

# PARTIAL REPLACEMENT OF COURSE AGGREGATE FROM COCONUT SHELL: A SUSTAINABLE APPROACH

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**Abstract:** Due to increase in the construction activity worldwide the requirement of construction material is increasing day by day as well as their cost with special reference to course aggregate there is tremendous increase but the production of course aggregate is limited as well as degrading environment or disturbing ecosystem with increasing cost of course aggregate. There is a need of replacement of course aggregate in concrete. The rising cost of construction materials in developing countries has necessitated research into the use of Alternative materials civil engineering construction. In the present study concrete was prepared in the quantity of 40% & 60% by weight. Coconut shell was used as a replacement of course aggregate. Total of 15 cubes were casted and crushed in order to investigate the compressive strength.

**Index Terms:** concrete, course aggregate, cement, coconut shell, compressive strength test.

## I. INTRODUCTION

Many studies have been carried out in the area of concrete materials that resulted in the introduction of various types of materials to be introduced and added to the production of the concrete. In order to produce a strong and durable concrete, there are new methods have been introduced such as the use of waste material from industries as the main components. Mainly, the selection of new materials in today's construction is due to resource constraint and cost-cutting measures thus, resulting in the selection of materials that do not have any value in the current market. By using these waste materials, concrete production cost can be reduced. The coconut can be found throughout the tropic and subtropics area, the coconut is known for its great versatility as seen in the many domestic, commercial, and industrial uses of its different parts. Coconuts are part of the daily diet of many people. However, the wastes from the coconuts are often thrown away in many places. Most of the villagers who use their own oil will burn the waste. Things like this will result in environmental pollution. Despite the removal of waste, efforts to reuse coconut waste should be reviewed to prevent pollution, it can be used in the making of concrete as a replacement for the original materials in making concrete such as aggregate and so on. The coconut shell-cement composite is compatible and no pre-treatment is required. Coconut shell concrete has better workability because of the smooth surface on one side of the shells. Compared with conventional concrete, the impact resistance of coconut shell concrete is high. Water absorbing and moisture retaining capacity of coconut shell are also higher than conventional aggregate. The presence of sugar in the coconut shell as long is not in a free sugar form, so it will not affect the setting and strength of concrete. Although the wood based materials, being hard and of organic origin found in coconut shell, it will not contaminate or leach to produce toxic substances once they are bound in a concrete matrix. Coconut shell also can be used for applications of both non-structural and structural.

## II. MATERIALS AND METHODS

### Materials:

**Course Aggregate:-** Normal stone aggregate was used in the present study with the size passes from 10mm sieve and retained on 4.75 mm sieve.

**Fine Aggregate:-** core sand is used in the present investigation for making concrete

**Cement:-** Ordinary Portland cement is used as a binding material in the concrete. It is easily available in the market.

**Coconut Shell:-** Coconut shell is the hard strata of coconut which is an organic waste.

### Methods:

**Sampling:-** In the present study the coconut shell which has been used is been collected from coconut sellers on daily basis for 3 days from Mahmudabad main market and about 20 kg of coconut shell has been collected for the use in the research work. After the collection of the coconut shell they were washed properly and dried in sunlight.

**Crushing of Coconut Shell:-** After bringing the Coconut Shell to the concrete technology laboratory of R. R. Institute of Modern Technology. It was cleaned than as it may contain lots of dirt and unwanted material and coco pit was attached with so cleaning becomes very necessary. Cleaning was done by tap water by spraying over coconut shell. Then it was crushed in order to make it into small pieces with the help of rammer and sieve through 20 mm sieve to maintain the uniformity of the size of course aggregate.

**Mixing of Coconut Shell:** - After cleaning and crushing of coconut shell then arrives a very important part of the study and it is the mixing of crushed coconut shell with coarse aggregate. The coconut shell was mix in the coarse aggregate in the ratio of 40% & 60% then the mixture of coconut shell and coarse aggregate will be treated as coarse aggregate on whole.

**Cube Casting & Curing:** - After proper mixing of coconut shell and coarse aggregate, now concrete was prepared of grade M20 in the ratio of 1:1.5:3 (Cement: Sand: Course aggregate) then it is subjected to the casting of cube. About 20 cubes will be casted and then it will be immerse in the curing tank for 3, 7, 14, 21 & 28 days. The cube casting was done with the help of metallic mould of 15 cm X 15 cm size and these mould were fasten with nut and bolt and shuttering oil was applied before placing the concrete in the mould and then tempting rod was used for compacting and removing of air voids.

**Testing on cubes:** - Compressive strength test will be performed on the casted and cured cube on the specified days. On the casted cube this is the only test which will provide the strength gain by the cube at specified days.

### III. RESULTS

The sample preparation as well as analysis of the cured concrete cubes were done according to the IS 456:2000.

The results for compressive strength test are:-

Coconut Shell ratio	40%	60%
Testing days		
3 day	6.32 N/mm <sup>2</sup>	7.93 N/mm <sup>2</sup>
7 day	11.59 N/mm <sup>2</sup>	12.89 N/mm <sup>2</sup>
14 day	16.75 N/mm <sup>2</sup>	17.42 N/mm <sup>2</sup>
21 day	16.81 N/mm <sup>2</sup>	18.23 N/mm <sup>2</sup>
28 day	17.53 N/mm <sup>2</sup>	18.98/mm <sup>2</sup>

### IV. CONCLUSIONS

In our study, we replaced coarse aggregate with coconut shell, by volume. Specimens were cast by replacing 40% and 60% of coarse aggregate with coconut shells. Tests were conducted on the cast specimens at 3, 7, 14, 21 & 28 days as mentioned in the IS code. Tests for compression strength was conducted and results were obtained.

- Up to 60% of aggregate replaced by coconut shell is good according to strength and cost wise.
- Increase in percentage replacements by coconut shells increase the strength and density of concrete.
- It helps in reducing up to 60% pollution in environment.
- 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.
- Trying to replace aggregate by coconut shell partially to make concrete structure more economic along with good strength criteria.
- From one cube calculation bulk amount of shell replacement can be evaluated & reduces over all construction cost.
- This can be useful for construction of low cost housing society.

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