HARDENED PROPERTIES OF PARTIALLY REPLACED COCONUT SHELL AS COARSE AGGREGATE IN CONCRETE

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ABSTRACT:

The rising cost construction material is a matter of concern. The reason for increase in cost is high demand of concrete and insufficiency of raw material. Hence the concrete technologies must search for some economical alternatives to the coarse aggregates. Hence we make use of coconut shell as a partial substitute to coarse aggregate.

In this experimental investigation, the coconut shell used as a light weight aggregate in concrete, the properties of coconut shell concrete examined, Control concrete with normal aggregate and Partially replaced coconut shell concrete with 10 - 30% coarse aggregate were made, and Constant water cement ratio of 0.45 was maintained for all the concretes. Properties like Strength under compression, consistency, feasibleness were investigated in the laboratory. The results showed that, there is a decrease in density of the concretes with increase in CS percentage. Feasibleness decreased with increase in CS percentage. Strength under compressions of CS concretes werereduced compared to control concrete.

The paper aims at analysing split tensile, flexural and Strength under compression characteristics of with partial replacement using M30 grade concrete. Cubes are casted, tested and their physical and mechanical properties are determined. The mainobjective is to encourage the use of these waste products as construction materials in low-cost constructions.

Key words: Light weight concrete, Strength under compression, Feasibleness, Split Tensile strength, Flexural strength,

INTRODUCTION

The use of aggregates for construction is the most important parts of construction. Finding a substitute for the aggregates used today is a task that is worth studying because the digging of aggregates from rivers and mountains harms the environment. If aalternate for aggregate can be obtained naturally and the source is sufficient and can be regenerated, obtaining the aggregate would deplete its source. The use of coconut by products has been a long time source of income for manyfamilies in the country. The use of coconut shell could be a valuable substitute in the formation of composite material that can be used as a housing and pavement construction, Coconut is famous as multifunction plant that all parts of it can be used for various activities.

The use of this agricultural waste due to an assumption is that it can replace the existing material used in commercial product in order to reduce cost and maintain the mechanical properties of the composite material. On the farmers' side, agricultural slag can be a source of extra income. Studies have shown that burning of agricultural wastes causes air pollution and also lead to decreased soil fertility. Building materials from agricultural and forest wastes are ideal for low-cost housing since these are generally cheaper and locally available material than conventional materials.

The availability of suitable materials is intimately linked to the development of a new product, such as producing a concrete cubes using coconut shells. Generating this product using agricultural waste will introduce alternative construction materials with a low production cost and lessen the social and environmental problems. Modern construction technologies being developed, respond to ecological and social issues ofexcessive use of raw materials from nature.

The main objective of this study will give partial replacement for the aggregates and will determined the ability and benefits to the concrete cubes when substitutes. The Coconut shells are not commonly used in construction industry and are often dumped as agricultural waste.

AIM OF THE STUDY:

The aim of this research is to spread awareness of using coconut shell as partial replacement of coarse aggregate in concrete and determining its Strength under compression, split tensile strength, flexural strength test and density. Until now, industrial by-products and domestic wastes has been utilized in concrete, but the use of agricultural waste in concrete is in its infancy stage. Coconut shell is an agricultural waste. The materials are proportioned by their weights. Tests are as per the specified procedure of IS Codes [Indian Standard Codes].

EXPERIMENTAL INVESTIGATION

1)Cement: For all the mixes in this project, 53 Grade (Birla Super cement) OPC was used. The cement was tested for codal specifications as per IS 12269-1897 to determine its properties like specific gravity, fineness and normal consistency test.

2)Fine aggregate: Locally available river sand passing through 4.75mm sieve with confined Grading zone II of IS: 383-1970 having a specific gravity of 2.55.

3)Coarse aggregate: Locally available crushed stones of nominal size 20 mm as per IS:383-1970 with a specific gravity of 2.60.

4)Water: The water used is a potable drinking water.

5)Coconut Shell: Coconut shells which were already broken into two pieces were collected and air dried for five days approximately at the temperature of 25 to 100C, removed fiber and husk on dried shells and further broken the shells into small chips manually using hammer and sieved through 20mm sieve. The material passed through 20mm sieve and retained in 4.75mm sieve was used to replace coarse aggregate with Coconut Shell. The material retained on 20mm sieve was discarded.

Fig1: Coconut Shell as aggregates

Table 1: Material properties

Material	Properties	Value
CEMENT	Specific gravity	3.16
	Consistency	33 %
FINE AGGREGATES	Specific gravity	2.55
	Bulk Density	1162 Kg/m^3
COARSE AGGREGATES	Specific gravity	2.60
	Bulk Density	1696 Kg/m^3
WATER	Specific gravity	1.0

Table 2: Mix Design Calculations using IS:10262:2009for M30 Grade

Material	Quantity	Unit
CEMENT	437.38	Kg/m^3
FINE AGGREGATES	661.34	Kg/m^3
COARSE AGGREGATES	1054	Kg/m^3
W/C ratio	0.45	

Fresh property tests for Control concrete and CS Concrete:-

In order to determine workability properties Slump flow testwas carried out:

Table 3: Slump test results

Trial	Type of Concrete	Slump		
		Initial Reading	Final Reading	Slump value (mm)
M1	Control Concrete	300	217	83
M2	10% CS Concrete	300	221	79
M3	20% CS Concrete	300	232	68
M4	30% CS Concrete	300	226	74

Hardened property tests for Control concrete and CS Concrete:-

1. Strength under compression

The test specimen used is cube of dimension 150X150X150mm.

