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"Effect of Coconut Shell as a Coarse Aggregates on Behavior of Concret"

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ABSTRACT: Nature resources such as river sand and coarse aggregate are depleting at an alarming level in developing countries like India From study. The high demand for concrete in the construction using normal weight aggregates such as gravel and granite drastically reduces the natural stone deposits and this has damaged the environment thereby causing ecological imbalance. Therefore, there is a need to explore and to find out suitable replacement material to substitute the natural stone. In developed countries, the construction industries have identified many artificial and natural lightweight aggregates (LWA) that have replaced conventional aggregates thereby reducing the size of structural members. This has brought immense change in the development of high rise structures using LWC. . The coconut shell was used as a Replacement of coarse aggregate. The quantity of coconut shell is 0%, 5%, 10%, 15% replacement by coarse aggregate and cubes were casted and crushed in order to investigate the compressive strength .use of coconut shell as a substitute of aggregate will be not only is cost effective and eco friendly, but also help to resolve the problem of disposal of shortage of conventional material such as coarse aggregate.

KEYWORD: Coconut shell, aggregate, partial replacement, lightweight concrete,Coconut Shell, Coarse Aggregate

I. INTRODUCTION:

concrete is an artificial material similar to similar in appearance & properties to some natural lime stone rock .The major component of concrete is natural aggregate such as gravel or crushed rock ,sand and fine particles of cement powder and ultimately mixed with water .while the construction material cost is increasing day by day ;the reasons are high demand ,scarcity of raw material as well as high price of energy .Coconut shell represents more than 60% of domestic waste volume .coconut shell is an abundantly available agricultural waste from local industries .So, in developing countries like India, these can be used as potential material or replacement material in the construction field. This will ultimately lead to the reduction in the cost of construction material as well as means of disposal of waste. Infrastructure development across the world created demands for construction material. Concrete is the premier civil engineering materials used in the structure. Concrete manufacturing involves consumption of ingredients likecement, aggregates, water and admixtures. Among all the ingredients, aggregates form the major parts. Production is expected to increase to more than billions tons per year by the year. Use of natural aggregates in such a rate leads to a question about the preservation of natural aggregate sources. Using alternative materials in place of natural aggregates in concreteproduction makes concrete as sustainable and environmentally friendly construction material. The chemical composition of coconut shell is similar to wood and it contains 33.61% cellulose, 36.51 % lignin and 0.61% ash.

II. AIM &OBJECTIVE

Aim: To encourage the use of these harm free waste products as construction materials in low-cost housing. Analyzing flexural and compressive strength characteristics of concrete produced using crushed, granular coconut as substitutes for conventional coarse aggregate.

Objective:

- To encourage the use of these 'seemingly' 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.

III. LITERATURE VIEW

Siti Aminah Bt Tukiman and Sabarudin Bin Mohd (2009): replaced the coarse aggregate by coconut shell and grained palm kernel in their study.

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Percentage of replacement by coconut shell were 0%, 25%, 50%, 75% and 100% respectively. Conclusion is that the combination of these materials has potential of being used as lightweight aggregate in concrete and also has reduce the material cost in construction

Olutoge (2010) studied the saw dust and palm kernel shells (PKS). Fine aggregates are replaced by saw dust and coarse aggregates by palm kernel shells in reinforced concrete slabs casting. Conventional aggregates were replaced by saw dust and PKS in same ratios of 0%, 25%, 50%,75% and 100%. Compressive and flexural strengths were noted at different time intervals. It was seen that at 25% sawdust and PKS can produce lightweight reinforced concrete slabs that can be used where low stress is required at reduced cost. 7.43% reduction can be achieved **.**

J. P. Ries (2011) observed that Lightweight aggregate 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 demand and increasing the life of structural concrete

Maninder Kaur & Manpreet Kaur (2012) published a review paper in which it is concluded that use of coconut shells in cement concrete can help in waste reduction and pollution reduction. It is also expected to serve the purpose of encouraging housing developers in investing these materials in house construction. It is also concluded that the Coconut Shells are more suitable as low strength giving lightweight aggregate when used to replace common coarse aggregate in concrete production.

