LIGHT WEIGHT CONCRETE USING COCONUT SHELL

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Abstract:

In this constructed environment, the rising cost of building construction materials is the factor of great concern. Nowadays, most of the researches are doing the research on the material which reduce the cost of the construction. The coarse aggregate are the main ingredients of concrete. . For instance fly ash, rice husk, slag and sludge from the treatment of industrial and domestic waste water have been found suitable as partial replacement for cement in concrete. The coconut shell is a material which can be a substitute for aggregate. The utilization of coconut shell as partial replacement for coarse aggregate.

At the moment, 90% of this waste is disposed of the land fill as non-hazardous waste while only 10% is beneficially reused. In the present study, steps have been taken to partially replace the coarse aggregate. The use of coconut shells in concrete will considerably decrease the scarcity of natural aggregates. Because of this reason coconut shells are utilized as partial replacement for coarse aggregate in concrete with 5%,10% and 15% substitution in M20 concrete.

These were casted and tested for compressive strength test and split tensile strength after a curing period of 3,7 and 28 days. The use of coconut shell can also help economically. Density of coconut shell is in the range of 550-650 kg/m3 and these are with in the specified limits for light weight aggregate. Sun drying shell should be used to make sure biodegradable materials decay before its mixing with concrete. It also contributes to sustainable construction

Keywords: coconut shell; aggregate; coconut fiber; mechanical properties; bond properties

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1. INTRODUCTION

Concrete is a composite material composed of fine and coarse aggregate bonded together with a fluid cement (cement paste) that hardens overtime. Concrete has been used since ancient times for example regular Roman concrete was mad from volcanic ash pozzalano and hydrated lime. Roman concrete was superior to other concrete recipes (for example, those consisting of only sand and lime) used by other cultures. There are many types of concrete, designed to suit a variety of purposes coupled with a range of compositions, finishes and performance characteristics. Some of them are,

1. High strength concrete
2. Self compacting concrete
3. Light weight concrete
4. Quick setting concrete
5. Bio concrete
6. Transparent concrete etc

The main characteristics of light weight aggregate are its low thermal conductivity, lower density, internal curing property etc. Due to its cellular structure, it can absorb more water than normal aggregate, and depends on the pore structure of the aggregate.

This means that light weight aggregates usually absorb more water when placed in a concrete mixture, and the resulting rate of absorption is important in proportioning of light weight concrete mix.

The main specialties of lightweight concrete are its low density and thermal conductivity. Its advantages are that there is a reduction of dead load, faster building rates in construction and lower haulage and handling costs. Lightweight concrete maintains its large voids and not forming laitance layers or cement films when placed on the wall.

2. OBJECTIVES

1. To find economical materials for high cost construction.

2. To prepare lightweight concrete structure by using coconut shell as course aggregate.

3. To reduce the solid waste by using coconut shell as a course aggregate.

3. MATERIALS

1.CEMENT

Ordinary Portland cement conforming to IS 269-1976 and IS 4031-1968 was adopted in this work. The cement used is 53 Grade. The 53 Grade ordinary Portland cement is a higher strength cement to meet the needs of the consumer for higher strength concrete. As per BIS requirements the minimum 28 days compressive strength of 53 MPa. For certain specialized works, such as prestresed concrete and certain items of precast concrete requiring consistency high strength concrete, the use of 53 grade. Ordinary Portland cement produces higher grade concrete at very economical cement content. In grades a saving of 8 to 10% of cement may be achieved with the use of 53 grade ordinary Portland cement.

2.COARSE AGGREGATE

The aggregate used in this project mainly of basalt rock which comes under normal weight category. The aggregate are locally available. 50% of the aggregate used are of 10-12 mm size and remaining 50% are of 20mm size. The coarse aggregate was also tested for various properties like specific gravity test, fineness modulus, crushing strength test, water absorption test to check their suitability for the experiment.

3.FINE AGGREGATE:

Natural M-sand which is easily available and low in price was used in the work. It has cubical or rounded shape with smooth surface texture. Being cubical, rounded and smooth texture it give good workability. Particles of this sand have smooth texture. Manufactured sand is a substitute of river sand for concrete construction. Produced from hard granite stone by crushing. The crushed sand is of cubical shape with grounded edges, washed and graded to as a construction material. The size of manufactured sand is less than 4.75mm.

