

# Experiments on Replacement of Coconut Shell as Coarse Aggregate in Concrete: Review

Palak Patel<sup>1</sup> Dr. N.K. Arora<sup>2</sup> Asst. Prof. Shraddha R. Vaniya<sup>3</sup>

<sup>2</sup>Professor & Head <sup>3</sup>Assistant Professor

<sup>1,3</sup>Department of Civil Engineering <sup>2</sup>Department of Applied Mechanics

<sup>1</sup>Darshan institute of Engineering & Technology <sup>2</sup>LEC, Morbi <sup>3</sup>DIET, Hadala

**Abstract**— coconut shell is a waste from agricultural and is available in large quantities. The cost of building material is rising day by day. The use of alternative material is a natural step in solving part of natural aggregate. Various waste materials such as recycle aggregate, foundry sand, glass ware, bottom ash and coconut shell were replaced with natural aggregate . This paper aims at replacing coconut shell as coarse aggregate and analysing compressive strength, split tensile strength and flexural strength. the main objective is to use of coconut shell waste as replacement material in construction and helps in reducing the cost of construction materials.

**Key words:** Coconut Shell, Light Weight Material, Coarse Aggregate

## I. INTRODUCTION

Concrete is the widely used first number of structural material in the world today. Structure developed across the world created demand for different construction materials. Different waste materials by products such as recycle aggregates, foundry sand, bottom ash; glass ware, cockle shell and coconut shell were replaced with natural aggregate. Using the alternative materials in place of natural aggregate in concrete as sustainable and environmentally friendly construction materials. In India demand of construction aggregate in 2010 was 2210 million metric tons.(in 2015 it will be expected as 3330 million metric tons and after 2020 it will be more than 5075 million metric tons.

### A. Coconut Shell:

Coconut is one of the ten most useful trees in the world, providing food for millions of people, especially in the tropics. Coconut is grown in more than 93 countries namely India, srilanka, Mexico, Malaysia, Indonesia, Thailand etc.India is the third largest produce of coconut products in the world. the highest traditional areas of coconut cultivation in India is the state of Kerala(45.22%).agriculture product (coconut shell) used as aggregate in concrete throughout the world expected coconut production will be more than 54,716,444 tons. Coconut shell, which presents serious problem for environment is an available agricultural waste from coconut industries. These wastes can be used as replacement material in construction. It also helps in reducing the cost of construction materials.



Fig. 1: Coconut Shell



Fig. 2: Coconut Shell Particles

## II. DESCRIPTION OF MATERIALS

### A. Cement:

Ordinary Portland cement grade 53, conforming to I.S.12269-1987 was used. The physical property of cement is shown as per table 1.

TEST	RESULT
Initial setting time	185 min
Final setting time	320 min
Compressive strength   3 days	27.08 N/mm <sup>2</sup>
Soundness	4.9 mm
Fineness (90 um sieve)	1.7 %
Standard consistency	30.50 %

Table 1: Basic result of Ordinary Portland cement (OPC)

### B. Coarse Aggregate:

As coarse aggregate in concrete consist 35 to 70% of volume of the concrete.an aggregate with specific gravity more than 2.55 and absorption less than 1.5%.the physical properties of coarse aggregate is shown in table 2.

Coarse aggregate	Aggregate Impact value	12.4
	Aggregate Crusher Value	14.3
	Aggregate Abrasion Value	16.3
	Specific Gravity	2.85
	Water Absorption	0.94%
	Gradation	Falls in 20 mm size
	Combined Flakiness Index, Elongation Index	22.9 %

Table 2: Test Value of Coarse Aggregate (20 Mm)

### C. Coconut Shell:

The physical property of coconut shell is shown in table 3.

TEST	RESULT
Sp. Gravity	1.12
Water absorption (%)	24.03%
Moisture content (%)	4.3
Bulk Density(kg/m3) loose	522.31
Bulk Density(kg/m3)compacted	649.23

Table 3:

**D. Fine Aggregate:**

The fractions from 4.75 mm to 150 microns are termed as fine aggregate. Locally available natural river sand conforming to grading of IS: 383 1970 with specific gravity 2.77 was used as fine aggregate.