Vishwas P. Kulkarni et al (2013) studied that Aggregates provide volume at low cost, comprising 66 percent to 78 percent of the concrete. M20 Concrete is produced by 0%, 10%, 20%, 30% replacement of coarse aggregate by coconut shell. There is no need to treat the coconut shell before use as an aggregate except for water absorption. No bond failure was observed, confirming that there was adequate bonding between the coconut shell aggregate concrete and the steel bars

IV. COCONUTSHELL AGGREGATE

Crush coconut shell as coarse aggregates and this coconut shell aggregate was used as partial replacement of coarse aggregate. which is crushed stone coconut shell were unruffled from the local seller after that it was clean, sun dry remove fibres to evaluate its properties. Coconut shell needs no pretreatment, for water absorption .Due to the property, before use coconut shell were in portable water for24hours

V. TESTING OF MATERIAL

1. Properties of cement

Sr .No	Particulars	Experimental Values
1	Setting time Initial setting time (min) Final setting time (hr)	 30 10
2	Normal consistency (%)	31%

2.Test data for material

Sr.No	Test data for material	
1	Specific gravity of Fine aggregate	2.77
2	Specific gravity of coarse aggregate	2.77
3	Water absorption of coarse aggregate	1.78%
4	Specific gravity of water	1.0
5	Free surface moisture of coarse and fine aggregate	Nil

VI. MIX DESIGN

6.1 Definition

Mix design is the process of selecting suitable ingredient if concrete and determines their relative proportions with the object of certain minimum strength and durability as economically as possible.

6.2 Objective Of Mix Design

The objective of concrete mix design as follows.

- The first objective is to achieve the stipulated minimum strength.
- The second objective is to make the concrete in the most economical Manner. Cost wise all concrete's depend primarily on two factors, namely cost of material and cost of labor.

6.3 Mix Proportion for M30 grade of concrete

Cement	Fine aggregate	Coarse aggregate	Water
288	790.02	994	170.39
1	2.21	3.09	0.45

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VII. MATERIAL PROPERTIES:

7.1Cement:

Ordinary Portland cement of 43 grade conforming to Indian Standard IS 12269-1987 **9** was used throughout the experimental program. The standard consistency was 31%, whereas the initial and final setting times were 30 min. and 10hrs. respectively.

7.2Coarse Aggregate:

In this investigation, two types of coarse aggregates were used for preparation of concrete, Natural Coarse Aggregate. (NCA) and coconut shell Coarse Aggregate. (CSA)

7.3Natural Coarse Aggregate (NCA)

Crushed hard granite chips of maximum size 20 mm were used in the concrete mixes. The bulk density of aggregate was 1460 kg/m3 and specific gravity was found to be 2.65.

7.4Sand:

Fine aggregate (sand) used for this entire investigation for concrete was river sand conforming tozone-II of IS: 383-1970

7.5 Water:

Potable water conforming to IS 456-2000 **11** was used for casting and curing

VIII. PREPARATIO OF SPECIMENS:

8.1 Batching: All cement, sand, coarse aggregate and coconut shell measured with digital balance. Water is measuring cylinder of capacity 1 lit and measuring jar of capacity 100 ml and 200 ml..

8.2 Mixing of concrete: The ingredients are thoroughly mixed in concrete mixer. The sand, cement and aggregate are measured accurately.

8.3Moulds:

Concrete moulds are cubes (150 mm x 150 mm x 150 mm), cleaned first and oiled for easy stripping. The moulds for conducting tests on fresh concrete were made ready and inner surface was oiled.

8.4 Placing and Compaction: To avoid the bond formation between moulds and concrete just clean and oil the moulds before pouring concrete. Place the fresh concrete and tamp each surface 25 time . Clean the mounds and apply grease. Fill the concrete in the moulds in 3 equal layers.

8.5 Demoulding:

After leveling the fresh concrete in the mould, it was allowed to set for 24 hours. The identification marks of concrete specimens were done with permanent markers and the specimens were removed from the mould. The moulds were cleaned and kept ready for next batch of concrete mix.

8.6 Curing:

Curing is an important process to prevent the concrete specimens from losing their moisture while they are gaining their required strength. Inadequate curing is also the cause of unexpected cracks on the surface of concrete specimen.

IX. COMPRESSION TEST ON CONCRETE CUBES

The determination of the compressive strength of concrete is very important because the compressive strength is the criterion of its quality. Other strength is generally prescribed in terms of compressive strength. The strength is expressed in N/mm2. This method is applicable to the making of preliminary compression tests to ascertain the suitability of the available materials or to determine suitable mix proportions. The concrete to be tested should not have the nominal maximum size of aggregate more than 20mm test specimens are either 15cm cubes or 15cm diameter used. At least three specimens should be made available for testing. The compressive loading tests on concretes were conducted on a compression testing machine of capacity 2000 kN. For the compressive strength test, a loading rate of 2.5 kN/s was applied as per IS: 516–1959. The test was conducted on 150mm cube specimens at 7,14 ,28 and 56 days. Each sample was weighed before putting into the crushing machine to ascertain it density. The compression strength of each sample was determined as follows Compressive strength = Crushing Load (kN) /Effective Area (mm2)

