

Study on Mechanical Properties of Concrete by Partial Replacement of Coarse Aggregate with Coconut Shells

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Abstract: - The prices of building materials are increasing day by day. The main ingredient of concrete is coarse aggregate. Nowadays, many of the researches are researching the material which can reduce the cost of construction as well as increase the cost. In developing countries, the possibility of using some agricultural wastes as well as industrial by-products from different industries as construction materials will be highly desirable and has found to have several practical advantages. It was observed that the coconut shells has a great potential as a partial replacement of the aggregate in the concrete

A large amount of waste coconut shell is generated in India from temples and industries of coconut product and its disposal need to be addressed. Researchers have proposed to utilize it as ingredient of concrete. This experimental investigation was aimed to quantify the effects of replacing partially the conventional coarse aggregate by coconut shell to produce concrete.

The research work was aimed to observe the effect of such replacement on compressive strength and density of concrete. In this work we determine the strength of concrete by replacing coarse aggregate in 0%, 20%, 30% and 40%. In this investigation mainly we have to promote the green construction.

Key words: coconut shells, coarse aggregate, compressive strength, Split tensile strength, Flexural strength, bond strength.

I. INTRODUCTION

Concrete is an artificial material similar to similar in appearance & properties to some natural lime stone rock. The major component of concrete is natural aggregate such as gravel or crushed rock, sand and fine particles of cement powder and ultimately mixed with water. While the construction material cost is increasing day by day; the reasons are high demand, scarcity of raw material as well as high price of energy. Coconut shell represents more than 60% of domestic waste volume. Coconut shell is an abundantly available agricultural waste from local industries. So, in developing countries like India, these can be used as potential material or replacement material in the construction field. This will ultimately lead to the reduction in the cost of construction material as well as means of disposal of waste.

II. OBJECTIVES

The overall objective of the project is to investigate the feasibility of incorporating coconut shell as a replacement for coarse aggregate in concrete.

The specific objectives of the project are as follows:

- 1) To find economical solution for high construction material.
- 2) To reduce the disposal problem of non-decaying waste coconut shells.

S.No	Property	Value Obtained
1	Fineness Modulus	2.29
2	Specific gravity	1.16
3	Water absorption	9.0%
4	Flakiness index	19.5%
5	Elongation index	19.5%
6	Surface texture	Smooth inner surface & Rough outer surface
7	Shape	Flaky

Table.1 Physical Properties of Coconut Shells



Fig.1 Coconut Shells

II. MATERIALS USED

It is proposed to test cement concrete in which coarse aggregate is replaced by certain percentages of coconut shells (CS).

Materials required for this concrete preparation are as follows

1. Cement
2. Fine aggregate
3. Coarse aggregate
4. Coconut shells
5. Water

III. METHODOLOGY

Moulds of required size and shape were prepared for casting process. The dimensions of the moulds for casting cubes, cylinders and prisms are 100mm x 100mm x 100mm, 300mm x 150mm & 500mm x 100mm x 100mm respectively are used. The casting was done on a smooth floor. All the moulds are applied lubricant before concreting. After a day of casting moulds are demoulded and then cubes, prisms & cylinders are moved to the curing tank carefully for curing

IV. RESULTS

Table.2 Compressive Strength of concrete with coconut shells replacement at different proportions

Mix Proportion	Compressive Strength(N/mm ²)	
	7 Days	28 Days
0% CS (Normal Mix)	16.2	26.8
10% CS	14.8	25.2
20% CS	13.5	23.8
30% CS	11.9	21.5
40% CS	10.6	19.5

Table.3 Split Tensile Strength of concrete with coconut shells replacement at different proportions

Mix Proportion	Split Tensile Strength (N/mm ²)	
	7 Days	28 Days
0% CS (Normal Mix)	1.34	2.13
10%Cs	1.15	2.05
20%Cs	1.05	1.89
30%Cs	0.95	1.72
40%Cs	0.75	1.65

Table.4 Flexural Strength of concrete with coconut shells replacement at different proportions

Mix Proportion	Flexural Strength (N/mm ²)	
	7 Days	28 Days
0% CS (Normal Mix)	1.85	2.75
10%CS	1.62	2.63

20%CS	1.38	2.32
30%CS	1.15	2.14
40%CS	1.02	2.05

Table.5 Bond Strength of concrete with coconut shells replacement at different proportions

Percentage replacement of coconut shells in concrete	Bond strength in KGF	Bond strength in KN
0% (Normal Mix)	9400	92.2
10%	8800	86.3
20%	8200	80.4
30%	7400	73.5

