hardens independently,and can bind other material together.Coconut shell is an agricultural biodegradable waste found in most of tropical countries especiallyin Asia.India manufactures 15,739 million nute annually,which is next to Indoneria with 16,498 million.coconut shell may offer itself as a potential construction material in the field of construction industries and would solve the environmental problem of reducing the generation of solid wastes simultaneously.

Coconut fibre or coir is a product which is extracted from the outer shell of the coconut fruit. It is used in a varitey of ways world wide, being especially popular for rope and matting, and there are anumber of source for coir and coir products.Coir comes from a matted fibrous layer found between the inner and outer husk of the coconut.

Coconut shell is one of the main polluter that contributes to the nation's pollution problem . It is a solid waste in form of shell with approximately 3.18 millon tonnes produced annually.The common waste materials that used to improve the strength of concrete.Coconut shell and coir fibre are known as new waste materials that used in high industry.This is because coconut shell has good weather resistant that it is suitable to use as construction materials.Besides,it has no economic value and its dispose process is costly and will cause environmentl problem.

Tests are conducted to study the mechanical properties of the concrete with various percentages of coconut shell and coir fibre.

The tests carried out are Compressive, Split Tensile strength test and flexural strength test.

Main aim of this project was therefore to increase the strength of concrete and compared with conventional concrete for replaced concrete.

## 1.1 OBJECTIVE

- 1) To find economical solution for high cost construction material
- 2) To prepare light weight concrete by using coconut shell and coir fibre as coarse aggregate and fine aggregate
- 3) The partial replacement of coconut shell and coir fibre of coarse aggregate and fine aggregate to determine theCompressive strength and Split tensile strength and Flexural strength test.
- 4) To prove that the conventional concrete results are compared with replacement concrete to increase the strength of concrete and it is obtained from experimental tests and represent these values with suitable graphs.

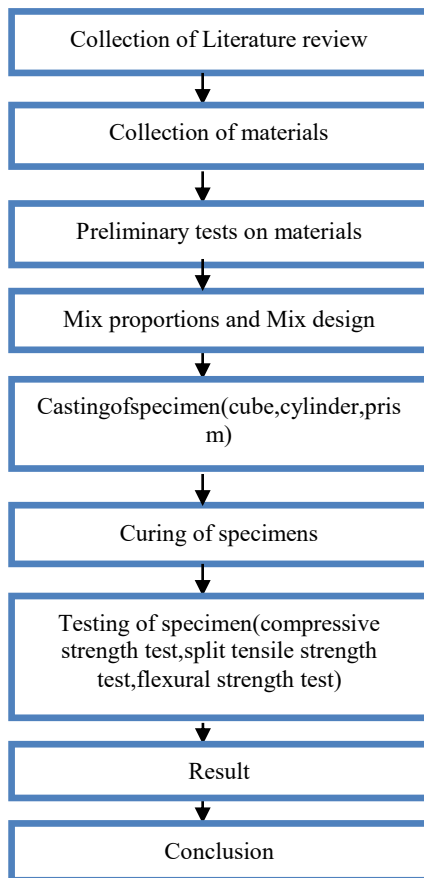
## 1.2 SCOPE

- 1) Application of coconut shell and coir fiber increases the strength
- 2) Using of coconut shell( or) waste natural materials the cost is reduced due to waste materials use of concrete
- 3) To determine the strength characteristics of concrete.

## 1.3 ADVANTAGE

- 1) It promotes the green construction
- 2) It has more resistance and it is light weight materials and it is economic and reduce its cost of material.
- 3) There is no need of treating coconut shells before usage except for water absorption
- 4) It is a good alternative to wood and helps to prevent deforestation and also inexpensive
- 5) Producing economic concrete by reducing the cost of materials

## 2. METHODOLOGY



## 3. MATERIALS

This section introduces the properties of materials used in this research. All materials were obtained from local sources.

### 3.1 cement

Cement is the hydraulic binder which is used to reduce concrete. Cement paste sets and hardens by hydration, both in air and under water.

**Table 1.** Physical Properties of Cement

Name of the tests	Tested value
Standard consistency test	31 %
Initial setting time	35 min
Fineness	9 %
Specific gravity	2.92

### 3.2 M-Sand

Passing through 4.75 mm sieve coarse aggregate-20mm and down size. The fine aggregate passing through 4.75 mm sieve is tested as per IS:2386 Part 3 and specific gravity is fine aggregate is 2.52.

**Table 2.** Test results of M-sand

Description	M-sand
Specific gravity	2.58
Water absorption	1.5%
Sieve analysis	Conforming to zone III
Fineness modulus	3.90%

### 3.3 Coarse Aggregate

Aggregate which are used in the surface course have to withstand the high magnitude of load stresses and wear and tear due to abrasion.

**Table 3.** Test results of coarse aggregate

Description	Coarse aggregate
Specific gravity	2.61
Water absorption	0.5%
Fineness modulus	6.02%

### 3.4 Concrete mix proportion

The mixes were designated in accordance with IS 10262-2009 mix design method. Based on the results, the mix proportions M 25 was designed. Concrete mix with w/c ratio of 0.47 was prepared. The details of mix proportions for 1m<sup>3</sup> of concrete are given in Table 5.

