



## A Study on Partial Replacement Of Coarse Aggregate With Coconut shell

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**ABSTRACT :** The high cost of conventional construction material affects economy of structure. The possibility of utilizing recycled coconut shell aggregates in concrete as coarse aggregate is examined in the present study. An optimum percentage replacement of coarse aggregate with coconut shell aggregate is determined from the study. Coconut shell is a light weight material thus producing light weight concrete. The replacement of coarse aggregate of coconut shell by 5% and 10%. Design mix used is M20 grade and testing of specimens are conducted after 7 and 28 days of curing. The slump and compressive strength of concrete are tests. The main objective is to encourage the use of these waste products as construction materials in low cost housing.

**KEYWORDS :** coarse aggregate, coconut shell, utilizing, light weight concrete, M20, slump, compressive strength

### 1. INTRODUCTION

Concrete is the vital civil engineering material. Its manufacturing involves utilization of ingredients like cement, sand, aggregates and water. With the

development of world, There are some negative impacts of more production of concrete like continuous extensive extraction of aggregate from natural resources will lead to its depletion and ecological imbalance. The construction field also developed. Now a day different types of waste materials used in construction. As an alternative solution, the agricultural waste is the best way to reduce the raw material used in construction industry and thus helping to reduce pollution caused by disposal of agricultural waste.

Coconut grown in over 86 countries worldwide. India is a divine land and in every occasion perhaps coconut is the main item of worshipping. So India produces a huge amount of waste from coconut. With the use of coconut shell as a replacement material in the construction history, indirectly reduce the costs production of concrete and the disposal of waste. Coconut shell is often used as a composite in concrete because of the characteristics found in it better than material that commonly used in production of concrete.

Besides, coconut shell is potential material for the development of new composite material in concrete mix design because of their high strength and modulus properties. The aim of this work is to spread awareness of using coconut shell as partial replacement of coarse aggregate in concrete and determining its compressive strength. It also provide more data on the strength of concrete with

coconut shell at different percentage coconut shell used. Furthermore, in this study the workability of concrete with coconut shell are also investigate

## 2. LITERATURE REVIEW

**Satish shinde,Ramiz sayed (2016):**They replaced M 20 grade concrete by coconut shell as a coarse cluster. Concrete made by replacing 10%,15% of coarse mixture by coconut shell earned by 28 days confining strength and ductile strength.

**Sanjay kumar(2019):** The investigation Of use of coconut shell as partially substitutionof coarse aggregate. In this work compressive strength of M20 grade had been concentrated by swapping natural coarse aggregate. This consequence indicates that coconut shell concrete can be used as a mild weight concrete

**Lopa M.Shinde (2015):** They recommended to promote sustainable development of the structure in order to lower the impact of the environment .It highly issues the concern about recycling the material in order to lower the burden on natural resources.

## 3. METHODOLOGY

### 3.1 MATERIAL SPECIFICATION

For the production of this concrete ,the constituent materials are cement, fine aggregate, coarse aggregate , coconut shell and water. To get better workability and strength, the material used should have better quality. To maintain the safety of any structure,provisions are provided as per **IS 456:2000**

#### 3.1.1 Cement :

In this experimental work cement used is Ordinary Portland Cement 53 grade .Various properties are shown in the following table no.1

Table no.1: properties of cement

Sr. No.	Properties	Values
1	Specific gravity	3.15
2	Normal consistency	31%
3	Setting time	
	Initial setting time	30 min
	Final setting time	600 min
4	Compressive strength	26.35 N/mm <sup>2</sup>
5	Soundness test	1mm

#### 3.1.2 Fine aggregate:

River sand was used as the fine aggregate, conforming to zone-2 .It has the following properties mentioned in table no. 2

Table no.2 : properties of fine aggregate

Sr. No.	Properties	Value
1.	Specific gravity	2.55
2.	Water content	1.8%
3.	Bulking	4%

#### 3.1.3 coarse aggregate:

Coarse aggregate of size upto 20 mm used in this experimental work. .the physical properties of coarse aggregate are mentioned from table no.3

Sr.No.	Properties	Value
1	Specific gravity	2.75
2	Impact value	27.94%
3	Water absorption	1.10%

Table no.3: properties of coarse aggregate

#### 3.1.4 Coconut shell:

coconut shell used in the study are brought from local temple and market. The coconut shell are sundried for five days before using it as an

aggregate. The outer shell is then broken in smaller parts. The broking of coconut shell is done with the help of 30 kg hammer. Then the broken pieces are passed through 12.5mm sieve and pieces are retained on 10 mm sieve are used. The physical and mechanical properties of coconut shell are mentioned in table no.4

Sr. No.	Properties	Values
1	Specific gravity	1.05-1.20
2	Bulk density	650 kg/m <sup>3</sup>
3	Impact value	8.15%
4	Abrasion value	1.63
5	Moisture content	4.20 %

Table no.4: properties of coconut shell

### 3.2 EXPERIMENTAL WORK

Mix design was done according to IS 10262:2009 and IS456:2000. For M20 grade concrete mix proportion was 1:1.5:3. Coconut shell replaced by 5% ,10% replacement of coarse aggregate with coconut shells.

#### 3.2.1 Test conducted on concrete

Slump cone test was conducted on fresh concrete mix to checkout the workability of coconut shell concrete. Cube, cylinder and beam were prepared for test. concrete were poured in to the mould by three layer and each layer compacted 25 times using tamping rod. After 24 hours of casting the specimens were demould and immersed in curing tank containing fresh water. Curing period was 7 and 28 days for cube and cylinders. And for beams the curing period was 28 days. Compression test was conducted for cube and splitting tensile test was conducted on cylinder on compression testing machine of capacity 2000 KN. Flexural test for beam were tested on universal testing machine having capacity 600 KN.

