TO STUDY CHARACTERISTICS OF CONCRETE WITH PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH COCONUT SHELL

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Abstract -*The cost of conventional building materials is rising day by day which is of great concern, which forces us to use alternative materials for civil engineering construction. Different waste materials such as fly ash, silica flumes, copper slag, brick bat, demolished concrete has been successfully employed to produce various materials for building construction such as concrete, flush door, plywood, jute boards etc. Aggregate in abundance is required for making concrete, it occupies almost 70-80% part of concrete. Conventionally crushed rocks are used as coarse aggregate and river sand as fine aggregate. Both are naturally available material. Due to rapid growth of construction activities, conventional aggregate sources are depleting very fast leading to significant increase in cost of construction. For sustainable development, these materials should be used wisely and alternative materials need to be searched to replace conventional aggregate. Large number of studies has been done to search alternative materials for production of concrete. India is the third largest coconut producing country in the world. Huge amount of waste is generated by coconut. The waste coconut shell can be used as conventional coarse aggregate. It may help to produce concrete economically and at the same time also will help to reduce its disposal problem.*

Keywords: ***Concrete, Coconut Shells, Compressive Strength, Coconut Shell Concrete.***

1. INTRODUCTION

Increase in waste is directly proportional to increase in population. As population of India is constantly increasing waste is increasing. To control this waste we can reuse, reduce or dispose it by some chemical process. As advancement in infrastructure created demand for construction material, concrete is premier civil engineering construction material and among all aggregate form the major part. So we thought of using agricultural waste in construction industry i.e. as partial replacement of coarse aggregate. Different waste materials such as fly ash, silica flumes, copper slag, brick bat, demolished concrete has been successfully employed to produce various materials for building construction such as concrete, flush door, plywood, jute boards etc.

Aggregate in abundance is required for making concrete, it occupies almost 70-80% part of concrete. Popularity for concrete in the construction that uses normal weight aggregates like gravel and granite significantly reduces the natural stone deposits and this cause's environmental degradation leading to ecological imbalance, there is a need to explore and to find out suitable replacement material to substitute the natural stone. Many developed countries, are using natural materials like Pumice, Scoria and Volcanic debris and manmade materials like expanded blast-furnace slag, vermiculite and clinker as substitutes for natural stone aggregates. Lightweight aggregate concrete (LWAC) is vital and flexible material in modern construction. Low density and superior thermal insulation properties makes it popular. Many architects, engineers, and contractors appreciate the intrinsic economies and benefits offered by this material. Although lightweight concrete has strengths comparable to normal concrete; it is typically 25-35% lighter. Structural LWC gives design flexibility and reduces cost due to self-weight reduction, improved seismic structural response, and lower foundation costs. Transportation and placement costs are low in lightweight precast element. High porosity of light weight concrete gives low specific gravity. Commercially available lightweight aggregate has more demand for manufacture of LWC, but more environmental and economical benefits can be achieved if waste materials can be used as lightweight aggregates in concrete.

In view of the increasing environmental harms, the use of aggregates from by-products and/or solid waste materials from various industries is highly enviable. In recent years, researchers have also paid more attention to some agriculture wastes for use as building material in construction. In India, use of non-conventional aggregates in concrete construction should take place commercially.

1.1 MATERIALS & METHODS:

- **CEMENT:** Ordinary Portland cement manufactured by Birla super was used. Test conducted on cement were normal consistency, initial setting time, fineness test and specific gravity.

- **FINE AGGREGATE:** Fine aggregates locally available were used and were tested, the results were as per Indian standards BIS: 383: 1970. Specific gravity of fine aggregate was 2.8.
- **COARSE AGGREGATE:** Coarse aggregate of size 4.75 mm-20mm (passing through 4.75 mm and retained on 20mm IS sieve).Specific gravity of coarse aggregate is 2.83 which is within the permissible limit (BIS: 10262, BIS :383).Water absorption of coarse aggregate was 0.9%. No aggregate which has water absorption more than 2% shall be used in concrete mix.
- **WATER:** Potable water was used for production of concrete.
- **COCONUT SHELL AGGREGATE:** Coconut shell aggregate of size 4.75 mm – 20 mm was used. Locally available coconut shell was crushed to size of coarse aggregate. Specific gravity of coconut shell aggregate was 1.437.