4.COCONUT SHELLS:

Coconut shell is a natural material that is available abundantly. Waste generated by industrial and agriculture processes, has created disposal and management problems that pose series issues of environmental pollution. Coconut shells are reused in many applications and some a considerable amount of its are exported. Therefore, the utilization of these materials in construction will be an important step to improve sustainability and eco-friendly construction. In addition to that, it will help to reduce other necessary ingredients in the production of concrete. The current study examines the suitability of a coarse aggregate with coconut shells in the production of concrete. The coconut shells are sundried for five days prior to using being a combination.

4. EXPERIMENTAL STUDY

The freshly discarded shells were collected from an oilmill. The coconut shells were crushed using concrete hammersto a size such that it passes through a 20mm sieve and retainedon 4.75 sieve. Crushed shells were washed to remove fibres,mud, etc. from them. The washed shells were dried in sunlightfor 2 days. The crushed edges were rough and spiky as shownin figure 1. The surface texture of the shell was fairly smoothon concave and rough on convex faces. Coconut shellaggregates used were in saturated surface dry (SSD) condition.Portland Pozzolana Cement (PPC) 43 Grade was used as abinder (Malabar Cements). River sand (passing through4.75mm sieve) was used throughout the study as the fineaggregate. Crushed stone (passing through 20 mm sieve andretained on 4.75 mm sieve) was used as coarse aggregatealong with coconut shells. Potable water was used for mixingand curing. A nominal mix of 1:2:4 with a water-cement ratioof 0.5 was used throughout. Four different mixes were madewith 5%,10%,15% replacement of coarse aggregate with coconut shells.

Specimens were cast in such a way as to produce full compaction of the concrete with neither segregation nor excessive laitance. Compaction was achieved through use of a table vibrator. Here in this experiment we replaced coarse aggregate with coconut shell, by volume. Specimens were cast by replacing 5%,10% and 15% of coarse aggregate with Coconut shells. Tests were conducted on the cast specimens after 28 days as mentioned in the IS code. Tests for

workability, flexure, compression and split tensile strength were conducted and results were obtained. Table I shows the set of experiments and number of samples used for measuring the properties of the different mixes.

TABLE I. Type of strength tests and specimens.

5. MIXDESIGN

Concrete mix has been designed based on Indian Standard Recommended Guidelines IS: 10262-1982

The mix designation and quantities of various materials for each designed concrete mix have been tabulated in Table

Grade designation : M20

Type of cement : OPC 43 grade, IS 8112

Maximum nominal size of aggregate : 20 mm

Minimum cement content : 60 kg/m3

Exposure condition : Mild

Degree of supervision : Good

Type of aggregate : crushed angular aggregate

6. PREPARATION OF SPECIMEN

CASTING AND TESTING DETAILS:

The mix proportion for coconut shell and coconut fiber based concrete is obtained by partially replacing aggregate with different dosages of coconut shells and coconut fiber volumetric. The quantities of materials for various mix are obtained by partial replacement of aggregate by coconut shell and coconut fibers. Cube of 150 mm size for compressive strength evaluation and specimens were cured in water for 7 days and 28 days then tested. For every mix, 6 cubes of 150 mm size (for compression tests: 3 numbers each for 7 days and 28 days. 3 levels of replacement of aggregate were considered (5, 15, 20%) compressive testing machine is used for testing the compressive strength of cube and split tensile strength of cylinder. The crushing loads were noted and average compressive strength for three specimens is determined.

MIXING

The steel molds of 150 x 150 x 150 mm were oiled properly before filling mortar. The mortar was filled into the molds in three layers with hand compaction after adding each successive layers. After filling the molds completely with the mortar, a needle vibrate was used to remove air voids from the mortar. It is to be kept in mind that needle vibrator is used just for few seconds to avoid segregation and floating of coconut shell and coconut fiber to surface.

Type of Test	Specimen Properties	Number
Compressive test	Cubes;150x150x150mm	3 x 4 = 12
Flexure test	Beams; 100x100x500mm	1 x 4 = 12
Split tensile test	Cylinders;150mm dia.,300mm long	3 x 4 = 12

TOTAL NUMBER OF CUBES : 36 NO'S

PREPARATION OF SPECIMEN:

Preparation of tests specimen includes the following producer.

