

Experimental Investigation on Banana Fibre Reinforced Concrete with Conventional Concrete

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Abstract— *Banana fibre reinforced concrete is high performance fibre reinforced concrete with significant behavior under tension. In this paper, examines the strength behavior of concrete reinforced with banana fibres. 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. Emphasis is placed on the influence of fibre content on the key micromechanics properties relevant to composite ductility. 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 and split tensile strength.*

Keywords: *Banana fibre, Compressive strength, Concrete, Ordinary Portland cement, Split tensile strength.*

1. INTRODUCTION

Durability and strength of concrete plays a vital role through several investigations and experiments. To strengthen the concrete properties fibres used from naturally available natural or artificial fibres. The sources of natural fibres are vegetables, animal and mineral sources. On the other hand, artificial fibres are shaped from synthetic materials, steel and natural polymers. Fibres exist in various forms such as Cocosnucifera (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 cracking's, decreases the permeability and hence ultimately decreases the bleeding of water.

2. OBJECTIVE

i. To evaluate the compressive strength, split tensile strength of the concrete by using Musa acuminata (banana)

Revised Version Manuscript Received on March 08, 2019.

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fibre in different proportions at different ages.

ii. The comparison is made between banana fibre reinforced concrete and normal concrete with different percentages at different ages.

iii. To evaluate the optimum percentage of Musa acuminata (banana) fibres.

III. EXPERIMENTAL INVESTIGATION

In the present investigation, the following materials were used.

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

a) Cement: Locally available 53 Grade Ordinary Portland cement is used for the experimental work. The physical properties of cement tested in the laboratory are presented in Table 1.

Table 1 Physical Properties of Cement

S.No.	Properties	Values
1	Normal consistency	31 mm
2	Initial setting time	120 min
3	Final setting time	300 min
4	Fineness test	7 %
5	Specific gravity	3.15

b) Fine aggregate: The locally available river sand from River Krishna is used for the experimental investigation. The physical properties are presented in Table 2.

S.No.	Properties	Value
1	Specific Gravity	2.60
2	Water absorption	1.65%
3	Fineness modulus	2.5

c) Coarse aggregate: In order to withstand the design loads and effects of weathering, aggregates must be better than the hardened cement. The tested physical properties of the coarse aggregates are tabulated in Table 3.

Table 3 Physical properties of coarse aggregate

S.No.	Properties	Value
1	Specific Gravity	2.70
2	Water absorption	1.40%
3	Bulk density	1490 kg/m ³

d) **Water:** Potablewater from the laboratory was used for mixing the concrete and also for curing the specimens.

e) **Banana fibre:** The banana fibre used for the research work is collected from the local village, Cherukupalli. The fibres are cut to uniform length of 40mm by using cutting machine. Fig.1.Banana fibres are an alternate to synthetic fibres.



Fig.1 Banana Fibre

3. MIX PROPORTIONS

Concrete mix design developed to suit the M30 grade of concrete. The procedure for designing concrete mix adhered as per 10262:2009.

4. HARDENED CONCRETE

a) Compressive Strength:

To evaluate the compressive strength of concrete tested after the curing period. The results that are obtained for the compressive strength at 28, 56 and 90 days are as shown in Table 4.

5. RESULTS

Table 4 Compressive strength of concrete reinforced with banana fibre

% of banana fibre	Compressive strength(N/mm ²)		
	28 days	56 days	90 days
0	40.8	43.75	47.81
1	43.49	47.07	54.95
2	49.47	53.70	62.41
3	55.10	58.90	67.33
4	52.92	56.96	65.05
5	49.29	52.90	60.53
6	47.17	50.77	57.99

B) Split tensile strength

Due to the addition of banana fibres in concrete increases the split tensile strength appropriately. The results that are obtained for the split tensile strength at 28, 56 and 90 days are presented in Table 5.

Table 5 Tensile strength of concrete reinforced with banana fibre

% of banana fibre	Split tensile strength (N/mm ²)		
	28 days	56 days	90 days
0	4.03	4.37	4.74
1	4.19	4.55	4.91
2	5.07	5.50	5.93
3	5.87	6.38	6.87
4	5.94	6.42	6.94
5	4.76	5.18	5.61
6	4.65	5.06	5.44

6. CONCLUSIONS

The research investigation on the addition of banana fibre for strengthening reinforced concrete established some general facts related to composite strengthening.

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 compressive strength of concrete has increased gradually up to 3% addition of banana fibre and has shown gradual decrement in the compressive strength beyond that percentage.

4. The increase in compressive strength was upto 35.04% and 40.83% with addition of 3% banana fibre when compared with reference concrete at 28 days and 90 days.

5. The percentage increase in the compressive strength for the banana fibre reinforced concrete is 34.62% compared to that of normal concrete for a curing period of 56 days.

6. The tensile strength of concrete has increased gradually up to 4% addition of banana fibre and has shown gradual decrement in the tensile strength beyond that percentage.

7. Increase of 47.39% with addition of 4% banana fibre when compared with reference concrete at 28 days for tensile strength.

8. The increase in tensile strength was upto 46.91% and 46.14% with addition of 4% banana fibre when compared with reference concrete at 56 days and 90 days.

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