

# STUDY ON COMPRESSIVE STRENGTH OF ORDINARY REINFORCED CONCRETE USING COCONUT SHELLSWITH PARTIAL REPLACEMENT OF COARSEAGGREGATE

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## ABSTRACT:

Aggregate is the basic material in conventional concrete which occupies almost 70% of concrete. due to immense utilization of aggregate in the construction of building structures, there is a lack of availability of aggregates such as gravels and stone deposits. Mean while disposal of waste material like coconut shell is also causing ecological imbalance to the environment. In order to solve this problem, utilization of coconut shell in the construction field as coarse aggregate may helpful. In our study, we have recycled coconut shell by replacing coarse aggregate with 0%,10%,20% and 30% of M20 grade concrete. Specimens were tested to know the compressive strength and splitting tensile strength and compared with normal concrete. The aim of our project is to introduce coconut shell in the construction industry as an aggregate for low cost construction.

**Keywords:** Coconut shell, M<sub>20</sub> grade, Compressive strength, split tensile strength

## 1.INTRODUCTION:

In India, four southern states namely Kerala, Tamil Nadu, Karnataka and Andhra Pradesh producing around 90% of the coconut production in the country. Statistical data of coconut production shows that, India is producing nearly 27% of total world production and the annual production is reported to be more than 12 million tons. The new and alternative building construction materials developed using agro-industrial wastes have ample scope for introducing new building components that will reduce to an extent the cost of building materials.

Coconut shell is a form of agricultural solid waste. It is one of the most promising agro wastes with its possible uses as coarse aggregate in the production of concrete. After the coconut is scraped out, the shell is usually discarded as waste. This waste is unutilized commercially, but can be used as a building material especially in concrete. The study of coconut shell will not only provide a new material for construction but will also help in the preservation of environment and to improve the economy by providing new use for the coconut shells

Cement is the topmost structural designing development material. Concrete can be made up of cement, sand, coarse combine, and required blends. Present construction will be developing on some innovative ideas are implementing on concrete mix. In this project we are establishing the coconut shell as partially adding in concrete. Coconut shell has good strength and it better to replace in concrete. If we replace the aggregate with coconut shell, not only it protects the environment but also makes the economical construction.

The result of this study will be provide and to introduce an alternate construction material with low cost. The investigator made this research to consider the coconut shells usage in concrete mix as aggregate. It analyze the performance and the effectiveness of the coconut shells as aggregate.

## 2.OBJECTIVES:

- To study the properties of coconutshells
- To study the strength properties of concrete in replacement of coarseaggregate.
- To study the behavior of compressive and split tensilestrengths.
- To fine economical solution for high cost constructionmaterial
- To prepare lightweight concrete by using shell as coarseaggregate.

## 3.LITERATURE REVIEW:

*AMARNATH YERRMALLA et al (2012)* studied the strength of coconut shells (CS) replacement and the transport properties of concrete with CS as coarse aggregate replacement. They concluded that increase in CS percentage decreased densities of the concrete. With CS percentage increased the 7 days strength gain also increased with corresponding 28 days curing strength.

*VISHWAS P. KULKARNI et al (2013)* studied that aggregates provide volume at low cost, comprising 66 percent to 78 percent of the concrete. Conventional coarse aggregate namely gravel and fine aggregate is sand in concrete will be used as control. While natural material is coconut shell as coarse aggregate will be investigate to replace the aggregate in concrete as coconut shell exhibits more resistance against crushing, impact and abrasion, compared to crushed granite aggregate.

*DEWANSHU AHLAWA et al (2014)* were investigated the coconut shell as partial replacement of coarse aggregate in concrete. The aim of this research is to spread awareness of using coconut shell partial replacement of coarse aggregate in concrete and determining its compressive strength and density. The conclusions for the research are the compressive strength of the concrete decreased as the percentage shell substitutionincreased.

## 4. METHODOLOGY&MATERIALS :

### A). Materials:

#### a) Cement

In the present study, ordinary Portland cement (opc) of 53 grade confirming to IS: 12269:1999 Was used. The tests were conducted to know the properties of cement.

