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Experimental Work on Carbon Fibre Reinforced Concrete Using Coconut Shell as Partial Replacement for Coarse Aggregate

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Abstract - *Cement, water, and aggregates—such as sand and gravel are combined to make concrete, which solidifies into a sturdy material over time. Owing to its affordability, durability, and ability to be moulded into almost any shape, it finds application in a wide range of construction projects. The most widely utilised artificial substance in the world is concrete. It is suggested that coconut shell be used in place of some of the coarse aggregate added to obtain the required strength in order to investigate the characteristics of concrete. It might be beneficial to partially substitute coconut shell for the coarse aggregate by an percentages of 5%, 10% and 15%.Fibres have the qualities that improve concrete's durability. Carbon fibre is one of them. These carbon fibres may be used more efficiently and have excellent mechanical qualities. The goal of this study is to compare the strength of carbon fibre concrete with ordinary concrete by analysing variations in fibre content. Carbon fibre concrete are examined at percentages of 0.5%, 1% and 1.5% by volume of concrete. Compressive strength and Split tensile strength of concrete were examined 7days and 28 days.*

KEYWORDS: Carbon fibres, Coconut shell, Compressive strength and Split tensile strength.

I. INTRODUCTION

Cement paste and fine and coarse aggregate are combined to create concrete, a composite material that dries over time. Most of the concert is either lime-based concrete or constructed using hydraulic cement. The peanut business generates waste materials like peanut shell ash. Typically, it is disposed of outside without taking into account the benefits to the environment or the economy.

Another material that can be substituted for other materials in concrete is the coconut shell. In this project, coconut shells are partially used in place of the coarse aggregate. This lessens the number of land filings brought on by waste material deposits on desolate areas. When compared to regular concrete, coconut shells have a very high resilience to impact load.

Carbon fibres can be utilised to lessen shrinkage and breaking because of their low density, strong heat conductivity, superior chemical stability, and exceptional abrasion resistance. These fibres improve the tensile and Compressive strength of the structure. Moreover, carbon fibres improve dry shrinkage and durability. Carbon fibres, on the other hand, reduce electrical resistance.

2. OBJECTIVES

1. To improve the coarse aggregate by partially substituting coconut shell.

2. The main objective of this research is to investigate the mechanical characteristics of carbon fibre reinforced concrete.

3. MATERIALS

3.1 Cement: Cement is a binder, which is another name for a substance that solidifies, hardens, and joins other substances to form a bond. Usually, cement isn't used alone; instead, it's combined with sand and gravel. Whereas mortar is created by mixing cement with fine particles, concrete is created by mixing cement with sand and gravel. Cement is used in construction; it is usually inorganic, often based on calcium and lime silicate, and comes in hydraulic and non-hydraulic forms.

3.2 Fine Aggregate: An conveniently accessible river sand was used as fine aggregate in the current experiment.

3.3 Coarse Aggregate: Coarse aggregate is defined as aggregate that is still present above the IS Sieve 4.75 mm. According to IS383:1970, an incremental rise in size of 10–20 mm is the usual maximum.

3.4 Water: The concrete was mixed and allowed to cure using only pure tap water after the aggregates had been cleaned.

3.5 Coconut Shell: The study's conclusions show that coconut shell concrete's (CSC) potential as a lightweight concrete. Coconut shell can be used as an environmentally friendly and cost-effective alternative to aggregate, and it can also help solve the problem of traditional materials like coarse aggregate getting short.

3.6 Carbon Fibre: Carbon fibre is a type of carbon filament made of carbon atoms that are joined together by polymer resin and heated to a specific pressure. It is a lightweight, extremely transmissible substance.

4. EXPERIMENTAL RESULTS

4.1 Compressive strength

Since compressive strength acts as a barometer for material quality, it is an important property of concrete that needs to be assessed.

Table1: Compressive strength result of concrete with Coconut Shell as partial replacement of Coarse aggregate.

Sl.no	% Of CS	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	26.82	39.74
2	2.5%	37.32	53.47
3	5%	39.08	55.68
4	7.5%	23.04	33.69

Table 2: Compressive strength result by addition of Carbon Fibre Reinforced Concrete.

Sl.no	% Of CFRC	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	26.82	39.74
2	0.5%	38.02	56.09
3	1.0%	44.51	63.67
4	1.5%	37.38	53.48

Table 3: Combined compressive strength result with 5% Coconut Shell as partial replacement of Coarse aggregate and by adding 1.0% Carbon fibre reinforced concrete.

Sl.no	% Of CS+CFRC	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	26.82	39.74
2	5% of CS++1.0% CFRC	50.02	71.57

4.2 Split tensile strength results

Results of the split tensile strength test for the cast and cured specimens, performed in a compressive strength machine, are shown in a table.

Table 4: Split tensile strength result of concrete with Coconut Shell as partial replacement of Coarse aggregate.

Sl.no	% Of CS	Split tensile strength Results (N/mm²)	
		7 days	28 days
1	0%	2.74	3.93
2	2.5%	3.65	5.28
3	5%	3.73	5.45
4	7.5%	2.28	3.31

Table 5: Split tensile strength result by addition of Carbon Fibre Reinforced Concrete.

Sl.no	% Of CFRC	Split tensile strength Results (N/mm²)	
		7 days	28 days
1	0%	2.74	3.93
2	0.5%	3.56	5.17
3	1.0%	4.31	6.17
4	1.5%	2.97	4.25

Table 6: Combined Split tensile result with 5% Coconut Shell as partial replacement of Coarse aggregate and by adding 1.0% Carbon fibre reinforced concrete.

Sl.no	% Of CS+CFRC	Compressive strength Results (N/mm²)	
		7 days	28 days
1	0%	2.74	3.93
2	5% of CS++1.0% CFRC	4.87	6.91

5. CONCLUSION:

1. The Normal Concrete Compressive strength result for 7 and 28 days is 26.82 and 39.74 N/mm².

2. At 5% replacement of coarse aggregate by coconut shell the compressive strength of concrete for 7 and 28 days is 39.08 and 55.68 N/mm².

3. By addition of 1.0% Carbon fibre in concrete the compressive strength of concrete for 7 and 28 days is 44.51 and 63.67 N/mm².

4. Combined replacement of coarse aggregate by coconut shell and 1.0% of Carbon fibre adding on concrete the compressive strength of concrete for 7 and 28 days is 50.02 and 71.57 N/mm².

5. The Normal Concrete Split tensile strength result for 7 and 28 days is 2.74 and 3.93 N/mm².

6. At 5% replacement of coarse aggregate by coconut shell the Split tensile strength of concrete for 7 and 28 days is 3.73 and 5.45 N/mm².

7. By addition of 1.0% Carbon fibre in concrete the Split tensile strength of concrete for 7 and 28 days is 4.31 and 6.17 N/mm².

8. Combined replacement of coarse aggregate by coconut shell and 1.0% of Carbon fibre adding on concrete the Split tensile strength of concrete for 7 and 28 days is 4.87 and 6.91 N/mm².

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