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PARTIALLY REPLACEMENT OF COARSE AGGREGATE WITH COCONUT SHELL IN CONCRETE

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Abstract - *Concrete is an artificial material similar in appearance and properties to some natural lime stone rock. It is a manmade composite, the major constituent being natural aggregate such as gravel, or crushed rock, sand and fine particles of cement powder all mixed with water. The concrete as time goes on through a process of hydration of the cement paste, producing a required strength to withstand the load. The use of coconut shell as coarse aggregate in concrete has never been a usual practice among the average citizens, particularly in areas where light weight concrete is required for non-load bearing walls, non-structural floors, and strip footings. Although coarse aggregate usually take about 50% of the overall self-weight of concrete. The cost of construction materials is increasing day by day because of high demand, scarcity of raw materials, and high price of energy. From the standpoint of energy saving and conservation of natural resources, the use of alternative constituents in construction materials is now a global concern.*

Key Words: Light weight concrete, coursed aggregate, Compressive strength , Spilt tensile strength.

1. INTRODUCTION

Now-a-days many engineers and scientists are in process to find various natural as well as modernized ways for the production of construction materials especially concrete. They are also keen in maintaining its quality and strength and therefore various other materials are used as a replacement of a particular material in the making of concrete. One such material is coconut shell which can be used in concrete making by partially replacing coarse aggregate which is a very important component in concrete. Coconuts being naturally available in nature and since its shells are non-biodegradable. India is the third largest producer of coconut products in the world. Coconut trees are widely cultivated in the southern states of India, especially Kerala. Kerala got its name itself derived from a word, 'kera' meaning coconut tree. Kerala is densely populated state and most of its population uses coconut or it's byproducts in their daily activities India produces about 20% of the coconut produced in the world. Within India, Kerala produces 45% of it. Disposal of coconut shells poses environmental issues as it is not easily degradable. Aggregates made by crushing coconut shells can be effectively used in concrete by partially replacing coarse aggregate up to a certain amount. This will not only reduce the unit weight of resulting concrete made, but also provides an efficient solution to the disposal of coconut shells .

1.1 Objective

- To check suitability of coconut shell as concrete ingredient.

  a)Compressive strength of normal M20 concrete.

  b)Compressive strength of concrete with coconut shell with different percentage.

- To study Recycling of the coconut shell .
- To study impact on environment.

1.2 All India coconut production

States/Union Territories	Area (ha)	Production (million nuts)	Productivity (nuts/ha)
A & N Islands	21.70	102.22	4711
Andhra Pradesh	104	1042.52	10024
Assam	18.80	157.86	8397
Chhattisgarh	0.70	9.45	14067
Goa	25.60	137.54	5373
Gujarat	16	168.80	10550
Karnataka	419	2339.81	5584
Kerala	788	6259.50	7918
Lakshadweep	2.70	62.52	23156
Maharashtra	21	187.56	8931
Nagaland	0.90	0.47	521
Orissa	51	296.97	5823
Puducherry	2.10	31.26	14886
Tamil Nadu	390	5770.60	14796
Tripura	5.80	12.50	2156
West Bengal	28.60	382.94	13389

2. LITERATURE REVIEW

A) J.P.RIES:-

J.P. RIES (2011) studied that Lightweight aggregate (LWA) plays important role in construction. 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 labor demands and increasing the Survive

B) DEWANSHU AHLAWAT :-

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 partial replacement of coarse aggregate in concrete and determining its compressive strength and density. The conclusions for the research are the compressive strength of the concrete decreased as the percentage shell substitution increased. Also increased in percentage replacement by coconut shell increase workability of concrete . Coconut shell can be used as partial replacement of coarse aggregate in R.C.C. concrete .

3. PROPERTIES OF COCONUTSHELL

3.1. COCONUT SHELL

Available coconut were hammered and crushed to smaller pieces and sieved. The sieved materials were washed with clean water for several times and then on sun, made saturated and then required quantity was taken for casting. Physical properties are tabulated in Table No. The CSA aggregates after crushing and sieving by manual means were presented in Figure.

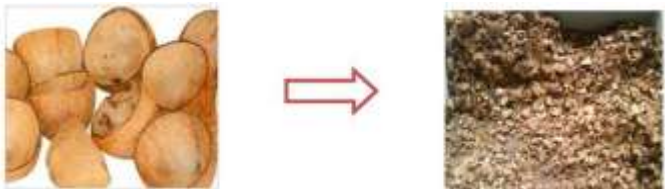


Figure No. 3.1: Coconut shell as aggregate

4. METHODOLOGY

The raw materials used in the experimentation were locally available and these included Ordinary Portland Cement as binding agent, river sand and fine aggregate and coarse aggregate and coconut shell as a coarse aggregate. Potable tap water was used for mixing and curing throughout the entire investigation.

Concrete mix design: M 20 grade of concrete was designed by IS 10262-1982 method. The natural coarse aggregate were replaced as 0%, 8%, 10%, 15%, 20%. The test results were analysed and compared with conventional concrete. Due to high water absorption of coconut shell, they were pre-soaked in water for 24 hours, prior to mixing. Batching and Mixing: weight Batching was practiced with the help of electronic weight balance, Batching was done as per mix proportions. Mixing was done by manually. 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 three layers, tamping each layer 25 times. The entrapped air in concrete is removed by table vibration. Demoulding After placing fresh concrete in moulds, it was allowed to set for 24 hours. It was marked with some permanent identification mark. Concrete cubes are now kept in curing tank for 28 days. After 28 days, concrete cubes were removed from curing tank to conduct tests on hardened concrete.