BATCHING

The quantity of ingredients was arrived by conducting proper weight batching and stored separately for mixing.

MIXING OF CONCRETE:

Proper mixing of concrete was carried out manually in a good way.

PLACING:

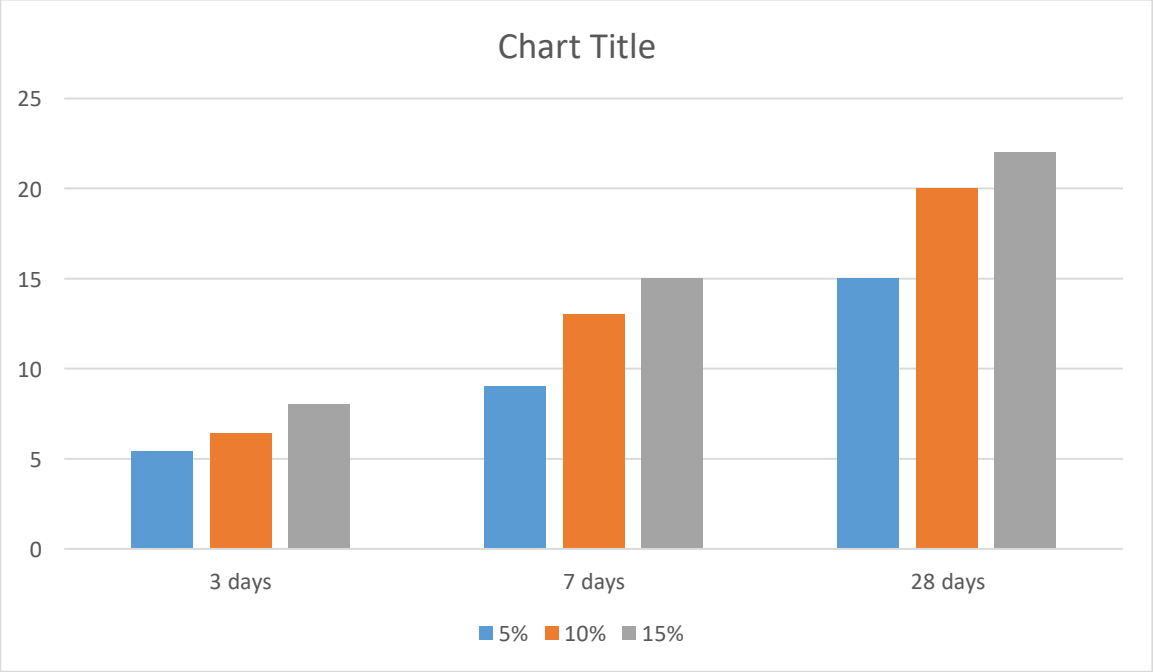
Mixed concrete is placed in the mould in such a way that there is no chance of segregation. Proper compaction was done by using tamping rod.

FINISHING AND CURING:

After placing the concrete, the surface of specimen was finished properly in smooth manner. After 24 hours the moulds are removed and the specimen was subjected to curing.

7. RESULT AND DISCUSSION(compressive strength)

S.NO	NAME OF THE SPECIMEN	PERCENTAGE OF REPLACEMENT	COMPRESSIVE STRENGTH (N/MM^2)		
			3 DAYS	7DAYS	28 DAYS
1.	CUBE 1	5%	5.3	8.7	14.8
	CUBE 2		5.1	8.9	14.5
	CUBE 3		5.6	8.8	14.9
2.	CUBE 1	10%	6.3	12.5	18.9
	CUBE 2		6.7	12.9	18.7
	CUBE 3		6.5	12.6	18.6
3.	CUBE 1	15%	7.6	15.2	21.8
	CUBE 2		7.0	14.6	22.4
	CUBE 3		7.7	14.9	22.7



8. CONCLUSION

The use of coconut shell as partial replacement of coarse aggregate should be encouraged for sustainable and eco friendly construction. By the utilization of agricultural waste materials in concrete tends to low cost construction and waste management. To increase the speed of construction, enhance green construction environment we can use light weight concrete. Coconut shell exhibits more resistance against crushing, impact and abrasion. Coconut shell is compatible withthecement.It leads to sustainable development.

9. REFERENCE

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