**Table -1: Properties of cement**

S.no.	Properties of cement	Results
1	Standard consistency	32 %
2	Initial and final setting time	40 minutes & 580 minutes
3	Soundness	5mm

**b). FineAggregate.**

Locally available river sand confirming to IS: 383:1970 was used as the fine aggregate in the concrete preparation

S. No.	Properties of fine aggregate	Results
1	Specific gravity	2.61
3	Bulk density	15.75 KN/m <sup>3</sup>
4	Grading of sand	Zone II

**c). CoarseAggregate**

Coarseaggregateofnominalsize20mm,obtainedfromthe local quarryconfirming to IS: 383:1970 wasused.

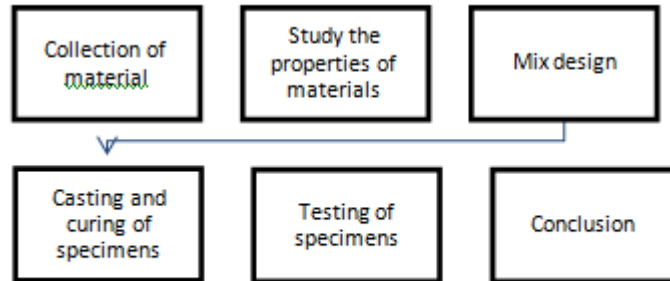
**d). Coconutshell**

Coconut shell is obtained from temples etc. they were sun dried for minimum 1 month before using crushed manually. The particle size of the coconut shell range from 5mm to 20mm.

**e). Water**

Water used for mixing the concrete ingredients, casting and curing the test specimens is free from impurities which when present can adversely influence the strength of concrete confirming to IS:3025:1964 (part 22 and 23) and IS:456:2000 was used for the preparation of concrete mixture.

## B). Methodology



### a). Mix Design

coarse aggregate is partially replaced by increasing the percentage of coconut shell for every trail mix in the range of 10%, 20% and 30%. In our study, M20 grade as per IS: 456-2000 was used

### b). Experimental Procedure

In the present experimental investigation coconut shell is used as partial replacement of coarse aggregate in concrete mixes. On replacing of coarse aggregate with different percentage of according to the required proportions the compressive, flexural and splitting tensile strength are studied at different ages of concrete cured in normal water for 7 & 28 days.

### c). Batching

Batching is the process in which the quantity or proportion of materials like cement aggregates and water, etc. are measured on the basis of either weight or volume to prepare the concrete mix. Proper Batching improves the workability of concrete by reducing the segregation or bleeding in concrete. In this study the process of weight batching is adopted. The process of measuring ingredients or materials to prepare concrete mix is known as batching of concrete. Batching can be done by two methods, volume batching and weight batching. Batching should be done properly to get quality concrete mix.

### d). Mixing

The object of mixing is to coat the surface of all aggregate particles with cement paste and to blend all the ingredients of concrete into a uniform mass. Though mixing of the materials is essential for the production of uniform concrete. The mixing should ensure that the mass becomes homogeneous, uniform in color and consistency. In this study the process of hand mixing was adopted.



Figure :2- Mixing of concrete

#### e). Casting

The specimens are casted in the ratio of 0%, 10%, 20%, 30%, replacement of coconut shell aggregate respectively with each ratio comprising of 6 cubes and 6 cylinders. A total of 24 cubes and 24 cylinders were casted. After the casting process, the cubes and cylinders were kept for 24 hours and de- moulded, and they were cured for 7 days and 28 days.



Figure:3- Cube V



Figure :4-Cylinder

#### f). Preparation of Specimens

The concrete is prepared through hand mixing (Fig 2) and cast in the standard cube mould 150mm x 150mm x 150mm (Fig 3) & in the standard cylinder (Fig 4) of length 300mm and diameter 150mm. They are cured for 7 days and 28 days.

#### g). Curing

The cube shall be removed from the moulds at the end of 24 hours and immersed in clean water till the 7 and 28-days age of testing. The cubes shall be tested in the saturated and surface dry condition. For the true representation of actual strength of concrete in the structure, extra cubes shall be cast, stored and cured as per the identical conditions of that structure, and tested at required age.