**Table 4.** Material required for 1m<sup>3</sup> of Concrete (Kg/m<sup>3</sup>)

Grade	Cement (kg)	FA (kg)	CA (kg)	Water (lit)
M25	420	792	1005	197

### 3.5 About Coconut shell and Coir fibre

Coconut shell and coir fibre are natural materials. Coconut shell is obtained from temples and local areas. Coir fibre is a product which is extracted from the outer shell of the coconut fibres are strong, light in weight. The addition of coconut fibre can reduce the thermal conductivity of the composite specimens. Coconut fibres are commercially available in three forms, namely bristle (long fibres), mattress (relatively short) and decorticated (mixed fibres). These different types of fibres have different uses depending upon the requirement.

## 4. VARIOUS TYPES OF FIBRE USED IN CONCRETE

- 1) Brown fibre
- 2) White fibre
- 3) The brown fibre is extracted from matured coconut. The white fibre is extracted from immatured coconut.

## 5. TESTING RESULTS

### 5.1 Compression Test:

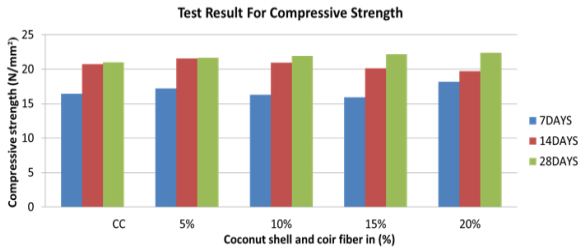
Compressive strength is defined as resistance of concrete to axial loading. It was tested in compressive testing machine and reading were recorded of the final crack.

It is determined by using the formula :

$$\text{compressive strength} = \text{maximum load} / \text{cross sectional area} = P/A$$

**Table 5.** Compressive strength for concrete

S.No	Mix (ml)	Compressive strength (N/mm <sup>2</sup> )		
		7 Days	14 Days	28Days
1	0	16.43	20.74	21.01
2	5	17.20	21.58	21.65
3	10	16.27	20.96	21.91
4	15	15.92	20.11	22.16
5	20	18.17	19.72	22.37



**Figure.1** Compressive strength Graph



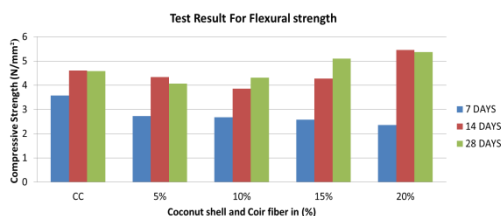
**Figure.2** Testing of compressive strength

**5.2 Flexural Strength Test**

Flexural strength is the another method of measuring tensile strength of concrete. It is a measure of an and reinforced concrete beam to resist failure in bending.

**Table 6.** Flexural strength for concrete

S.No	Mix	Flexural strength (N/mm <sup>2</sup> )		
		7 Days	14 Days	28Day s
1	0	3.58	4.61	4.58
2	5	2.73	4.34	4.07
3	10	2.68	3.86	4.32
4	15	2.58	4.28	5.1
5	20	2.36	5.46	5.37



**Figure.3** Flexural strength graph



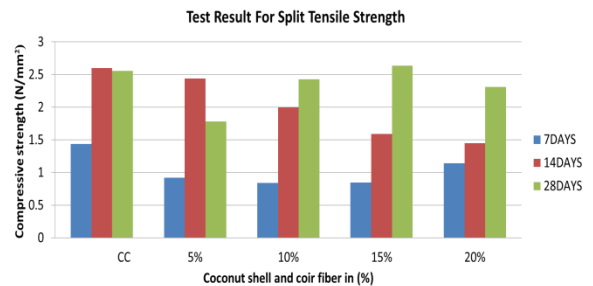
**Figure.4** Testing of Flexural strength for concrete

**5.3 Split Tensile strength Test**

Split tensile strength test concrete cylinder is a method to determined the tensile strength of concrete.

**Table 7.** Split Tensile strength for concrete

S.NO	Mix	Split Tensile strength (N/mm <sup>2</sup> )		
		7 Days	14 Days	28Days
1	0	1.44	2.6	2.56
2	5	0.92	2.44	1.78
3	10	0.84	2.00	2.43
4	15	0.85	1.59	2.64
5	20	1.14	1.45	2.31



**Figure.5** Split Tensile strength graph



**Figure.6** Testing of Split Tensile strength

## 6.CONCLUSION

The use of coconut shell and coir fibre as a partial replacement of coarse aggregate and fine aggregate should be encouraged for sustainable and economic construction. By the utilization of agricultural waste materials in concrete tends to low cost construction and waste management. The results conclude that the concrete with coarse aggregate and fine aggregate partially replaced with coconut shell and coir fibre shows the increase in the strength of the concrete

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