#### 3.2.2 Test Result

(a) For concrete mix with 5% and 10% replacement of coconut shell that had 87mm and 80mm slump. These mixture had medium degree of workability. From the result, show that if the percentage of coconut shell added increase, the degree of workability of concrete mix will decreased.

Table no. 5: Data of workability test

Tests	5% replacement	10% replacement
Slump (mm)	87mm	80mm

(b) The compressive strength varied 14.30N/mm<sup>2</sup> and 13.83 N/mm<sup>2</sup> for 5% and 10% replacement at 7 days and 22.78N/mm<sup>2</sup> and 20.76N/mm<sup>2</sup> at 28 days (fig.no.1).It is observed that increase in percentage replacement by coconut shell reduces compressive strength of concrete.

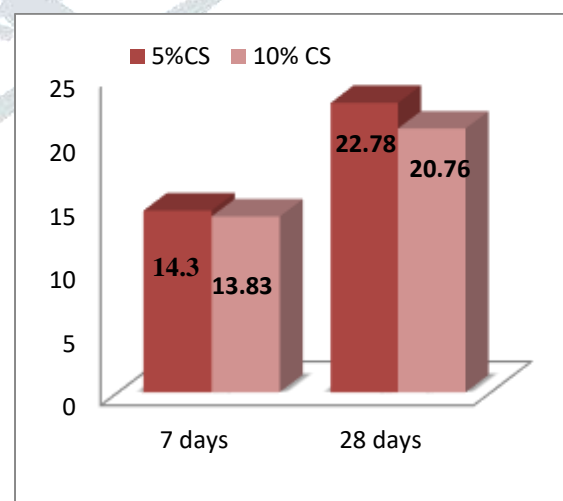


Fig. No.1: Compressive strength Test

(c) The flexural strength varied 1.98N/mm<sup>2</sup> and 2.01N/mm<sup>2</sup> for 5% and 10% replacement at 7 days

and  $2.28\text{N/mm}^2$  and  $3.1\text{ N/mm}^2$  at 28 days (fig.no.2)

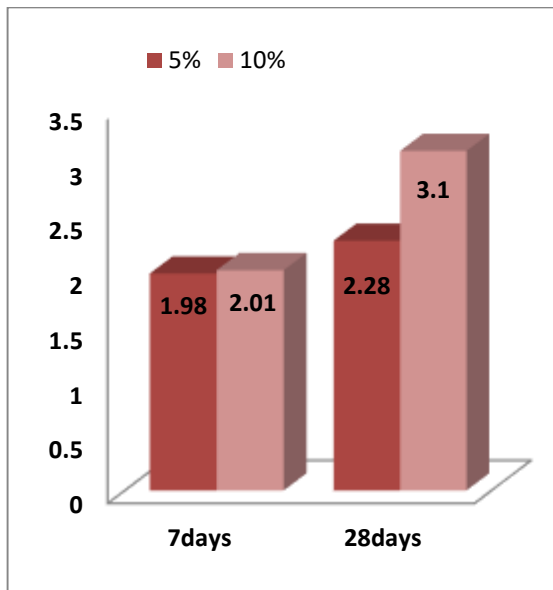


Fig.No.2: Flexural Strength Test

(d) The split tensile strength is well known indirect test used to determine the tensile strength of concrete. the tensile strength of 5% and 10% replacement of coconut shell varied  $1.05\text{N/mm}^2$  and  $1.32\text{N/mm}^2$  at 7 days and  $2.45\text{N/mm}^2$  and  $2.54\text{N/mm}^2$  at 28 days (fig.no.3)

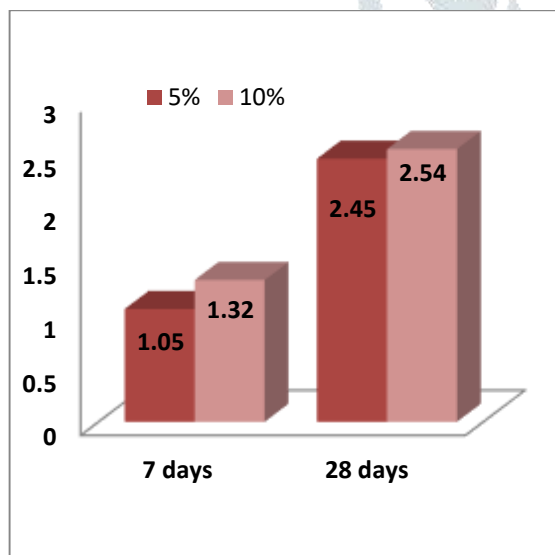


Fig. No.3: Split Tensile Strength Test

## 4.CONCLUSION

The coconut shell has potential as light weight aggregate in concrete. Also, using the coconut shell as aggregate in concrete can reduce the material cost in construction because of the low cost. Use of coconut shell in concrete can help in waste reduction and reduction in pollution. Generally, the compressive strength of concrete added with coconut shell decreased as the percentage of coconut shell added is increased. same result goes to the workability test, the workability of concrete decreased as percent of coconut shell added in concrete is increased. Coconut shell can be utilized as fractional substitution of coarse total as there is negligible distinction in quality between coconut shell and tradition total. Because of it is a waste material and abundantly available in the area of its production and near the industry used coconut, one can reduce the effective cost of the concrete and it is also helpful for the environmental point of view.

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