Fine aggregate	Gradation	
	Moisture content	1.4%
	Fine modulus	2.56
	Silt content	0.78%

Table 4: Test Value Result of Fine Aggregate

**III. RESEARCH FINDING**

- 1) properties of concrete with coconut shells as aggregate replacement were studied(1).the concrete with normal aggregate and CS concrete with 10-20% coarse aggregate replacement with CS were made. the results showed that density & workability of the concrete decreased with increase percentage of coconut shell. Similar to compressive as well as split tensile strength also decreased with increase in percentage of coconut shell concrete. permeable voids, water absorption and sorption were higher for increase coconut shell replaced coarse aggregate than normal aggregate concrete.
- 2) The study of coconut shell as a coarse aggregate in concrete (2).the concrete cubes with different mixed ratios were casted and tested. The result showed that compressive strength of the concrete decrease as the percentage coconut shell increase.
- 3) Coconut shell as partial replacement of coarse aggregate in concrete were studied(3).in this study M 20 grade of concrete was produced by replacing coconut shell .the various percentage of 2.5%,5%,7.5% and 10% replace of coconut shell. The result showed that increase in percentage by coconut shell increase workability but decrease compressive strength of concrete.
- 4) The experimental investigation was carried out for the strength characteristics on M 25 concrete with partial replacement of cement with fly ash and coarse aggregate with coconut shell(4). The strength characteristics such as compressive strength, split tensile strength and flexural strength of concrete mix are found for 7 days,14 days,28 days and 56 days of curing period and results are analysed and compared to conventional mix. The result showed that specific gravity of coconut shell is low as compared to the natural coarse aggregate an water absorption is high for coconut shell than coarse aggregate. The slump of concrete increase as the percentage of coconut shell increase and compressive strength, split tensile strength and flexural strength decrease as the percentage of coconut shell increase.
- 5) In this study the use of coconut shell as coarse aggregate in concrete (5).the aim of project to that coconut shell aggregate is a construction material and reducing environment problem. The replaced coarse aggregate with 25%, 50%, 75% and 100% of coarse aggregate. Test for workability, flexural, compression and split tensile strength were

conducted and results were obtained. Coconut shell concrete has better workability because of the smooth surface on one side of the shells and smaller size of coconut shell.

- 6) The study of partial replacement of cockle shell as coarse aggregate in concrete (6).the replacement of 5%,10%,15%,20% ,25% and 30% cockle shell in concrete. The result showed that cockle shell as partial coarse aggregate replacement reduced the concrete workability. The replacement of natural coarse aggregate by cockle shell at a level of 20% resulted in increasing compressive strength.

**IV. CONCLUSION**

From the above literature following point are observed.

- The workability of the concrete increased as the percentage of coconut shell increased.
- The split tensile, flexural and compression strength increased as the percentage of coconut shell increased.
- The specific gravity of coconut shell is low as compared to natural coarse aggregate and water absorption of coconut shell as higher than natural coarse aggregate.
- Permeable voids, water absorption and sorption were higher for increase coconut shell replaced coarse aggregate than normal aggregate concrete.
- Coconut shell as replaced coarse aggregate in concrete. It also helps to reduce the cost of construction material.

**REFERENCES**

- [1] Amarnath Yerramala and Ramachandrudu c, "properties of concrete with coconut shell as aggregate replacement," International Journal of Engineering inventions, vol.1, issue 6, October 2012.
- [2] Kabiru Usman Rogo and saleh abubakar, "Exploratory study of coconut shell as a coarse aggregate in concrete," journal of engineering and applied sciences, vol.2, December 2010.
- [3] Dewansu Ahlawat and L.G.Kalurkar, "coconut shell as partial replacement of coarse aggregate in concrete,"IOSR journal of mechanical and civil engineering, vol.4,issue 6,December 2014.
- [4] R.Nagalakshmi,"Experimental study on strength characteristics on M 25 concrete with partial replacement of cement with fly ash and coarse aggregate with coconut shell," International journal of scientific & engineering research,vol.4,issue 1,January 2013.
- [5] B.damodhara Reddy, S.Aruna Jyothy and Fawaz shaik, "Experimental analysis of the use of coconut shell as coarse aggregate"IOSR journals of mechanical and civil engineering, vol.10,issue 6,January 2014.
- [6] K.Muthusamy and N.A.Sabri, "cockle shell: a potential partial coarse aggregate replacement in concrete"international journal of science, environment and technology, vol.1, issue 4, January 2012.