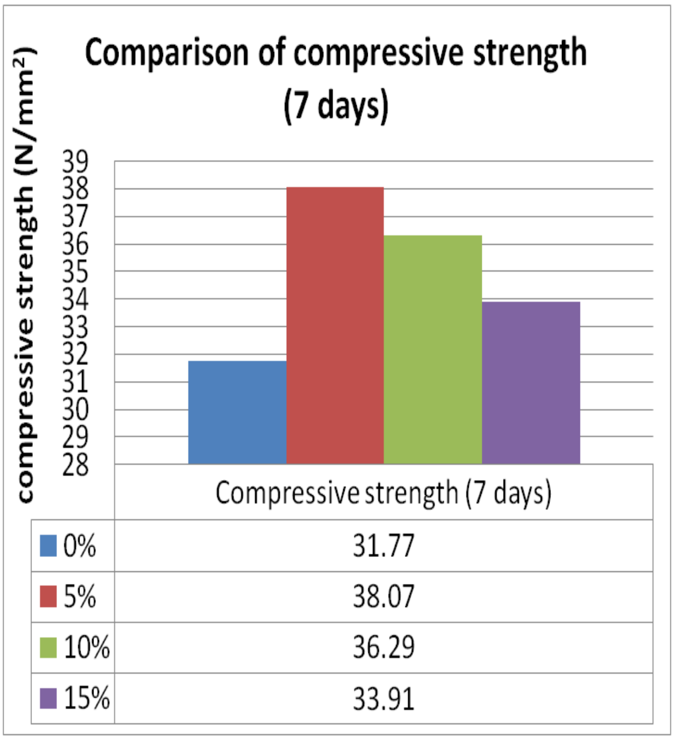
2. EXPERIMENTAL DETAILS:

In this experimental work 24 cubes, 12 cylinders and 12 beams were casted. The size of cubical mould was 150x150x150 mm, the size of cylindrical mould was 150x300 mm, the size of beam mould was 500x100x100 mm. The mix design was made using IS 456:2000 and IS 10262:2009.For M30 concrete grade mix proportion was 1: 1.56: 2.94 for 1 m^3 concrete. Coconut shell aggregate was replaced by 5%, 10% and 15% weight of coarse aggregate. Water cement ratio of concrete mix was 0.35.Compaction of concrete was hand compaction (using tamping rod of 16mm diameter and 0.6 m long) and table vibrator. Specimens were removed from mould after 24 hours after their casting and immersed in curing tank containing fresh water. Curing period was 7 and 28 days for cube, 28 days for beams and cylinders. Compression test was conducted on Compression testing machine of capacity 2000 KN.Split tensile and Flexural test were carried on Universal testing machine of capacity 600 KN.

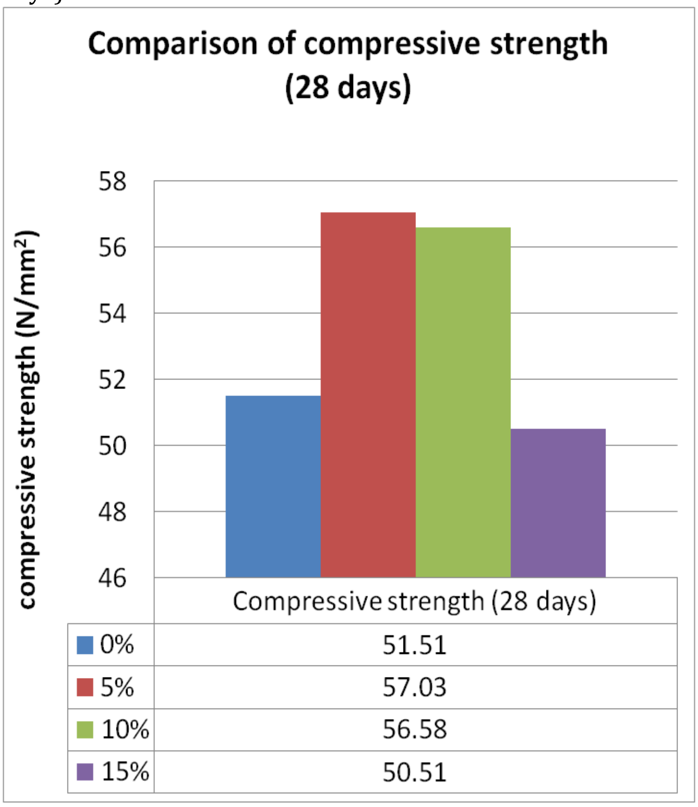
3. RESULTS & DISCUSSION:

After curing period specimens were tested for compressive strength, split tensile strength and flexural strength.Results showed an increase in compressive strength at 7 days curing period for 5%, 10% and 15% replacement of coarse aggregate with coconut shell.There was an increase in compressive strength at 28 days curing period for 5% and 10% but strength decreased for 15% replacement of coarse aggregate with coconut shell. Split tensile strength decreased with increase in replacement of coarse aggrgate with coconut shell. Flexural strength decreased with increase in replacement of coarse aggrgate with coconut shell. Densities of coconut shell concrete showed decrease with increase in replacement .