## Testing Of Specimens

### Cube Compression Test



Figure -6 cube compression test



Figure -7 split tensile test

$$\text{Split tensile strength} = \frac{2P}{\pi DL} \text{ (MPa)}$$

Where

P = Failure load

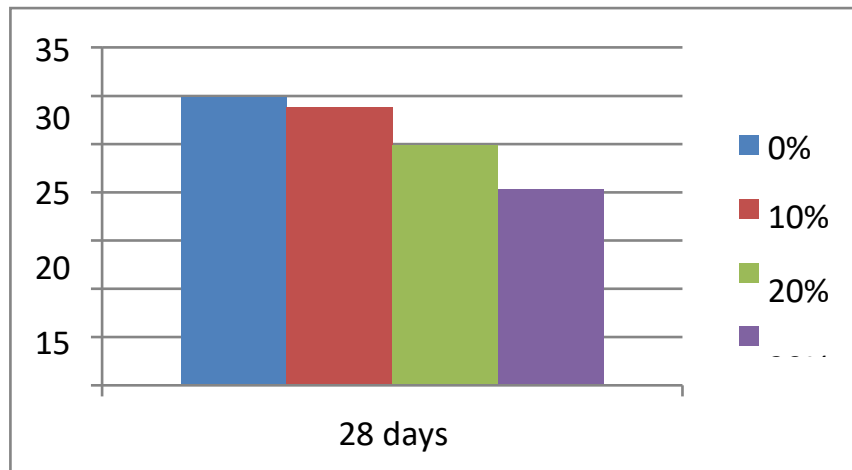
D = Diameter of the cylinder

L = Length of the cylinder

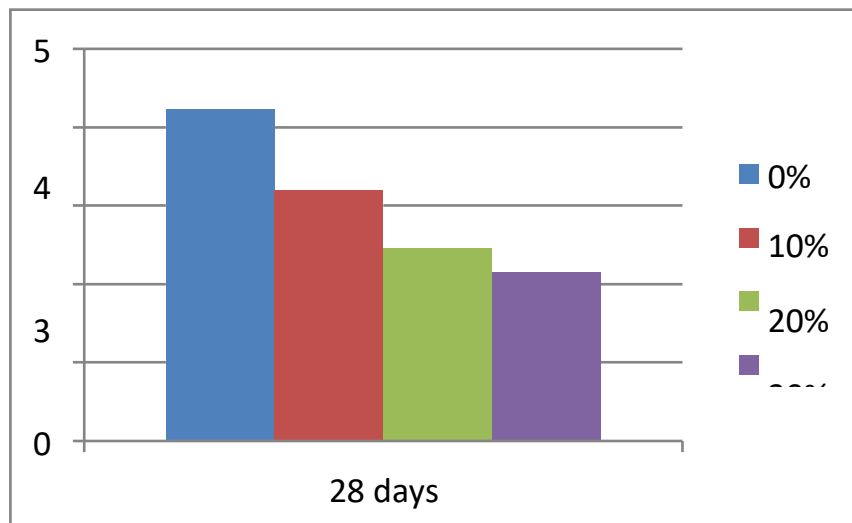
### III TEST RESULTS

**Table -3 Compressive strength and Split tensile strength results of 28 days**

S. no.	Percentage of replacement	Compressive strength (N/mm <sup>2</sup> )	Split tensile strength (N/mm <sup>2</sup> )
1	0%	29.8	4.22
2	10%	28.8	3.2
3	20%	24.8	2.45
4	30%	20.36	2.15



**Graph -1 comparison of compressive strength results**



**Graph -2 comparison of split tensile strength results**

## V. CONCLUSION

- a) From the experimental results, it is concluded that the coconut shells are more suitable as low strength-giving aggregate when used to replace common coarse aggregate in concrete production.
- b) Increase in percentage of replacement by coconut shells reduces the strength and also density of concrete.
- c) It is concluded that the Coconut Shells are more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in concrete production.
- d) This can be useful for construction of low cost housing society

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