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Behavior of Concrete replaced with Coconut shell for Coarse aggregate added with Steel Fibers

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Abstract – *This experiment describes the behavioral study of coconut shell incorporated with steel fibers in concrete structure. The addition of fibers in concrete improves various engineering properties of concrete. The experiment was conducted on high strength concrete with addition of fibers with 6mix proportions (10%,15%,20%)of CS replaced for coarse aggregate and (0.5%,1%,1.5%)of steel fibers by the volume of concrete. Here we use M-sand as fine aggregate. The compressive strength, split tensile strength & flexural strength of cured concrete is evaluated for 28days. The study found that the optimum steel fiber content to be 1%by volume of concrete and 10%CS by weight of coarse aggregate.*

Key Words: **Coconut Shell, Steel Fibre, M-Sand (Quarry dust), Compressive Strength, Split Tensile Strength, Flexural Strength.**

1. INTRODUCTION

There is a great deal of interest in developing the technology by introducing natural material in concrete thus by choosing CS. To improve tensile & flexural strength in concrete steel fibres are used. Now a days there is a demand for River sand so it was replaced by M-Sand (Quarry dust). The aim of this project is to study the behavior of concrete replaced with coconut shell for aggregate with steel fiber and M-Sand for River Sand. The advantage of using Coconut Shell provides low cost construction and elimination of landfills for waste disposal.

1.1 LITERATURE REVIEW:

Parvesh, (1) He concrete added with M-Sand, Steel fiber, Coconut shell and discuss the combined effect of using 50% replacement of M-Sand as fine aggregate, 50% replacement of Coconut shell and Steel fiber as reinforcement. Asish Kumar Parashar, et. (2) Investigate the influence of addition of lathe machine waste material as fiber in nominal concrete mix. Priyanka Bhujugade, et. (3) Made investigation of coconut shell replaced by coarse aggregate for cost effective and eco-friendly. Shende, et. (4) made experimental study on Steel Fiber reinforced concrete and found optimum value in 1% of Steel Fiber usage by the weight of cement.

1.2 MATERIALS AND METHODOLOGY

The following materials were used for preparing concrete mix.

OPC cement of 53 grade.

1. Fine aggregate i.e, M-Sand
2. Coarse aggregate
3. Coconut shell
4. Steel fibres
5. Water

Ordinary Portland cement of grade 53 was used in this project. The fine aggregate was quarry dust that is M-Sand which is now a days used and the coarse aggregate of size 12mm was used. The steel fibre with mean aspect ratio 60 was added by volume of concrete.

1.3. Coconut Shell

They were collected from the street waste, cleaned, sun dried, remove dust to analyze its properties. It has high water absorption. Due to this property, they were pre-soaked in water for 24 hours.

2. TEST DETAILS

Compressive strength test, Split Tensile strength test & Flexural Strength test are performed.

Cubes of size (150*150*150mm), Cylinders of size (150*300mm) and Prisms of size (500*100*100mm) for each mix were casted and tested.

3. TESTING PROCEDURE

MIXING PROCEDURE

The coarse and fine aggregates were placed on the mixing pan and it is mixed. Then coconut shells was added and mixed after that steel fibers are added and mixed along with the cement. It is thoroughly mixed and at last water is added to form concrete mix.

CURING

The specimens were demoulded after 24 hours of casting and they are put in a water pond until for testing. The specimens were removed from water after 28 days and testing the specimen for 28 days strength.

4.TEST RESULTS:

A. **COMPRESSIVE STRENGTH:** Compressive strength is defined as resistance of concrete to axial loading. It was tested in Compressive Testing Machine (C.T.M) and readings were recorded up to the final crack. It is determined by using the formula: compressive strength=Maximum load/Cross Sectional Area=P/A

Table -1: COMPRESSIVE STRENGTH OF CONCRETE AT 28 DAYS- M20

S. No	Cement (kg)	FA (kg)	CA (kg)	Coconut shell (%)	Coconut shell (kg)	Water Ratio (kg)	Steel fiber (%)	Steel fibers (g)	Compression Strength at 28 days (N/mm^2)
1	1.32	1.98	3.96			0.594			30.66
2	1.32	1.98	3.564	10%	0.396	0.594			27.1
3	1.32	1.98	3.37	15%	0.594	0.594			20.6
4	1.32	1.98	3.17	20%	0.792	0.594			17.3
5	1.32	1.98	3.564	10%	0.396	0.594	0.5%	16.88	38.7
6	1.32	1.98	3.564	10%	0.396	0.594	1%	33.75	27
7	1.32	1.98	3.564	10%	0.396	0.594	1.5%	50.62	26.2

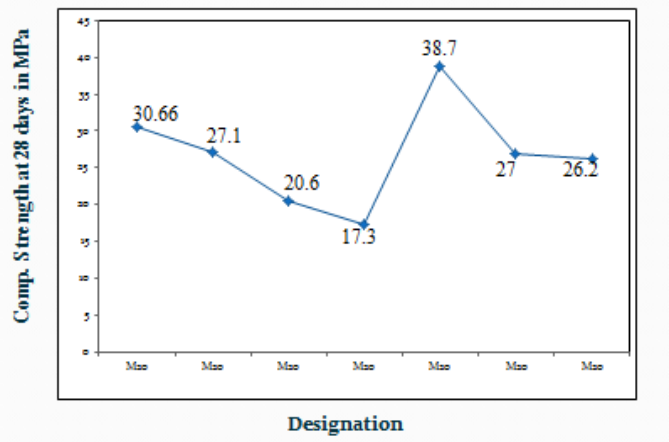

Fig-1 Graph shows Compressive Strength of Concrete

B. **SPLIT TENSILE STRENGTH:** Splitting tensile strength test on concrete cylinder is a method to determine the tensile strength of concrete by using C.T.M. Formula : PL/πDL where P=load, L=clear span length, D= diameter of cylinder.

