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Coarse Aggregate and Fine Aggregate are Partially Replaced by Coconut Shell and Rice Husk

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ABSTRACT:- The purpose is to reduced the high cost of conventional buildings using the coconut shell or rice husk coarse aggregate or fine aggregate such that we can avoid the costing of aggregate.

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. There is a need to explore and to find out suitable natural replacement material to substitute the natural stone. India is the third largest producer of coconut products in the world. Coconut trees are widely cultivated in the south states of India, especially Kerala, Karnataka. Coconut shells as a substitute for coarse aggregates in concrete is gaining importance especially in this region in terms of possible reduction of waste products in the environment and finding a sustainable alternative for non-renewable natural stone aggregates.

The properties of concrete using crushed coconut shell as coarse aggregate were investigated in an experimental study. Coarse aggregate was replaced by crushed coconut shells in three different percentages namely 10% ,15% 20%and 25%. Workability, compressive strength, flexural strength and splitting tensile strength of the above said mixes were compared with normal concrete properties. The results from the study is expected promote the use of coconut shell as a substitute for conventional coarse aggregates.

This paper reports of weight replacement and volume replacement of coarse aggregate and fine aggregate by coconut shell and rice husk on the workability, bulk density and compressive strength of concrete. Rice Husk was used to replace sand by weight and by volume respectively. The percentage replacement was 10%, 15%, 20% and 25%. The mix ratio adopted was 1:1:2 by weight and volume respectively. Compacting factor test was carried out on fresh concrete while Compressive Strength test was carried out on hardened 15 cm concrete cubes after 7, 14,21 and 28 days curing in water. The results reveal that the Compacting Factor, Bulk Density and Compressive strength decreased as the percentage replacement of sand with rice husk increased a limit.

Keywords – Coconut Shell, coarse aggregate, concrete, fine aggregate, rice husk, compressive strength, workability, bulk density.

INTRODUCTION:-

Lightweight aggregate concrete is an important and useful material in modern construction. It has gained popularity due to its lower density and superior thermal insulation properties. Many architects, engineers, and contractors recognize the economies and advantages offered by this material, as evidenced by the many impressive lightweight concrete structures found throughout the world. LWC has strengths comparable to normal concrete is 20–30% lighter. Structural LWC offers many design flexibility and cost savings due to self-weight reduction, improved seismic structural response, and low foundation costs. Commercially available lightweight aggregate has been used widely for manufacture of light weight concrete, more environmental and economic benefits can be achieved if waste materials can be used as LWC. In developed countries, many natural materials like coconut shell, rice husk, Pumice, scoria and volcanic debris and manmade materials like expanded blast-furnace slag, vermiculite and clinker are used in construction works as substitutes for natural aggregates. In India, commercial use of non-conventional aggregates in concrete construction is not popular but its good and economy so using this materials. India is the 3rd largest producer of coconut in the world. Coconut trees are widely cultivated in the southern states of India. Coconut shells thus get accumulated in the mainland without being degraded for around 100 to 120 years. Disposal of these coconut shells is therefore a serious environmental issue. The study on use of coconut shells or rice husk as a substitute for coarse aggregates or fine aggregate in concrete is gaining importance in terms of possible reduction of waste products in the environment and finding a sustainable alternative for non-renewable natural stone aggregates. In current years, researchers have also paid more attention to some agriculture wastes for use as

building material in construction. Certain investigations used crushed, granular coconut and shells as substitutes for conventional coarse aggregate and the results of the tests showed that the compressive strength of the concrete decreased as the percentage of the shells increased up to limit. The properties of concrete using coconut shell as coarse aggregate were investigated in an experimental study and the study concluded coconut shell concrete can be classified under structural lightweight concrete. From the research works reviewed above, it can be understand that coconut shells can be successfully used as a substitute for coarse aggregate in concrete. The study presented here is focusing on finding out the optimum range of replacement of coarse aggregate with coconut shells based on its strength properties. The study also aims to find out the advantage of commercially produced coconut shell concrete work in terms of self-weight reduction.

MATERIAL:-

F- 1 Crushed Coconut shell F-2 Materials

F-3 Rice husk F-4 casting of cubes F-5 Curring of cubes

METHEDOLOGY:-

MATHEMATICAL CALCULATION:-

Calculation of weight of concrete in one cube :-

Density of M25 grade of concrete = 2500

Weight calculated in kg:-

Formula = density x volume =2500 x 15 x 15 x 15/1000000 = 8.43 kg

Weight of cement in kg = 1/4 x 8.43 = 2.10 kg

Weight of sand in kg = 1/ 4 x 8.43 = 2.10 kg

Weight of aggregate in kg = 1/2 x 8.43 = 4.21 kg

Procedure of making cubes by adding coconut shell:-

1. Material cement, sand , aggregate, coconut shell were taken 17 kg , 17 kg , 26.8kg ,7.2 kg respectively with water 8.5 litre.

