# Coconut Shell as Partial Replacement of Coarse Aggregate In Concrete

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**Abstract –** *The increasing cost of conventional aggregates affects the economy of our country. Due to this, excessive exploitation of aggregates occurs. It creates environmental issues and as a result, certain restrictions were put forward by the government, in order to stop these exploitations. Now, it is essential to find out a new source of aggregates. In the present work, coconut shell is selected as a partial replacement of coarse aggregate in concrete. Coconut shell is a waste material and the amount of these wastes is increasing day by day. Usage of these as aggregates will reduce its presence as a waste material from earth. Coconut shell is a light weight material thus producing light weight concrete. In this project, coarse aggregate is replaced by 5% and 10% of coconut shell. Design mix used is M20 grade and the testing of specimens was conducted after 7 and 28 days of curing. Its usage is cost effective.*

***Key Words***: **Coarse aggregate, Coconut Shell, Compressive Strength, Splitting Tensile strength, Concrete Cubes, Concrete Cylinders.**

## 1. INTRODUCTION

The three basic needs of man are food, clothing and shelter. Civil Engineer has relevance with all basic needs of man directly or indirectly. Man has progressed a lot in developing the method of constructing shelter. Initially man used to stay in huts and time passed it developed into house that is load bearing. In this constructed environment, the rising cost of building construction materials is the factor of great concern. The cost of building materials are raising day by day. Nowadays most of the researchers have focus on use of the waste materials in concrete according to their properties. Fly ash, Rice husk, Slag and Sludge from the treatment of industrial and domestic waste water has been found suitable as partial replacement for cement in concrete.

The coconut shell is a material which can be a substitute for coarse aggregate. Coconut shell concrete has better workability because of the smooth surface on one side of the shell. The impact resistance of coconut shell concrete is high when compared with conventional concrete [7]. Moisture retaining and water absorbing capacity of coconut shell are more compared to conventional aggregate. Using alternative material in place of natural aggregate in concrete production makes concrete as sustainable and environment friendly Construction material.

### 1.1 Materials and Methodology

- **Cement:** Ordinary Portland cement 43 grade by Sankar was used in concrete. The experiments conducted to cement includes consistency of cement, initial setting time of cement, and specific gravity of cement. Specific gravity of cement got as 3.08

- **Fine Aggregate:** The size of the fine aggregate used was 4.75 mm and below size. The properties of fine aggregate were tested as per Indian Standards BIS: 383: 1970 and it conforms. Manufactured sand was used for the experiment and it obtained from a local crusher unit. The different tests did on fine aggregate were specific gravity and water absorption. The specific gravity of fine aggregate used was 2.68

- **Coarse Aggregate:** The used aggregates were in the range of 20 mm to 25mm IS sieve size and it collects from the local crusher. The tests conducted on coarse aggregate include specific gravity, water absorption, aggregate crushing value test, and aggregate impact value test. Specific gravity of coarse aggregate used was 2.87

- **Coconut shells:** For the purpose of this project, the Coconut shells were obtained from local house. They were crushed manually. The crushed materials were later being transported to the laboratory where they are washed and allowed to 24 hours water absorption. The particle sizes of the coconut shell range from 20 to 25 mm. Tests conducted on coconut shell includes specific gravity, water absorption, aggregate crushing value test, and aggregate impact value test. Specific gravity of coconut shell used was 1.25

- **Water:** The water used of concreting purpose was free with any kind of chemical and biological impurities and also can used for drinking

### 1.2 Experimental Work

Mix design was done according to IS 10262:2009 and IS 456:2000. For M20 grade concrete mix proportion was 1:1.66:3.33 with water-cement ratio 0.6. Coconut shells were replaced by 5%, 10% replacement of coarse aggregate with coconut shells. A total of 18 cubes, 18 cylinders and 3 beams were prepared for test. The size of cube was 150x150x150 mm, the size of cylinder was 150x300 mm, the size of beam was 500x100x100 mm. Concrete were poured in to the mould by three layer and each layer compacted 25 times using tamping rod .After 24 hours of casting the specimens were unmoulded and immersed in curing tank containing

fresh water. Curing period was 7 and 28 days for cube and cylinders. And for beams the curing period was 28 days. Compression test was conducted for cube and splitting tensile test was conducted on cylinders on Compression testing machine of capacity 2000 KN. Flexural test for beam were tested on Universal testing machine having capacity 600 KN.