Table -2: SPLIT TENSILE STRENGTH OF CONCRETE AT 28 DAYS- M20

S. No	Cement (kg)	CA (kg)	FA (kg)	Coconut shell (%)	Coconut shell (kg)	Water ratio (kg)	Steel fiber (%)	Steel fibers (g)	Split tensile Strength at 28 days (N/mm^2)
1	2.067	6.2	3.1			0.93			3.14
2	2.067	5.58	3.1	10%	0.62	0.93			3.96
3	2.067	5.27	3.1	15%	0.93	0.93			2.98
4	2.067	4.96	3.1	20%	1.24	0.93			2.65
5	2.067	5.58	3.1	10%	0.62	0.93	0.5%	26.5	11.3
6	2.067	5.58	3.1	10%	0.62	0.93	1%	53	9.86
7	2.067	5.58	3.1	10%	0.62	0.93	1.5%	68	7.98

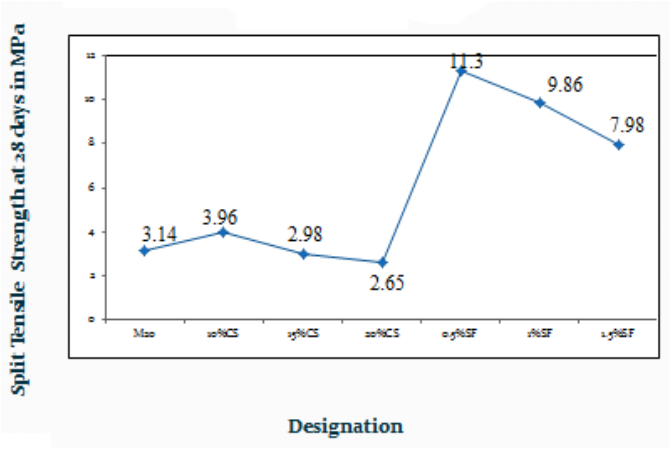

Fig-2 Graph shows Split Tensile Strength of Concrete

C. FLEXURAL STRENGTH: Flexural strength is the another method of measuring tensile strength of concrete. It is a measure of an unreinforced concrete beam to resist failure in bending. It is determined by using 3 formulae:

- If a = 110mm to 133mm= $(3/2)(Pa/bd^2)$
- If a > 133mm= (PL/bd^2)
- If a = 110mm = rejected

Table -3: FLEXURAL STRENGTH OF CONCRETE AT 28 DAYS- M20

S. No	Cement (kg)	FA (kg)	CA (kg)	Coconut shell (%)	Coconut shell (kg)	Water ratio (Kg)	Steel fiber (%)	Steel fibers (g)	Flexural Strength at 28 days (N/mm^2)
1	1.95	2.93	5.85			0.88			5.175
2	1.95	2.93	5.27	10%	0.585	0.88			4.175
3	1.95	2.93	4.97	15%	0.88	0.88			3.256
4	1.95	2.93	4.68	20%	1.17	0.88			2.825
5	1.95	2.93	5.27	10%	0.585	0.88	0.5%	25	4.864
6	1.95	2.93	5.27	10%	0.585	0.88	1%	50	3.462
7	1.95	2.93	5.27	10%	0.585	0.88	1.5%	75	2.92

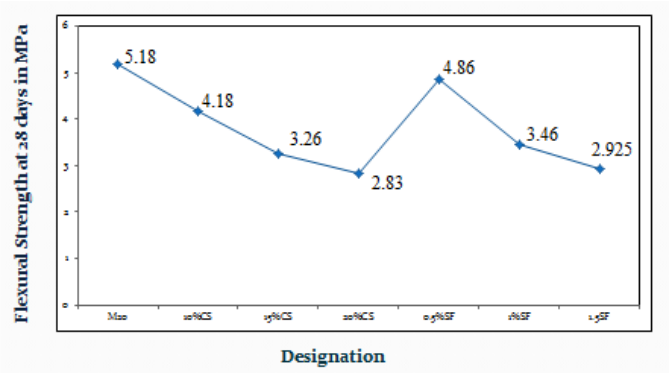

Fig-3 Graph shows Flexural Strength of Concrete

5. CONCLUSIONS

1. From the above experiment, by adding the Coconut Shell in accordance with the replacement of coarse aggregate shows the weight of the concrete is reduced and Flexural Strength is increased.

2. Addition of Steel Fibers with the optimum value of Coconut Shell received also increases the strength of concrete.

3. Hence the combination of Coconut Shell and Steel Fiber gives the optimum result.

4. Here the optimum value of Coconut Shell was (10%) by weight of coarse aggregate and Steel Fiber was 1% by volume of concrete.

5. By using 100% of M-Sand decreases the properties of harden concrete.

6. Use Super Plasticizer for additional workability of concrete.

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