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STUDY OF BEHAVIOR OF CONCRETE USING COCONUT SHELL AS COARSE AGGREGATE

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ABSTRACT

Concrete a composite man-made material is the most widely used building material in the construction industry. It consists of a rationally chosen mixture of binding material such as lime or cement, well graded fine and coarse aggregates, water and admixtures (to produce concrete with special properties). In a concrete mix, cement and water form a paste or matrix which fills the voids of the fine aggregate and binds them (fine and coarse) together. The matrix is usually 22-34% of the total volume. The project was carried out with various % replacement of coconut shell in place of coarse aggregates like 0%, 5%, 10%, 15%, 20%, 30%, 40%, 50%, 75% & 100%.

Keywords- Coconut shells; Compressive strength, Tensile Strength, crushing strength.

I. INTRODUCTION

The simple reason for its extensive use in the construction of almost all civil engineering works is that the properties can be controlled with a wide range by using appropriate ingredients and by special mechanical, physical and chemical processing techniques. Buildings – from single storey to multistory, bridges, piers, dams, weirs, retaining walls, liquid retaining structures, reservoirs chimneys, bins, silos, runways, pavements, shells, arches, railway sleepers are but a few examples of cement concrete applications.

II. NEED FOR THE STUDY:

- To determine the mix proportioning of concrete using coconut shell as coarse aggregate and to determinate workability.
- Determination of mechanical properties of coconut shell concrete such as compressive strength at various stages of curing , tensile strength , modulus of rupture and bond strength
- To find the durability of coconut shell concrete, the properties such as fire resistance, acid and alkali resistance of this concrete, etc.
- To investigate the behavior of coconut shell concrete in flexure, using beam specimen.

III. METHODOLOGY



IV. TESTS ON CONCRETE

4.1 SLUMP TEST

Slump test of concrete describes the ability of the concrete to use it in various concreting fields, its character and uses and finally the degree of workability of concrete.

4.2 COMPACTION FACTOR TEST

This compaction factor test is more precise and sensitive than the slump test and is particularly useful for concrete mixes of medium and low workability.

4.3 SPECIFIC GRAVITY OF CEMENT

In concrete Technology, specific gravity of cement is made use of in design calculations of concrete mixes, and it is also used to calculate its specific surface. The specific gravity is defined as the ratio between the weight of a given volume of cement and weight of an equal volume of water. The most popular method of determining the specific gravity of cement is by the use of kerosene which doesn't react with cement

4.4 PARTICLE SIZE DISTRIBUTION

Sieve analysis is carried out for the determination of particle size distribution of fine and coarse aggregates by sieving them through differently sized sieves. The aggregate sample is brought to an air-dried condition before weighting and sieving. The air-dry sample is then weighted and sieved successively on the appropriate sieves starting with the largest size sieve. If sieving is carried out with a nest of sieves on a machine, not less than 10 minutes sieving will be required for each test.

4.5 AGGREGATE CRUSHING VALUE

Aggregate crushing value gives the relative measure of the resistance of an aggregate to crushing under a gradually applied load. Aggregate crushing test is conducted as per IS 2386 part IV. The material for the test should consist of aggregate passing 12.5mm sieve and retained on 10mm sieve

4.6 AGGREGATE IMPACT VALUE

The aggregate impact value gives a relative measure of the resistance of an aggregate to sudden shock or impact, which in some aggregate differs from its resistance to a slow compressive load.

V. TEST RESULTS

5.1 COMPRESSION TEST:

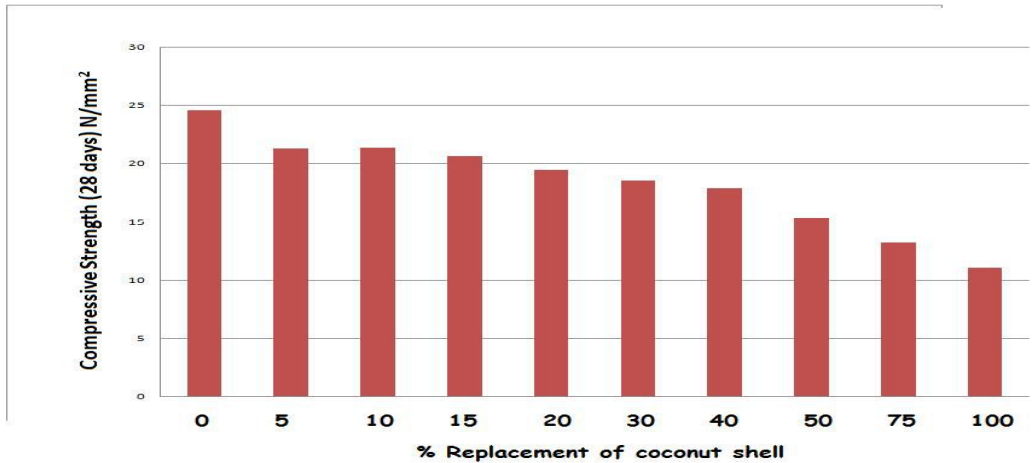
- Compressive strength is the capacity of a material to withstand axially directed pushing forces.
- When the limit of compressive strength is reached, materials are crushed.