2. The sand were sieved using sieve of 20 micron.

3. Then all the materials were mixed in correct proportions thoroughly.

4. The cubes moulds were cleaned and they and they were lubricated using turpentine oil.

5. The concrete was filled up by means of three layers.

6. Each layer was hit 25 times by use of tapping rod for no voids to remain in between.

7. Thus 8 cubes were casted and were labeled.

8. After a good surface finishing they left to dry.

9. Finally after 24 hours they were put on for the curing process

10. Testing 2-2 cubes in 7days, 14 days, 21 days and 28 days by testing machine.

Procedure of making cubes by adding Rice husk:-

1. Replacement of rice husk by 20% of rice husks.
2. Grade of concrete M25.
3. Material cement, sand, rice husk and aggregate were taken 17kg, 13.6kg, 3.4 kg, 34 kg with water 8.5 litres.
4. The sand and rice husks were sieved using 20 micron.
5. Then all the materials are mixed in correct proportions thoroughly.
6. The cube moulds were cleaned and they were lubricated using turpentine oil
7. The concrete was filled up by means of three layers.
8. Each layers was hit 25 times by using of tapping rod for no void to remain in between.
9. Thus cubes were casted and were labeled.
10. After a good surface finishing they left to dry.
11. Finally after 24 hours they were put on curing process.
12. Testing two- two cubes in 7,14,21 and 28 days by using testing machine.

RESULT AND DISCUSSION:-

Compressive Strength:-

Compressive strength is defined as resistance of concrete to axial loading. Cubes were placed in Universal Testing Machine (U.T.M), and load was applied. The readings on dial gauge were recorded and compressive strength was calculated. The results of Compressive strength are shown in Table 01.

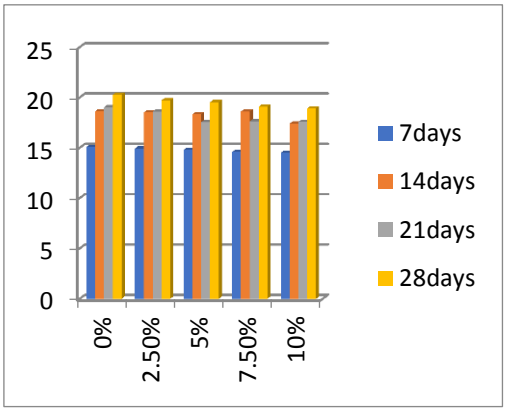
Calculations: Compressive Strength = Maximum load/Cross Sectional Area =P/A

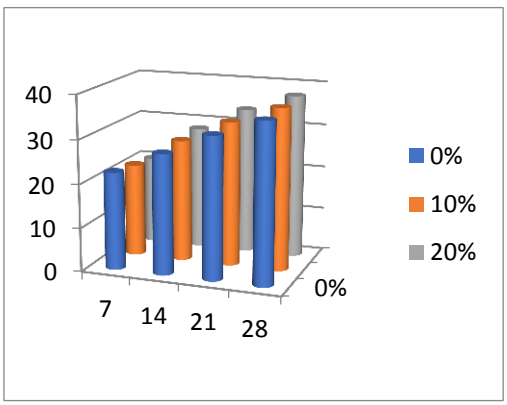
Table -01. Compressive Strength of Coconut Shell Concrete (N/mm2)

Curing days	0%	2.5%	5%	7.5%	10%
7	15.09	14.93	14.79	14.58	14.50
14	18.63	18.51	18.32	18.60	17.40
21	19.03	18.59	17.54	17.62	17.55
28	20.27	19.71	19.53	19.08	18.91

Table -02.Workability of Coconut Shell Concrete

	0%	2.5%	5%	7.5%	10%
Slump(mm)	85	61	67	73	79
Compaction factor	0.910	0.910	0.917	0.920	0.924





F-6 Compressive strength of coconut shell F-7Compressive strength result of rice husk

Workability test

Workability of concrete is defined as the easiness with which it can be transported, placed into moulds and compacted with sufficient surface finishing without segregation of concrete. Slump cone test was employed to find the workability of the different mixes in which consistency of each mix was measured.

CONCLUSIONS:-

- Using of waste materials which are easily available in many countries.

- Savings of money and times.
- Structures making light weight and eco-friendly.
- Coconut shell and rice husk are biodigredable

DISADVANTAGE;-

- Coconut shell and rice husk are partially replaced not more than 25% .If coconut shell and rice husk are replaced more than 20% than strength of concrete are decrease.
- Coconut shell and rice husk are not used in heavy construction like bridge, dame etc.

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