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Enhancing Properties of Concrete by Coconut Shell Replacement over Coarse Aggregate

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Abstract—*The aim of this study is to evaluate the performance effect on concrete by partially replacement of coarse aggregate by coconut shell in concrete for lightweight concrete and economical. Coconut shell use as a supplementary coarse aggregate material that can be utilized agricultural waste which is getting from temples and industries of coconut product. In this study, coconut shell has been used to replace coarse aggregate which varies 2.5% to 10% at an interval of 2.5% by total weight of coarse aggregate in M20 and M30 grade of concrete. When various tests such as compressive strength test, split tensile test and flexural strength test was performed on cubes at 7 days and 28 days, cylinder at 28 days and beams at 28 days respectively it was found that coconut shell there is a decrement in compressive strength, split tensile strength and flexural strength test. The total number of the specimen for cubes 60, cylinder 30 and beams 30 which were casted for testing to study the compressive strength, flexural strength and split tensile strength of coconut shell aggregate. These concrete specimens were deeply cured in water under normal atmospheric temperature. To take out or limit the negative effect on condition of solid industry and advance ecological maintainability of the business, the utilization of wastage from industry as materials for solid making is considered as an elective answer for keeping the intemperate use of material.*

Keywords*: Coconut Shell, Light Weight Concrete, Compressive Strength, Flexural Strength, Splitting Tensile Strength.*

1. INTRODUCTION

Coconut is developed in excess of 93 nations [1]. South East Asia is viewed as the birthplace of coconut. India is the third biggest, having development on a territory of around 1.78 million hectares. Yearly generation is around 7562 million nuts with a normal of 5295 coconuts per hectare [2]. Notwithstanding, it is likewise the fundamental supporter of the country's contamination issue as a strong waste in the type of shells, which includes a yearly generation of around 3.18 million tones [3]. Coconut shell (CS) speaks to additional than 60% of the local waste volume. CS, which presents genuine transfer issues for neighborhood condition, is a copiously accessible agriculture waste from neighborhood coconut industries. This will have the double advantage position of lessening in the cost of development material and furthermore as a method for disposal of waste.

2. MATERIAL USED

In this study, the materials used were Ordinary Portland Cement 53 grade (OPC 53), Potable Water, River Sand, and Coarse Aggregates. Waste coconut shell was used as a partial replacement of conventional coarse aggregate. Details of materials used are provided in following section.

Coconut shell use as a supplementary coarse aggregate material that can be utilized agricultural waste which is getting from temples and industries of coconut product and they were sun dried for minimum 1 month before using crushed manually. And the size range 5 mm-20 mm.

Fig. 1 Sample of Coconut Shell

Ordinary Portland cement (OPC) of 53 grade conforming to Indian Standard IS 12269-1987 was used throughout the experimental program [4].

Naturally available river sand use as fine aggregate in coconut shell aggregate. Crushed hard basalt chips of maximum size 20 mm were used in the concrete mixes. The bulk density of aggregate was 1545 kg/m3 and specific gravity was found to be 2.77 [5].

3. METHODOLOGY

First the mix design is done with the help of grade of concrete. The ingredients of concrete are taken for mixing, the sample is poured and fill the mould. After 7days and 28days curing we have performed the various tests over the sample.

The main objective of the present investigation was to study the performance of coconut shell in conventional concrete as a coarse aggregate for reduce the problem of disposal of agricultural waste and as well as reduce the cost of construction and also reduce the dead load of Various test performs on specimen for compression, split tensile and flexural strength.

Compression strength tested on cube for 7 days and 28 days, split tensile strength tested on cylinder for 28 days and Flexural strength tested on beam for 28 days the average respective value of strength reported.

3.1. Compressive Test: - Compressive strength test is perform for the resistance of axial loading on concrete(6). This type of loading test conducted on concrete cube in compression testing machine of capacity 1000KN. The test on cubes perform in Compressive Testing Machine for 7 days and 28 days. The result of compressive strength recorded in dial gauge and calculate compressive strength.