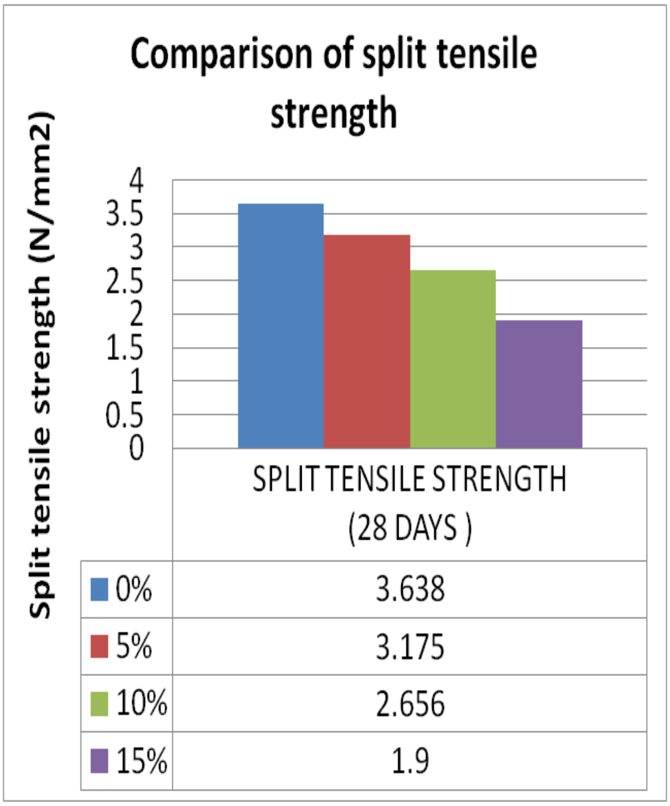
Graph No. 3.1: Comparison of compressive strength(7 days) of conventional and coconut shell concrete.



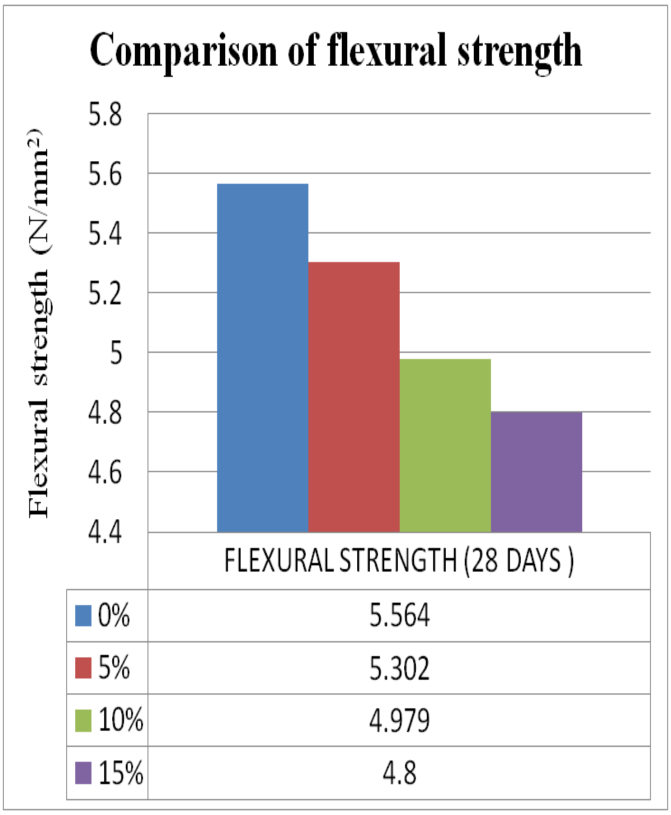
Graph No. 3.2: Comparison of compressive strength (28 days) of conventional and coconut shell concrete.



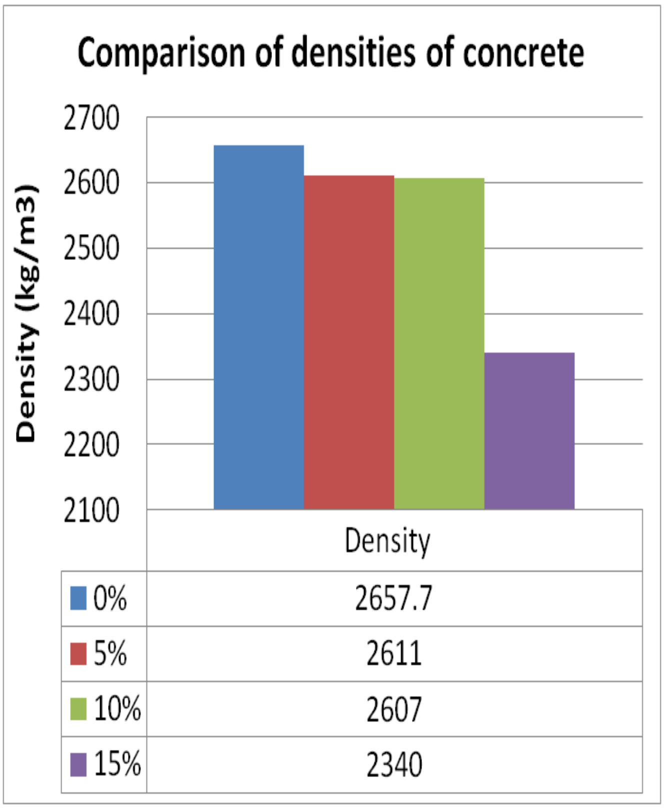
Graph No. 3.3: Comparison of split tensile strength of conventional and coconut shell concrete.



