AN EXPERIMENTAL INVESTIGATION ON CONCRETE WITH PARTIAL REPLACEMENT OF COARSE AGGREGATE BY COCONUT SHELL

[1]Shivasharanappa, [2]Pramitha L, [3]Nandish S M, [4]Amir Suhail, [5]Abhilasha G T

[1,2,3,4]UG Scholar, [5]Head of the Department,
Department of Civil Engineering,
Mysore college of Engineering and Management, Mysore, India

***Abstract*: Concrete is made up of cement, fine aggregates, coarse aggregate, water and admixtures if necessary. Aggregate is one of the main ingredients in producing concrete covering up to 75% of total concrete mix. Strength of concrete produced is dependent on properties of concrete. High cost is the dominating factor of conventional construction material which is affecting the housing system. Thus to overcome this drawback, it is necessary to make research on an alternative material which reduces the cost. Thus waste coconut shell may be used to replace conventional coarse aggregate. India is the third largest coconut producing country and accounts for over quarter of world's total coconut oil output. However, it is also the main contributor to the nation's pollution problem as a solid waste in the form of shells and represents more than 60% of the domestic waste volume. Coconut shell which is an abundantly available agricultural waste from coconut industries poses a serious disposal problem. These wastes can be used as potential material or replacement material in the construction industry. This will have the double advantage of reduction in the cost of construction material and also as a means of disposal of wastes. In this study, M20 grade of concrete was produced by partially replacing Coarse Aggregate by coconut shell. Cubes and cylinders were casted and their compressive strength and Split tensile strength were evaluated at 7, 14 and 21 days by replacing coarse aggregate by coconut shell at 10%,20%, 30%,40%,& 50%.**

The aim of this project is to determine the strength and durability characteristics of concrete by using coconut shells as a replacement to coarse aggregates.

***Keywords*: Coconut Shell, Concrete technology, Hardened property.**

I. INTRODUCTION

Concrete

Concrete is a constructional material composed of cement, fine aggregates and coarse aggregates mixed with water which hardens with time. In a building construction, concrete is used for the construction of foundations, columns, beams, slabs and other load bearing elements.

Coarse Aggregate

Coarse aggregates of maximum size 20 mm was used as coarse aggregate. We are conducting tests on coarse aggregate are fineness, specific gravity, water absorption, impact test.

Coconut shell

Coconut shells which were already broken into two pieces were collected from the hotels nearby and college canteen and air dried for five days approximately at the temperature of 25 to 100C; removed fiber and husk on dried shells; further broken the shells into small chips manually using hammer and sieved through 20mm sieve.

II. LITERATURE REVIEW

Kabiru Usman Rogo (2010): Have studied that, coconut shell as full replacement of coarse aggregate in concrete for nominal mix of M20 (1:1.5:3) achieve 55% compressive strength of control concrete and which can be used for plain cement concrete. The flakiness index is six times greater for coconut shell when compared with gravel.

K Gunasegaram et al., (2011): Have studied that, the impact resistance of coconut shell aggregate concrete is high when compared with conventional concrete. So it can be used as flexural members. The experimental bond strength of coconut shell aggregate concrete is much higher compared to the theoretical bond strength as stipulated by IS456:2000.

J.P. Ries (2011): Studied that Lightweight aggregate (LWA) plays important role in today's move towards sustainable concrete, Lightweight aggregates contributes to sustainable development by lowering transportation requirements, optimizing structural efficiency that results in a reduction in the amount of overall building material being used, conserving energy, Reducing labour demands and increasing the survive life of structural concrete.

Maninder Kaur and Manpreet Kaur: Were investigated on the Use of coconut shells in cement concrete can help in waste reduction and pollution reduction. The need of the hour is to encourage the use of the waste products as construction materials in low-cost housing. It is also expected to serve the purpose of encouraging housing developers in investing these materials in house construction.

1. OBJECTIVE OF THE STUDY

1. To prove that aggregate replaced concretes which are lightweight can be used for structural applications with equivalent strengths to normal weight
2. To make sustainable concrete with more economical for constructions.

III. MATERIALS USED

a. CEMENT

Ordinary Portland cement is used in our experimentation. It has been tested as per Indian standard specification IS: 1489 PART-1 1991.

b. FINE AGGREGATE

M Sand is used for experimental program. It has been tested as per Indian standard specification IS: 383-1970.

c. COARSE AGGREGATE

20mm size aggregates are used for experimental program. It has been tested as per Indian standard specification IS: 383-1970.

d. COCONUT SHELL

Fig 2.1: COCONUT SHELL

Table 2.1 Chemical Properties of coconut shell

Property	Value
Carbon	10.00%
Potassium Oxide	1.21%
Chlorine	0.79%
Iron oxide	0.31%
Sodium oxide	0.29%
Calcium oxide	0.23%

e. MIX PROPORTION

Mix proportioning is the process of selecting suitable ingredients for concrete and determining their relative quantities with the objective of producing a concrete of the required strength, durability, and workability as economically as possible. M20 grade concrete was designed as per the Indian standard specification IS: 10262-2009.

Table2.2 Mix proportioning 0% Replacement

Materials	for 3 Cubes
Cement	5.7kg
Fine aggregate	10.38 kg
Coarse aggregate	16.14 kg
Water	2.85litres
W/C ratio	0.5

Table 2.3 Mix proportioning 0% Replacement

Materials	for 3 Cylinders
Cement	6.9kg
Fine aggregate	12.54 kg
Coarse aggregate	19.35 kg
Water	3.45 litres
W/C ratio	0.5

f. SPECIMEN DETAILS

The specimens like cubes, cylinders and beams are used to conduct the strength tests according to IS: 100086 – 1982.