## 2. RESULTS AND DISCUSSIONS

After the curing time specimens were tested for compressive strength, split tensile strength and flexural strength. Results showed a rise in compressive strength at 7 days curing time for 5%, 10% replacement of coarse aggregate with coconut shell. There was a rise in compressive strength at 28 days curing time for 5% but strength lowered for 15% replacement of coarse aggregate with coconut shell. Splitting tensile strength decreased for 5% replacement of coarse aggregate with coconut shell. Compare with 5% replacement 10% replacement has a slight increase but not much as for conventional mix. Flexural strength has a notable decreased with increase in replacement of coarse aggregate with coconut shell. Densities of coconut shell concrete showed decrease with increase in replacement.

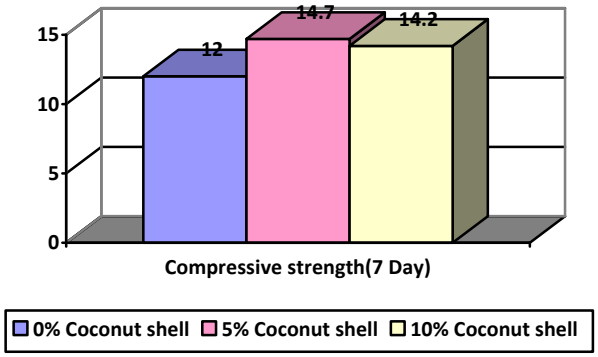


**Chart -2.1**: Compressive strength at 7 days

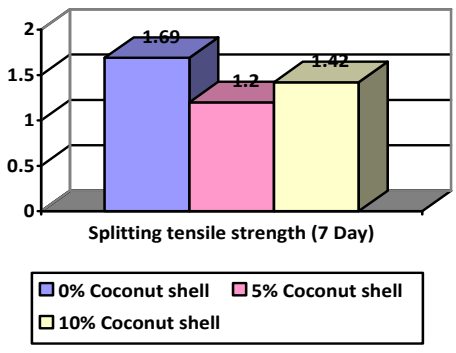


**Chart -2.2**: Splitting tensile strength at 7 days

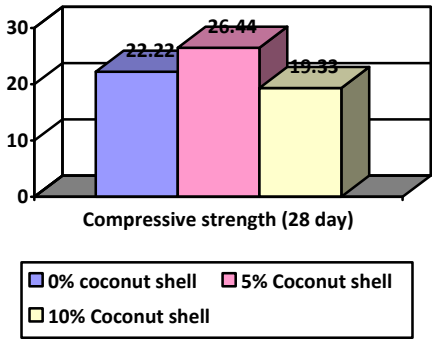


**Chart -2.3**: Compressive strength at 28 days

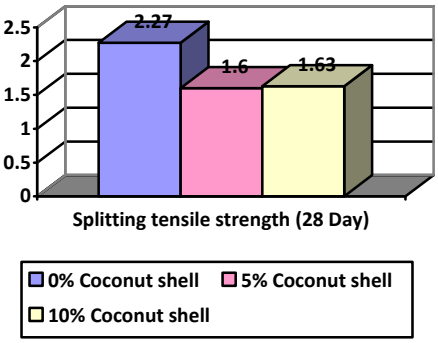


**Chart -2.4**: Splitting tensile strength at 28 days

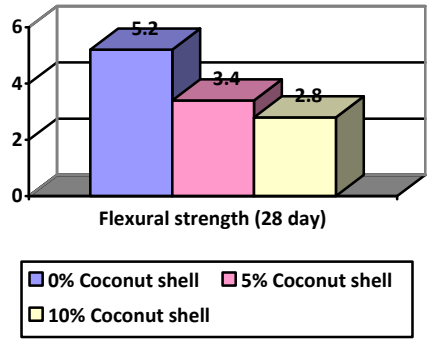


**Chart -2.5**: Flexural strength at 28 days

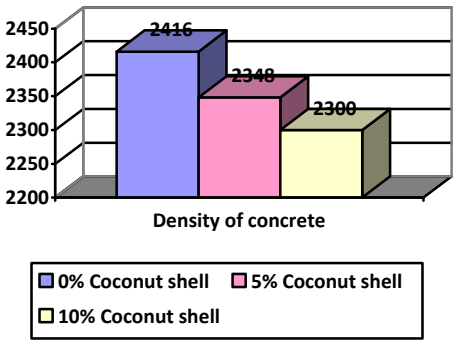


**Chart -2.6**: Density of concrete

## 3. CONCLUSION

From the test results, the coconut shell has a future as lightweight aggregate in concrete. It also reduces the total cost of concreting, because of the low cost and its ease of availability is profusion. Coconut Shell Concrete can be used in rural areas and places where coconut is profusion and the places where the regular aggregates are not economic. It is concluded that the Coconut Shells are more suitable as low strength-giving lightweight aggregate when used to replace common coarse aggregate in production concrete. Coconut shell s more power to resist crushing, and impact compared to traditional granite aggregate. There is no need to treat the coconut shell before use as an aggregate except for water absorption.

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