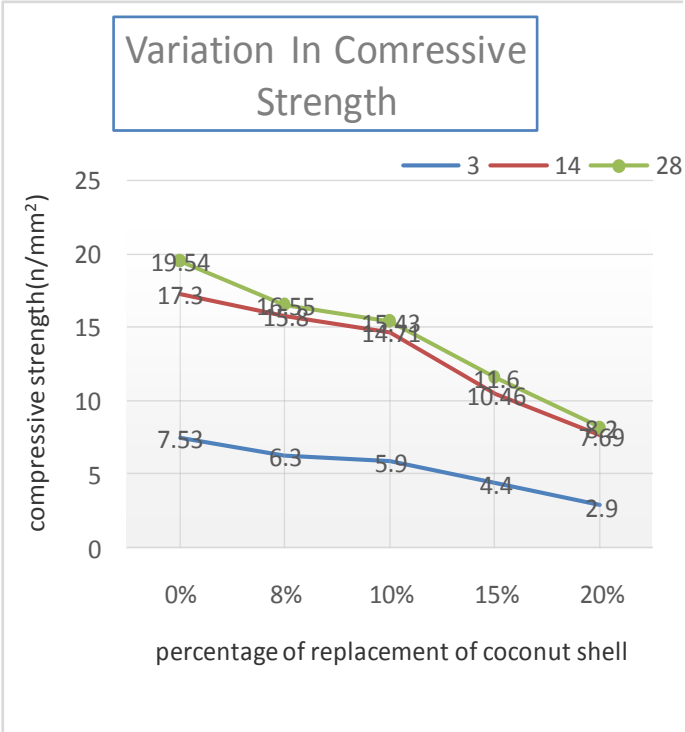
5. RESULT AND GRAPHCAL REPRESENTATION

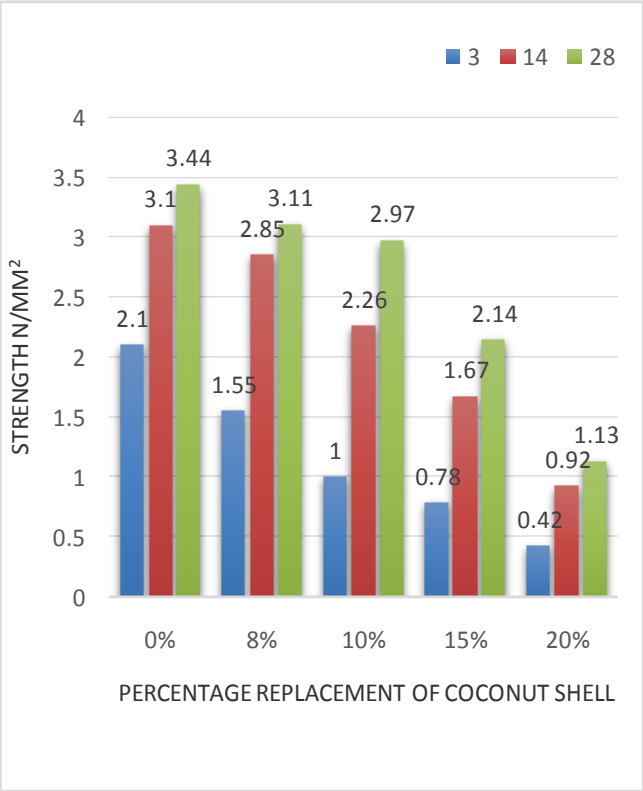
5.1 Compressive strength test

The compressive strength of concrete is one of most important properties of concrete in most structural applications. For compressive strength test, cube specimens of dimensions 150 150 150 *mm* were cast for M20 grade of concrete. The specimens were demolded after 24 hours of casting and were transferred to curing tank wherein they were allowed to cure for 3 days 14 days and 28 days. After curing, these cubes were tested on Compression Testing Machine (capacity 1500 KN) as per IS: 516-1959. The failure load was noted. In each category three cubes were tested and their average value is reported. The compressive strength was calculated as follows,

$$\text{Compressive strength (MPa)} = \frac{\textit{Failure load}}{\text{cross sectional area.}}$$

Bulk Density(gm/m3)	550
Specific Gravity	1.32
Fineness Modulus	7.28
Impact Value (%)	20
Abrasion Value (%)	5-10
Water Absorption (%)	27
Shell thickness (mm)	2-5





5.2 Spilt tensile strength test

Split tensile strength test was conducted as per IS 5816:1999. For split tensile strength test, cylinder specimens of dimension 150 mm diameter and 300 mm length were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank wherein they were allowed to cure for 3 days 14 days and 28 days.These specimens were tested under the compression testing machine by applying a compressive load across the diameter till the cylinder splits. The failure load was recorded. In each category three cylinders were tested and their average is reported. Split tensile strength was calculated as follows:

Split Tensile strength (MPa) = $2P / \pi DL$

Where, P = failure load, D = diameter of cylinder,

L = Length of cylinde

5 CONCLUSIONS

- From the experimental results and discussions of above researches on coconut shell, the coconut shell has potential as lightweight aggregate in concrete.
- Also, using the coconut shell as aggregate in concrete can reduce the material cost in construction because of the low cost and its availability in abundance.
- Coconut shell concrete can be used in rural areas and places where the conventional aggregate are costly.
- 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.
- From the above researches it also found that the addition of CS decreases workability.
- The amount of cement content may be more when coconut shell are used as an aggregate in the production of concrete compared to conventional aggregate concrete
- Increase in percentage replacement by coconut shell reduces compressive strength and split tensile strength of concrete.
- The reduction in compression strength is less in comparison with the split tensile strength with there placement of conventional material.
- To increase the speed of construction, enhance green construction environment we can use

lightweight concrete. The possibility exists for the partial replacement of coarse aggregate with

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