1. Compressive strength test- In this research, moulds of size 150×150×150mm were tested for knowing the compressive strength of different mixes at 7,14and 21days.
2. Split tensile strength test - Cylindrical moulds of 150mm diameter at 300mm height were tested for knowing the tensile strength of different mixes at 7, 14 and 21days.

IV. RESULTS AND DISCUSSION

a. COMPRESIVE STRENGTH TEST

The compressive strength results of 7, 14and 21th day are tested and results are represented graphically as shown in figure 3.1.

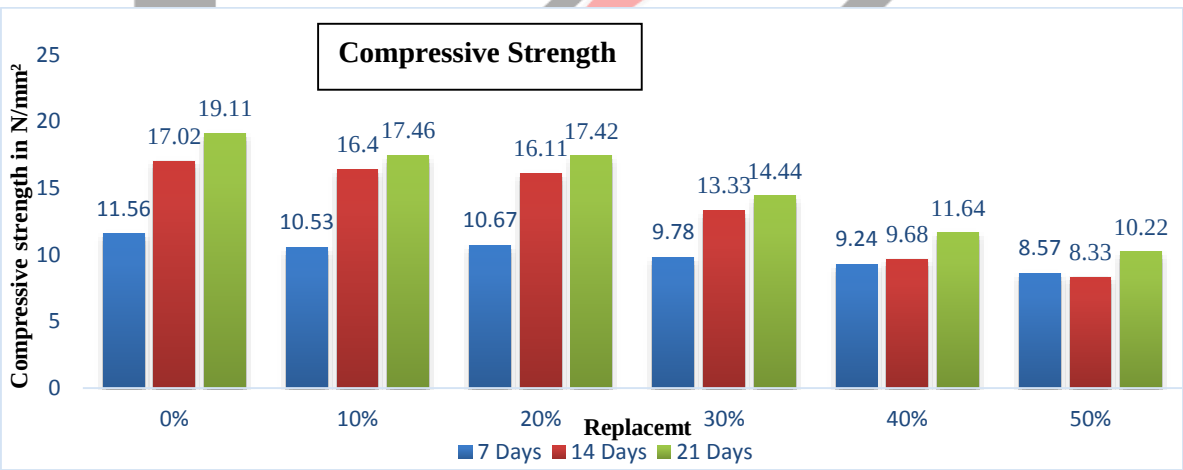

Fig 3.1: Graph of Compressive Strength V/S Replacement

1. The compressive strength of concrete has been increasing until the percentage of mix is up to 20%.
2. Strength of concrete decreases for 30% when compare to 20% replacement concrete.
3. Compressive strength of 20% mix is the highest and hence it can be considered as optimum dosage.

b. SPLIT TENSILE STRENGTH TEST

The tensile strength results of 7, 14 and 21th day are tested and results are represented graphically as shown in figure 3.2.

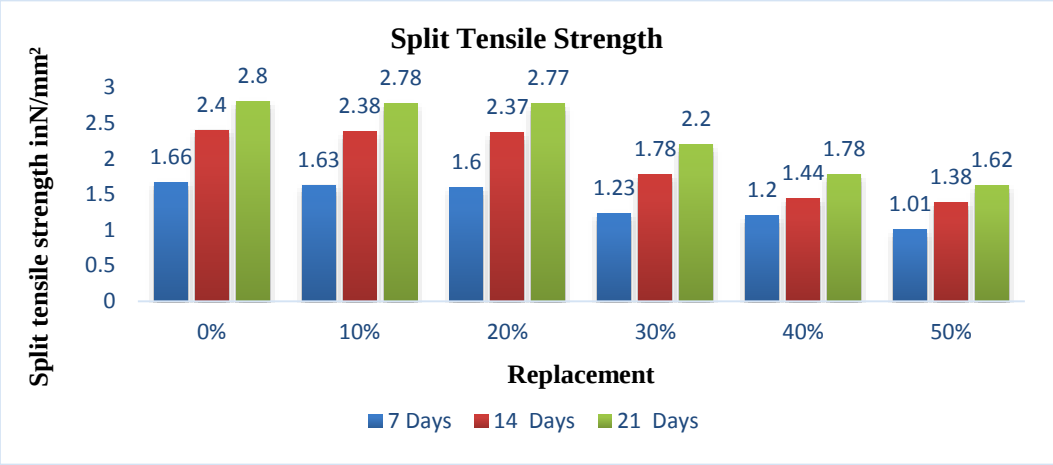

Fig 3.2: Graph of Split Tensile Strength V/S Replacement

1. We know that, concrete is weak in tension. By adding coconut shell tensile strength of concrete can be increased.
2. The highest increase in tensile strength is for the mix percentage 20%. Therefore 20% can be considered as the Optimum dosage.
3. For 30% tensile strength of concrete is decreased than 20% replacement of concrete.

V. CONCLUSION

1. By studying the results obtained we conclude that Coconut shell can be replaced up to 10-20% as a coarse aggregate.
2. It is concluded that Increase in percentage replacement by coconut shell reduces compressive strength of concrete.
3. Similar to compressive strength, the split tensile strength also decreased with increase in Coconut Shell replacement.
4. Increase in percentage replacement by coconut shell increases workability of concrete.
5. Use of coconut shells in cement concrete can help in waste reduction and pollution reduction. The need of this project is to encourage the use of the waste product as a construction material in low-cost housing.

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