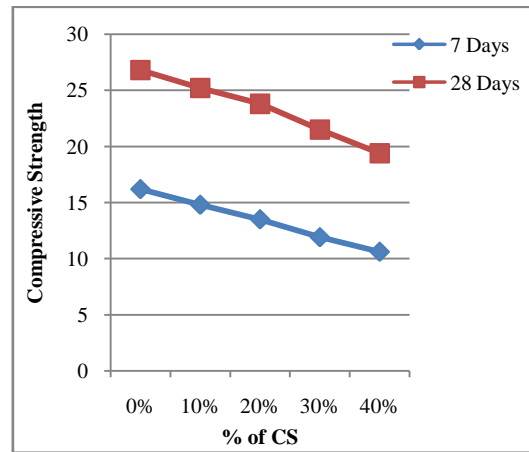


Fig.2 Compressive Strength of concrete with partial replacement of coconut shells

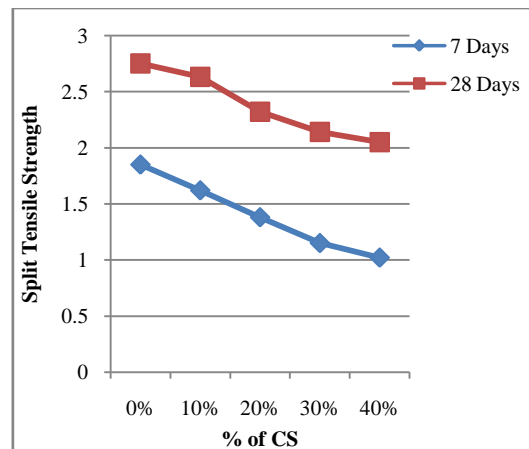


Fig.3 Split Tensile Strength of concrete with partial replacement of coconut shells

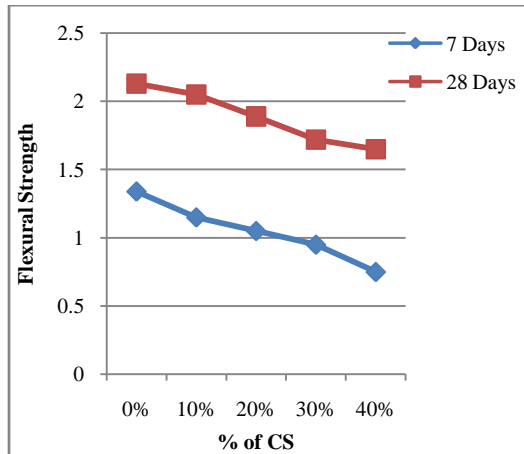


Fig.4 Flexural Strength of concrete with partial replacement of coconut shells

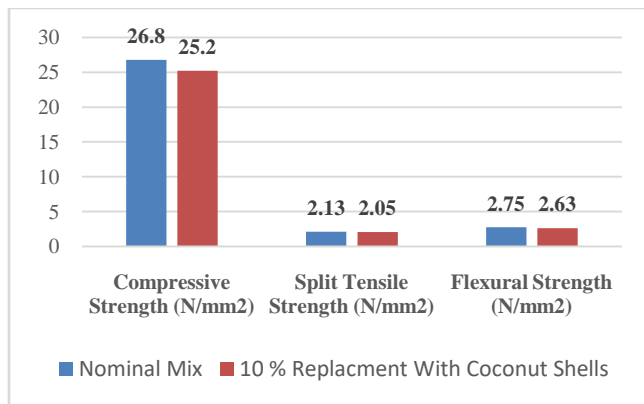


Fig.5 Maximum strength comparison between nominal mix and 10% replacement with Coconut shells

V. CONCLUSIONS

Based on the results of the experimental investigation following conclusions could be drawn.

- Replacement of conventional aggregate by waste coconut shell results in decrease of various test results i.e; compressive strength , split tensile strength, flexural strength , bond strength.

- For 10% replacement of Coconut Shells there is a decrease of 4-5% of strength in various test results when compared with conventional concrete.
- Similarly for 20% , 30% and 40% replacement of coconut shells maximum strength decreases in various test results of concrete when compared with conventional concrete
- In the case of pull out test also for 10% replacement of coconut shells there is a decrease in 5-6% of bond strength when compared with conventional concrete.
- Similarly for 20%, 30% and 40% replacement of coconut shells maximum bond strength decreases when compared with conventional concrete.
- Therefore replacement of coarse aggregate with coconut shells on different percentages does not increase strength in various test results of concrete when compared with conventional concrete.

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