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AN EXPERIMENTAL STUDY ON WASTE COCONUT SHELL AS A PARTIAL REPLACEMENT OF COARSE AGGREGATE IN CONCRETE MIX

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ABSTRACT

The prices of building materials are rising day by day. The main ingredient of the concrete is coarse aggregate. Nowadays, many of the researchers 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 & has found to have several practical advantages. It was observed that the coconut shell has a great potential as a partial replacement of the aggregate in the concrete. The paper aims at analyzing compressive strength of concrete (M20-1:1.5:3) produced using coconut shell as substitute for conventional coarse aggregate with 0%, 10%, 15%, 20%partial replacement. These results showed that Coconut shell concrete can be used in reinforced concrete construction. Itsutilization is cost effective and eco-friendly.Keywords: Coarse Aggregate, Coconut Shell, Compressive Strength, Waste Utilization.

I. Introduction:

The three basic needs of man are food, clothing and shelter.Civil Engineer has relevance with all basic needs of mandirectly or indirectly. Man has progressed a lot in developingthe method of constructing shelter. Initially man used to stayin huts and time passed it developed into house that is loadbearing. In this constructed environment, the rising cost ofbuilding construction materials is the factor of great concern.The cost of building materials is raising day by day.Nowadays most of the researchers have focus on use of thewaste materials in concrete according to their properties. Flyash, Rice husk, Slag and Sludge from the treatment ofindustrial and domestic waste water has been found suitableas partial replacement for cement in concrete. The coconut shell is a material which can be a substitute for coarse aggregate. Coconut shell concrete has better workability because of the smooth surface on one side of the shell. The impact resistance of coconut shell concrete is high when compared with conventional concrete. Moisture retaining and water absorbing capacity of coconut shell are more compared to conventional aggregate. Using alternative material in place of natural aggregate in concrete production makes concrete as sustainable and environment friendly Construction material.

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LITERATURE SURVEY:

Dewanshu Ahlawat 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 partialreplacement of coarse aggregate in concrete and determining its compressive strength and density. Theconclusions for the research are the compressive strength of the concrete decreased as the percentage shellsubstitution increased. Also increased in percentage replacement by coconut shell increase workability ofconcrete. Coconut shell can be used as partial replacement of coarse aggregate in R.C.C. concrete.

B. Damodhara Reddy ET al. (2014) were investigated the use of coconut shell as coarse aggregate. Inthis study, coconut shell is used as light weight aggregate in concrete. The project paper aims at analysing flexural and compressive strength characteristics of with partial replacement using M30 grade concrete. Theproject also aims to show that coconut shell aggregate is a potential construction material and simultaneouslyreduces the environment problem of solid. The conclusions for the result are, CSC where 25% of the coarseaggregate is replaced, shows properties similar to the nominal mix and 50% replaced CSC shows propertiessimilar to light weight concrete which can be used as filler materials in framed structures, flooring tiles, thermalinsulating concrete etc.

Amarnath Yerramala et al. (2012) from structures and materials laboratory of Civil Engineeringr,Intell Engineering College, Anantpur, India were Properties of concrete with coconut shell (CS) as aggregatereplacement were studied. Control concrete with normal aggregate and CS concrete with 10-20% coarseaggregate replacement with CS were made. Two mixes with CS and fly ash were also made to investigate flyash effect on CS replaced concrete. Constant water to cementitious ratio of 0.6 was maintained for all theconcrete. In this research properties like compressive strength, split tensile strength, water absorption andmoisture migration were investigated in the laboratory. The aim of this work is to provide more data on thestrengths of coconut shell concrete at different coconut shells replacement and study the transport properties ofconcrete with CS as coarse aggregate replacement.

II. MATERIALS AND METHOD

The raw materials used in this experimentation were locally available and these included Ordinary Portland Cement (O.P.C) as binding agent, river sand as fine aggregate, crushed granite and coconut shell as coarse aggregate. Potable tap water was used for mixing and curing throughout the entire investigation. The permissible and tolerance limits of water were checked as per the I.S 456- 2000[14]. Cement: Ordinary Portland cement grade 53, conforming to I.S 12269-1987[12] was used. Cement must develop appropriate strength. It must represent the appropriate rheological behaviour

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TEST ON CEMENT:

S. No	Property	Test results
1	Normal consistency	30%
2	Specific gravity	3.15
3	Initial setting time	45 minutes
4	Final setting time	185 minutes

TEST ON FINE AGGREGATES

S. No	Property	Value
1	Specific gravity	2.61
2	Fineness modulus	2.9
3	Water absorption	1.80 %
4	Bulk density: Loose Compacted	14 kN/m3 15 kN/m3
5	Grading	Zone-II