Ultimate strength = Load/ cross sectional area

3.2 ***Flexural Strength Test:*** Flexural quality testing is utilized to decide the twisting properties of a material, for example, steel. At times it is alluded to as a transverse shaft test, it incorporates putting an example between two focuses or bolsters and starting a heap utilizing a third point or with two focuses which are individually call 3-Point Bend and 4-Point Bend testing(7). Size of the beam specimen is 100 mm x 100 mm x 500 mm.

Modulus of Rupture= $3PL/ bd^2$

3.3 Split Tensile **Test**: - This test conducted on cylinder according to ASTM C496. Size of cylinder is 150 mm diameter and 300 mm length(7). The test specimens were placed between two plates with two pieces of 3 mm thick and approximately 25 mm wide wood strips on the bottom and top of the specimens. The split tensile strength test was performed on the same machine on which the compressive strength test was performed.

$F = 2P/ \pi DL$

4. RESULT

Test performed on various cubes, cylinders and on beams. By these tests getting results which are shown in tables: -

Table 1: Compressive Strength for 7 Day

S. No.	Mix %	Cylinder1 (kN)	Cylinder2 (kN)	Cylinder3 (KN)	Average load (kN)	Compressive strength (kN/mm^2)
1	0	320.6	322.8	325.3	322.9	14.35
2	2.5	307.82	309.3	313.12	310.08	13.78
3	5	290.9	293.69	296.26	293.62	13.04
4	7.5	272.92	276.38	279.98	276.43	12.29
5	10	258.52	261.38	265.46	261.79	11.63

Table 2: Compressive Strength for 28 Days

S. No.	Mix %	Cylinder1 (KN)	Cylinder2 (kN)	Cylinder3 (kN)	Average load (kN)	Compressive strength (kN/mm^2))
1	0	472.26	475.38	480.12	475.92	21.15
2	2.5	452.6	456.38	461.24	456.74	20.29
3	5	426.26	431.12	435.68	431.02	19.16
4	7.5	403.19	407.32	412.6	407.70	18.12
5	10	382.4	386.28	391.82	386.83	17.19

Table 3 Flexural Strength for Beams on 28 Days

S. No.	Mix %	Cylinder1 (kN)	Cylinder2 (kN)	Cylinder3 (kN)	Average load (kN)	Flexural strength (kN/mm^2)
1	0	9.21	11.06	13.06	11.1	2.96
2	2.5	8.70	10.6	12.65	10.65	2.84
3	5	7.01	10.07	13.07	10.05	2.68
4	7.5	8.43	9.52	10.52	9.49	2.53
5	10	7.63	9.06	10.31	9	2.40

Table 4 Split Tensile Strength for Beams On 28 Days

S. No.	Mix %	Cylinder1 (kN)	Cylinder2 (kN)	Cylinder3 (kN)	Average load (kN)	Split tensile strength (kN/mm^2)
1	0	119.48	117.46	121.46	119.46	1.69
2	2.5	115.72	117.75	115.75	116.63	1.65
3	5	109.66	111.71	113.67	111.68	1.58
4	7.5	103.06	107.98	107.02	106.02	1.50
5	10	98.06	101.10	104.08	101.08	1.43

5. CONCLUSION

In this study Coconut shell replace by the weight of coarse aggregate. Replace 0%, 2.5%, 5%, 7.5%, and 10% coarse aggregate by the coconut shell and check strength of coconut shell concrete. And it is include that:

Increase in percentage replacement of coconut shell in concrete to reduce the strength and density of concrete.

The test in making a lightweight cement is diminishing the thickness while keeping up quality and without antagonistically influencing cost.

When coconut shell use as aggregate can reduce the material cost in construction because of the low cost and its availability is abundance.

Coconut shell are more appropriate as low quality giving lightweight total so used to supplant in solid creation.

Increase in percentage by coconut shell reduces compressive strength, split tensile strength and flexural strength of concrete.

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