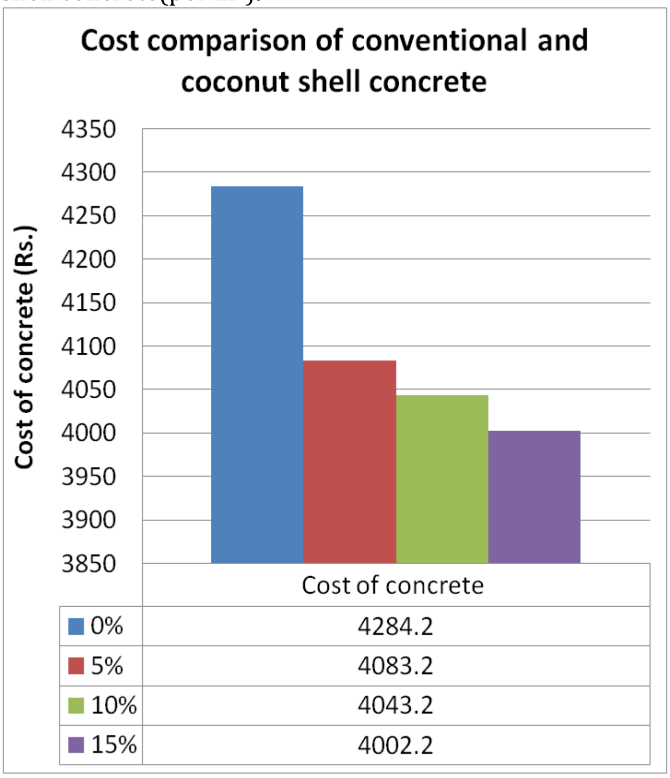
Graph No. 3.4: Comparison of flexural strength of conventional and coconut shell concrete.



Graph No. 3.5: Comparison of densities of conventional and coconut shell concrete.



Graph No 3.6: Cost comparison of conventional and coconut shell concrete(per m³).



4. CONCLUSION:

The results showed that there is increase in compressive strength at 7 days for 5%, 10% and 15% replacement of coarse aggregate with coconut shell. There is there is increase in compressive strength at 28 days for 5% and 10% but there is decrease in strength for 15% replacement of coarse aggregate with coconut shell. Compressive strength for 5% replacement of coarse aggregate increased by 19.83% and 10.71% for 7 days and 28 days respectively. Compressive strength for 10% replacement of coarse aggregate increased by 14.22% and 9.84 for 7 days and 28 days respectively. Compressive strength for 15% replacement of coarse aggregate increased by 6.73% for 7 days and decreased by 1.94 % 28 days respectively. There was decrease in split tensile strength with increase in replacement of coarse aggregate with coconut shell. Split tensile strength of 5% replacement aggregate decreased by 12.72 % for 28 days strength. Split tensile strength of 10% replacement aggregate decreased by 27 % for 28 days strength. Split tensile strength of 15% replacement aggregate decreased by 47.78 % for 28 days strength. There was decrease in flexural strength with increase in replacement of coarse aggregate with coconut shell. Flexural strength of 5% replacement aggregate decreased by 4.7% for 28 days strength. Flexural strength of 10% replacement aggregate decreased by 10.51 % for 28 days strength. Flexural strength of 15% replacement aggregate decreased by 13.73 % for 28 days strength. Density of coconut shell aggregate decreases with increase in replacement of coarse aggregate. Density of 5%, 10%, and 15% replacement aggregate decreased with 1.57 %, 1.9 %, 11.95 % respectively compared with conventional concrete. Density of coconut shell aggregate decreases with increase in replacement of coarse aggregate. Cost of coconut shell concrete (5 % replacement) decreased by 4.7 % compared with conventional concrete. Cost of coconut shell concrete (10 % replacement) decreased by 5.62 % compared with conventional concrete. Cost of coconut shell concrete (15 % replacement) decreased by 6.59 % compared with conventional concrete.

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