TEST ON COARSE AGGREGATE:

S. No	Property	Value
1	Specific gravity	2.65
2	Fineness modulus	5.12
3	Water absorption	0.15%
4	Bulk density Loose Compacted	14.5 kN/m3 16.5 kN/m3
5	Nominal maximum size	20 mm

The physical properties of Coconut shell are shown below

S. No	Property	Value
1	Specific gravity	1.34
3	Water absorption	22%
4	Bulk density	800 kN/m3
5	Shell Thickness	(2-7) mm

III. PREPARATION OF SPECIMENS

Concrete Mix Design: M-20 grade of concrete was designed by I.S 10262-1982 method. The natural coarse aggregates were replaced as with 0%, 10%, 15%, 20%.The test results were analyzed and compared with theoretical values, obtained from various codes. Due to high water absorption of coconut shell, they were pre-soaked in water for 24 hours, prior to mixing.

Batching and Mixing: Weigh Batching was practiced with the help of electronic weigh balance. Batching was done as per the mix proportions. Mixing was done in tilting mixer. It was mixed for 2-3 minutes, after addition of water. Placing and Compaction: Cubes are cleaned and oiled to prevent the formation of bond between concrete and moulds. Place the fresh concrete in cubes in 3 layers, tamping each layer 25 times. The entrapped air in concrete is removed by table vibrator. Anything kept on the table gets vibrated. **Demoulding:** After placing fresh concrete in moulds, it was allowed to set for 24 hours. Concrete cubes are now kept in curing tank for 7and 28 days. After 28 days, concrete cubes were removed from curing tank to conduct tests on hardened concrete.

IV. RESULTS AND DISCUSSION

Compressive Strength: Compressive strength is defined as resistance of concrete to axial loading. Cubes were placed in Universal Testing Machine (U.T.M), and load was applied. The readings on dial gauge were recorded and compressive strength was calculated. The results of Compressive strength are shown in Table 01. Calculations: Compressive Strength = Maximum load/Cross Sectional Area

Results of Compressive strength

% Replaced by coconut shell	Mix Name	Compressive strength (MPa)	
		7 Days	28 days
0%	M1	19.12	31.8
10%	M2	15.02	24.4
15%	M3	13.5	22.5
20%	M4	6.2	10.02

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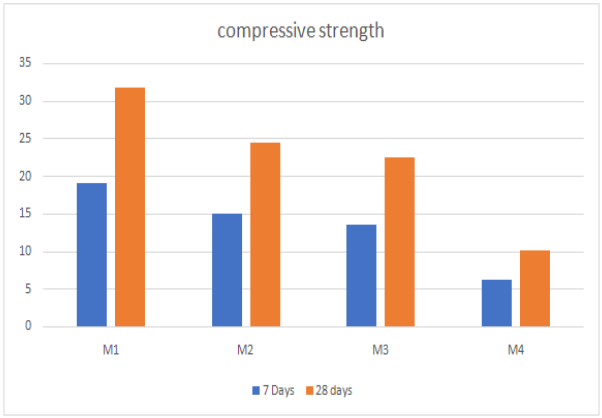
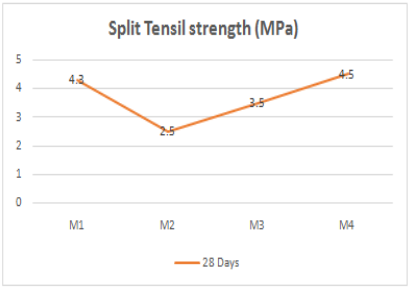


Results of Split Tensile strength:

% Replaced by coconut shell	Mix Name	Split Tensil strength (MPa)
		28 Days
0%	M1	3.5
10%	M2	2.76
15%	M3	2.20
20%	M4	1.24



CONCLUSION:

The purpose of this research is to compare and find out the characteristic strength of M20 grade Coconut Shell Concrete at the water cement ratio of 0.50. Using the waste coconut shell by replacing fast depleting conventional aggregate source construction material and thereby getting the solution for social and environmental issues. Based on experimental investigations concerning the compressive strength of concrete, the following observations are drawn:

The following conclusion drawn from the work:

1. Using the coconut shell as coarse aggregate in concrete can reduce the material cost in construction because of the low cost.
2. Increase in percentage replacement by coconut shell reduces compressive strength and split tensile strength of concrete.
3. Coconut shell concrete is also classified as structural lightweight concrete. 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
4. The reduction in compression strength is less in comparison with the split tensile strength with the replacement of conventional material.
5. Coconut Shell Concrete can be used in rural areas and places where coconut is abundant and may also be usedwhere the conventional aggregates are costly.

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