Concrete cubes of various percentage replacements of coconut shells were casted and tested for 7th and 28th day strengths in a compression testing machine.

SI.NO	MIX NO.	% REPLACEMENT OF COCONUT SHELL AGGREGATE	TESTING IN NO. OF DAYS	COMPRESSIVE STRENGTH IN N/mm ²
1.	M1	0	28	24.60
2.	M2	5	28	21.31
3.	M3	10	28	21.33
4.	M4	15	28	20.62
5.	M5	20	28	19.48
6.	M6	30	28	18.49

7.	M7	40	28	17.88
8.	M8	50	28	15.35
9.	M9	75	28	13.24
10.	M10	100	28	11.09

Compression test – 28th day strength



28th day compressive strength

5.2 SPLIT TENSILE TEST

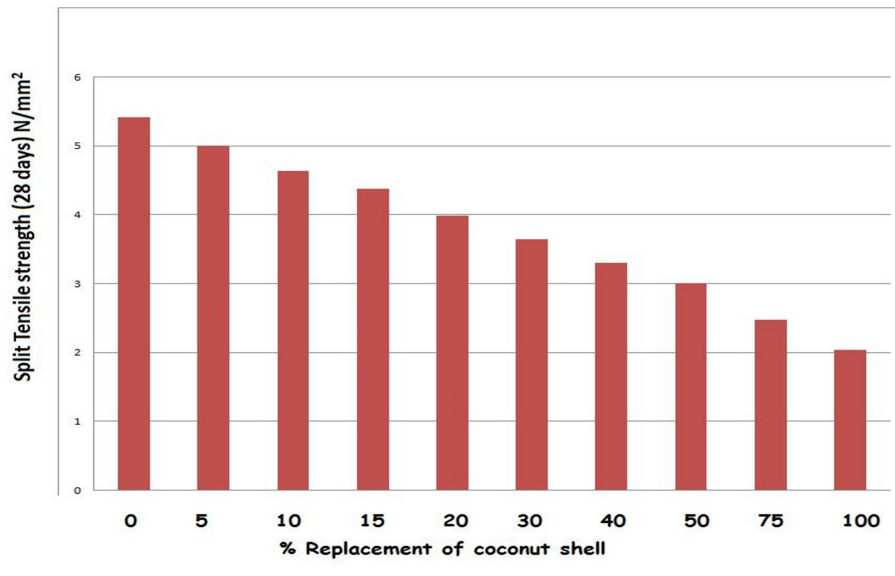
- Tensile strength is the capacity of a material to withstand axially directed tensile forces.
- When the limit of tensile strength is reached, materials get elongated and failed.

Concrete cubes of various percentage replacements of coconut shells were casted and tested for 7th and 28th day strengths in a split tensile testing machine.

Sl.NO	MIX NO.	% REPLACEMENT OF COCONUT SHELL AGGREGATE	TESTING IN NO. OF DAYS	TENSILE STRENGTH IN N/mm ²
1.	M1	0	28	5.41
2.	M2	5	28	5.00
3.	M3	10	28	4.63
4.	M4	15	28	4.37
5.	M5	20	28	3.98
6.	M6	30	28	3.64
7.	M7	40	28	3.30
8.	M8	50	28	3.01
9.	M9	75	28	2.47

10.	M10	100	28	2.04
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Split tensile test – 28th day strength



28th day split tensile strength

VI. DISCUSSION

From the compressive test results obtained, it is observed that the compressive strength for 30% replacement of coarse aggregates is 18.50 N/mm², which shows that it can be used in a large extent for non-structural works. As the compressive strength decreases with the increase in the % of coconut shell content, tests on coconut shell aggregates were carried out to enable the use of coconut shell concrete in road pavements. Standard value for impact and crushing test, according to IS 2386 Part-IV – 1963, is 30% for wearing surfaces and the values obtained was 2%. Impact test & Crushing value test results shows that coconut shell has very good resistance against impact and gradual loads and hence can be used for roadwork.

VII. CONCLUSION

Tests have been conducted for the prepared light weight concrete and the results have been verified with the specifications given by Indian Road Congress (IRC).

The test results for the nominal concrete and the concrete having coconut shell as coarse aggregate have been examined and compared. It is concluded that, the coconut shell concrete has been effectively used for non-structural concrete works. It could reasonably be concluded that coconut shell concrete would be more suitable than normal concrete when used as substitute for conventional aggregates in concrete production. Having the concept of sustainability in mind along with rural welfare, the use of coconut shell concrete will reduce the cost of project to a higher extent when construction is done at a large scale. It gains importance day by day since the population is increasing in a rapid manner, there is a decline in land availability and the dumping of coconut shell affects the agricultural demands. It can be used for pavement works, backfilling of undercuts, etc. Thus coconut shell concrete appears to have very broad applicability as an economical mode of construction especially in rural areas. It is not adequate to have awareness about the CSC; all the people should adopt this new method to have a sustainable development as well as to protect the environment from various industrial hazards.

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