Age at Test Tests is been made at the ages seven, fourteen, and twenty eight days. In the present investigation, the strength under compression test has been conducted on control concrete and *CS Concrete* with different percentages of partially replacement of coconut shell varying 10% to 30% for M 30 grade are tested. A Total of 12 specimens were cast and tested.

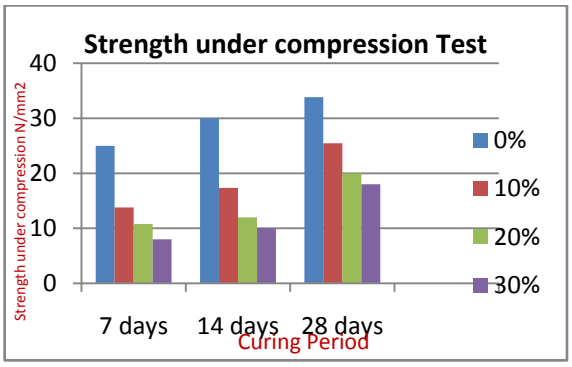

Fig2: Variation of Strength under compression with *Control concrete and* different proportion of *CS Concrete*.

2. Splitting Tensile Strength of Concrete

To find out the splitting tensile strength of cylinders were casted with dimensions 150mm diameter and 300mm height.

Age at test Tests shall be made at the ages of seven, fourteen, and twenty eight days. A cylindrical specimen of dimensions (150mm dia and 300mm height) was used. Also a total of 12 specimens were casted for this test and were tested at 7, 14, 28 days.

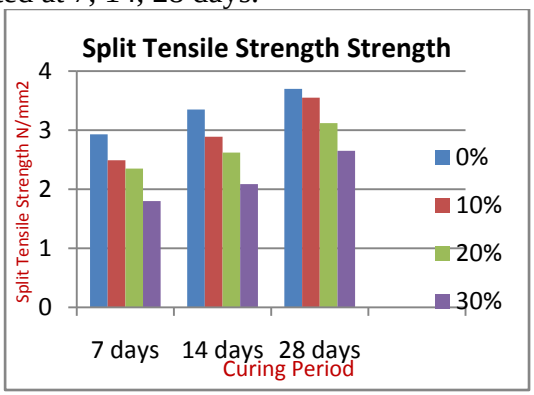

Fig3: Variation of Split tensile strength with with*Control concrete and* different proportion of *CS Concrete*.

3. Strength under flexures test

Tech ref: IS516-1959 To determine the Flexural strength test of concrete, Flexural testing machine was used, test specimens were of prismoidal in shape with dimensions 500X100X100mm.

Age at test Tests shall be made at ages of seven, fourteen, and twenty eight days. Total 72 specimens were casted for different ages of test.A total of 72 specimens were casted for this test and were tested at 7, 14, 28 days.

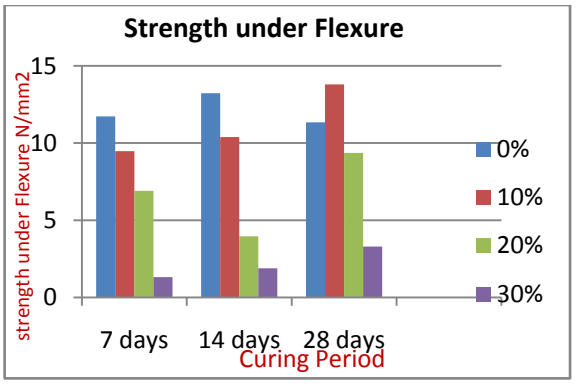

Fig4: Variation of Flexural strength with with*Control concrete and* different proportion of *CS Concrete*.

CONCLUSION

1. By studying the results obtained we conclude that Coconut shell can be replaced upto 10-12.5% as a coarse aggregates
2. It is concluded that Increase in percentage replacement of coconut shell reduces Strength under compression of concrete.
3. Similar to Strength under compression, the split tensile strength also decreases with increase in Coconut Shell replacement.
4. Increase in percentage replacement by coconut shell decreases workability of concrete.
5. Use of coconut shells in cement concrete can help in waste reduction and pollution reduction.
6. The need of this project is to encourage the use of the waste product as a construction materials in low-cost housing and construction of light weight load bearing structures.

SCOPE FOR FUTUREWORK

THE PRESENT RESEARCH CAN BE EXTENDED TO:

1. In our project we made use of M30 grade concrete and it can be tried for higher grades.
2. With the use of admixtures like super plasticizers workability can be improved.
3. We can also add Fly ash, Silica fume, Rice Husk ash etc as a replacement for cement to increase the workability of CS concrete.
4. Using quarry dust and glass powder as a replacement for fine aggregate, the cost of the project can be further reduced.

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