X. COMPRESSIVE TEST RESULT:

%Replaced by coconut shell	Days	Cubes	0 %	5%	10%	15%
Compressive Strength	7 Days	C1	21.87	18.89	19.98	15.89

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(N/mm2)		C2	21.60	18.40	19.87	15.78
		C3	21.35	18.15	19.50	15.50
		Avg	21.60	18.48	19.78	15.72

Table No.1 Result of compressive Strength of coconut shell concrete after 7 days (N/mm2)

%Replaced by coconut shell	Days	Cubes	0 %	5%	10%	15%
Compressive Strength (N/mm2)	14 Days	C1	25.75	23.45	24.34	15.89
		C2	25.58	23.15	24.13	15.78
		C3	25.33	23.05	24	15.50
		Avg	25.55	23.21	24.15	15.72

Table No.2 Result of compressive Strength of coconut shell concrete after 14 days (N/mm2

%Replaced by coconut shell	Days	Cubes	0 %	5%	10%	15%
Compressive Strength (N/mm2)	28 Days	C1	31.60	29.90	30.30	30
		C2	31.55	29.40	30.10	29.95
		C3	31.40	29.20	30.0	29.75
		Avg	31.51	29.5	30.13	29.9

Table No.3 Result of compressive Strength of coconut shell concrete after 28 days (N/mm2)

% Replaced by coconut shell	Days	Cubes	0%	5%	10%	15%
Compressive Strength (N/mm2	56 Days	C4	43.75	42.65	43.55	40.44
		C5	43.40	42.45	43.45	40.34
		C6	43.23	42.34	43.37	40.20
		Avg	43.46	42.48	43.03	40.32

Table No.4 Result of compressive Strength of coconut shell concrete after 56 days (N/mm2)

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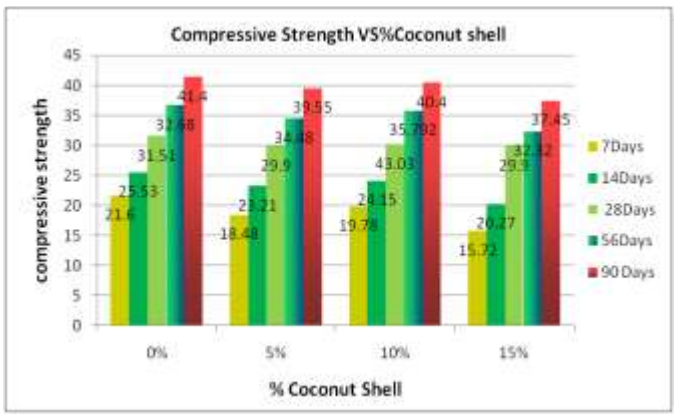
%Replaced by coconut shell	Days	Cubes	0 %	5%	10%	15%
Compressive Strength (N/mm2)	90 Days	C1	41.66	39.76	40.54	37.65
		C2	41.34	39.56	40.43	37.54
		C3	41.20	39.34	40.23	37.16
		Avg	41.4	39.55	40.4	37.45

Table No.5 Result of compressive Strength of coconut shell concrete after 90 days (N/mm2)

- **Comparsion on cube compression strength result of different % Replacement for coconut shell with coarse aggregate**

% Replaced by Coconut shell	0%	5%	10%	15%	Curing period (Days)
Compressive strength (N/mm2)	21.60	18.48	19.78	15.72	7Days
	25.55	23.21	24.15	20.27	14Days
	31.51	29.9	30.13	29.9	28Days
	36.68	34.48	35.79	32.32	56Days
	41.4	39.55	40.4	37.45	90 Days

Table No6: Result of compressive strength for coconut shell concrete after 7,14,28,56,90days



Graph 7.5 compressive strength VS% coconut shell

XI. CONCLUSION:

- Up to 10% of aggregate replaced by coconut shell is good according to strength as campare to other replacement percentage for coconut shell I.e 5%, 10%
- increase in percentage replacement by coconut shell reduced the strength and density of concrete.
- It help in reducing up to 15% pollution in environment.
- It is concluded that the coconut shell are more suitable as low strength giving lightweight aggregate when used to replace common coarse aggregate in concrete production.

XII. FUTURE WORK

- This study can be extended by using coconut shell under different physical conditions such as tender coconut shell, dried coconut shell etc.
- Seismic analysis of structure made by concrete with partial replacement of coarse aggregate with coir fibres and coconut shell can be carried out.

XIII. APPLICATIONS

- It is used in low cost building and marine structures
- Used as concrete blocks
- Eco friendly
- It is used as lightweight concrete for construction of footpath pavement

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