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EXPERIMENTAL INVESTIGATION OF COMPRESSIVE STRENGTH OF CONCRETE WITH VARYING PERCENTAGE OF CORE FIBRE

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ABSTRACT

This experimental study investigates the influence of different percentages of core fibers on the compressive strength of concrete. Concrete specimens were prepared with varying fiber contents, cured, and subjected to compressive strength testing. Results reveal a significant improvement in compressive strength with increasing fiber content, up to an optimal percentage. However, beyond this threshold, the enhancement diminishes. Understanding this relationship is crucial for optimizing concrete mix designs to achieve desired mechanical properties in construction applications. The findings contribute to the knowledge base of fiber-reinforced concrete and inform the development of more resilient and durable concrete structures.

Keywords: Concrete, Core Fibre, Compressive Strength, Experimental Investigation, Optimization.

I. INTRODUCTION

Concrete, a fundamental construction material, often requires enhancements in mechanical properties to meet structural demands. Incorporating core fibers, derived from materials like steel, synthetic, or natural sources, presents a promising avenue for improving concrete performance. This study aims to investigate the effect of varying percentages of core fibers on the compressive strength of concrete. Understanding the relationship between fiber content and compressive strength is essential for optimizing concrete mix designs and enhancing the durability and resilience of concrete structures. The findings of this research contribute to advancing knowledge in the field of fiber-reinforced concrete and inform the development of more robust construction materials.

II. METHODOLOGY

- Preparation of concrete specimens with varying percentages of core fibers.
- Casting of cylindrical molds and compaction of concrete fiber mix.
- Curing of specimens under controlled conditions for 28 days.
- Compressive strength testing of specimens using a hydraulic press.
- Conducting multiple tests for each fiber percentage to ensure reliability.
- Statistical analysis of test results to identify trends and correlations.

III. MATERIALS

CEMENT

In this study, Portland Pozzolana Cement, which is readily available in the neighborhood market, is employed. After being evaluated for a number of characteristics in accordance with IS 4031-1988, the cement was discovered to meet a number of IS 1489-2013 requirements.

Table 1: Properties of Cement

SI NO	TEST	VALUE
1	Standard Consistency	28%
2	Initial setting time	28 mins
3	Final setting time	600 mins
4	Specific Gravity	3.15
5	Fineness test	6.13%

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FINE AGGREGATE

We exploited river sand, which is readily available nearby, for our experiment. Tests on the sand have shown that, in accordance with IS-383, it is in **Zone II.**

Table 2: Properties of fine aggregate

SI NO	TEST	VALUE
1	Specific Gravity	2.83
2	Fineness Modulus	0.50%
3	Water Absorption	1%

COARSE AGGREGATE

We employed aggregate in our experiment, which was retained on a 12.5-mm sieve after passing through a 20-mm IS filter. Table 3: Coarse Aggregate Properties.

Table 3: Properties of Coarse aggregate

SI NO	TEST	VALUE
1	Specific Gravity	2.83
2	Impact value	15.32%
3	Water Absorption	1%

WATER

In the laboratory, potable water meeting IS 456-2000 standards and having a pH of at least six was utilized for both mixing concrete and curing specimens.

COIR FIBRE

The fiber found in coir is removed from the coconut's outer shell. Coconut fiber is known by the following names: coir, cocos, nucifera, and Arecaceae (palm), in that order. Coconut fibers come in two varieties: brown fibers from fully grown coconuts and white fibers from young coconuts. Thick, robust, and highly resistant to abrasion are brown fibers. White fibers are weaker despite being finer and smoother. We decided to include brown fibers in the concrete mix at different percentages (2%, 4%, and 6% by the weight of cement) for our experimental inquiry. The fibers were cut with a cutting machine to a uniform length. A micrometer was used to measure the fibers' diameter and a vernier scale was used to measure their length. Particular gravity.

Table 4: Properties of Coir Fibre

SI NO	PROPERTIES	VALUE
1	Diameter of Coir (L)	0.48mm
2	Length of coir (D)	50mm
3	Aspect Ratio (L/D)	104mm
4	Specific Gravity	1.12
5	Water Absorption	98%

IV. RESULTS AND DISCUSSION

SLUMP CONE TEST

The workability of concrete mixtures with different percentages of core fibers was evaluated using the Slump Cone Test. Concrete's slump after filling a standard cone was used to gauge consistency and flow ability. The outcomes shed light on how well the blend worked for casting and handling during building.

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Table 5: Slump cone test values

SI NO	PERCENTAGE OF COIR FIBRE	COMPACTION FACTOR VALUE
1	Conventional Concrete	80
2	2%	76
3	4%	65
4	6%	55

COMPRESSIVE STRENGTH TEST

Concrete specimens with various percentages of core fibers underwent the compressive strength test. A hydraulic press was used to apply axial loading to the samples. The impact of fiber content on the strength characteristics of concrete was demonstrated by the results, which helped to optimize mix designs for structural applications.

Table 6: Compressive Strength Result

SI.NO	DESCRIPTION	7 DAYS N/mm	14 DAYS N/mm	28 DAYS N/mm
1	Conventional Concrete	19.12	26.82	31.12
2	2%	19.5	27.5	31.56
3	4%	21.78	29.33	32.89
4	6%	20.89	28.44	32.2

Fig 1- compressive strength

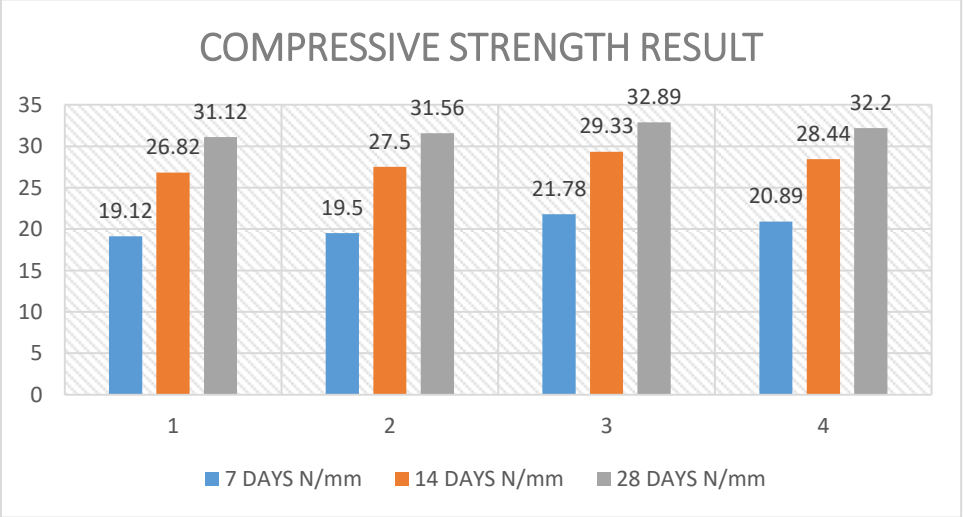

Chart -1: compressive strength

V. CONCLUSION

To sum up, the experiment proved that core fibers have a big impact on concrete's compressive strength. The results showed that, up to an ideal percentage, strength improved with increased fiber content. But at this point, the improvement became less pronounced. In order to obtain required mechanical qualities, this study emphasizes how crucial it is to properly choose and proportion core fibers in concrete mix designs. The knowledge acquired advances the technology of fiber-reinforced concrete, producing building materials that are more robust and long-lasting.

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