

Comparative Study of Banana Fibre Reinforced Concrete with Normal Concrete

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Abstract: This study investigates the strength behavior of concrete reinforced with banana fibres to improve the strength and practices of concrete. Banana plant (Scientific name: *Musa acuminata*) not only produces the delicious fruit but it also provides the textile fibre. This paper mainly focuses the banana fibre based composites which have wide applications in construction. These banana fibres have good physical and mechanical properties and can be employed more productively. Banana fibres are economical, ecological and perishable. In this investigation, six different percentages of banana fibres (1%, 2%, 3%, 4%, 5% and 6%) having 40mm length was used. Ordinary Portland cement of grade 53 and M30 grade concrete were used. At various periodical ages, the banana fibre reinforced concrete is tested for compressive strength, split tensile strength, UPV test.

Key words: Banana fibre, concrete, length, Ordinary Portland cement, ecological, compressive strength, split tensile strength

1. INTRODUCTION

Now-a-days, Construction Technology has advanced through several investigations and experiments to enhance the durability and strength of concrete. Fibres used in concrete are mainly categorized into natural and artificial fibres. The sources of natural fibres are vegetables, animal and mineral sources. On the other hand, artificial fibres are produced from synthetic materials, steel and natural polymers. Fibres exist in various forms such as *Cocos nucifera*(coconut) fibre, *Musa acuminata*(banana) fibre, steel fibre, AR glass fibre, natural fibre, Jute fibre, synthetic fibre, etc. It offers the resistance to suddenly applied loads, limits the shrinkage crackings, decreases the permeability and hence ultimately decreases the bleeding of water.

II. OBJECTIVES OF THE EXPERIMENTAL INVESTIGATION

- To evaluate the compressive strength, split tensile strength of the concrete by using *Musa acuminata* (banana) fibre in different proportions at different ages.
- The comparison is made between banana fibre reinforced concrete and normal concrete with different percentages at different ages.
- To evaluate the optimum percentage of *Musa acuminata* (banana) fibres.

COMPOSITION OF MUSA ACUMINATE (BANANA) FIBRES

SNO	COMPOSITION	PERCENTAGE
1	Cellulose	56%
2	Lignin	17%
3	Extractives	7%
4	Moisture	11%
5	Ashes	9%

Table1: Composition of Banana fibres

III. EXPERIMENTAL DETAILS

In the present investigation, the following materials were used.

- Ordinary Portland cement of 53 Grade.
- Fine aggregate
- Coarse aggregate
- Banana fibres
- Water

I. Cement:

53 Grade Ordinary Portland cement of Raasi gold brand is used for the experimental work.

The properties of cement tested have been listed below.

Normal Consistency - 31 mm

Initial Setting time - 120 min

Final Setting time - 300 min

Fineness test (90 micron sieve) - 7 %

Specific gravity - 3.15

2. Fine aggregate

The local available river sand from River Krishna is used for the experimental investigation.

The obtained values of the fine aggregate are as shown below:

Specific Gravity – 2.60

Water absorption – 1.65 %

Fineness modulus – 2.5

3. Coarse aggregate

In order to withstand the design loads and effects of weathering, aggregates must be better than the hardened cement. The tested properties of the coarse aggregates are tabulated below.

Specific Gravity – 2.7

Water absorption – 1.4 %

Bulk density – 1490 kg/m³

4. Water

Drinking water used in laboratory was used for mixing the concrete and curing the specimens.

5. Banana Fibre

Banana fibre is a very good replacement for synthetic fibre. The Banana used for this work is from the local village, Cherukupalli. Uniform length of fibers of 40mm was obtained by using cutting machine. Salient physical and mechanical properties of Banana were determined in their natural form.

Banana fibre properties

Density (kg/m³) – 1350

Moisture content (%) – 11

Tensile strength (M Pa) - 56

Elongation at Break (%) - 2.6

Young's modulus (M Pa) – 3.5

Fineness – 17.15



Banana Fibres



Mixing of concrete with banana fibres



Split tensile strength test of hardened concrete

IV. HARDENED CONCRETE

A. Compressive Strength

Compressive strength of concrete increases with the addition of banana fibers. The results that are obtained for the compressive strength at 7 days and 28 days are as shown below:

% of banana fibre	7 days(N/mm ²)	28 days(N/mm ²)
0	29.37	40.8
1	31.79	43.49
2	36.23	49.47
3	38.08	55.10
4	36.77	52.92
5	36.25	49.29
6	35.97	47.17

Table 2: Results of compressive strength test of concrete reinforced with banana fibre

B. Split Tensile Strength

The addition of banana fibres to the concrete increases the split tensile strength appropriately. The results that are obtained for the split tensile strength at 7 days and 28 days are as shown below:

% of banana fibre	7 days(N/mm ²)	28 days(N/mm ²)
0	2.90	4.03
1	3.12	4.19
2	3.88	5.07
3	4.67	5.87
4	4.24	5.94
5	3.48	4.76
6	3.32	4.65

Table 3: Results of split tensile strength test of concrete reinforced with banana fibre

V. CONCLUSIONS

Results have been analyzed taking into consideration the strength characteristics of concrete reinforced with the banana fibre of M30 grade.

1. The experimental tests revealed that the strength properties of concrete improved with the addition of banana fibres to the concrete.
2. The addition of banana fibres considerably increased the strength characteristics of concrete, mainly compressive strength and tensile strength.
3. The cracking resistance of the concrete has also improved to a greater extent.
4. When compared to normal concrete, the compressive strength of banana fibre reinforced concrete of M30 grade has improved.
5. The compressive strength of concrete has increased gradually up to 4% addition of banana fibre and has shown gradual decrement in the compressive strength beyond that percentage.

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