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Experimental Study on Properties of concrete using Banana Fibre as Reinforced Concrete

[1] Babloo Kumar Mishra, [2] Prof. Iqbal Sheikh

[1] M.Tech Scholar, [2] Assistant Professor

[1,2]Department of Civil Engineering,

[1,2]BIT Sindri Dhanbad, Jharkhand, India

Abstract: This study outlines experimental investigations into the usage of banana fibre to improve the durability and uses of concrete. These organic fibres can be used more successfully because of their great physical and mechanical qualities. They are cost-effective and chemical-free. Many of the concrete's engineering parameters, including compressive strength, tensile strength, and flexural strength, were greatly increased by the addition of banana fibres. Spelling and cracking resistance were both improved. As a result, it functions as a natural additive, adding extra qualities to regular cement concrete. Three various percentages of banana fibres (0 percent, 1 percent, 2 percent, 4 percent, 6 percent, 8 percent, and 10 percent) with a length of 30 to 40 mm will be employed in this project. Portland pozzolana cement is used to cast concrete of the M30 grade, which is a standard reinforced cement concrete. Both regular reinforced cement concrete and banana fibre reinforced cement concrete underwent tests for compression strength, splitting tensile strength, and flexural strength at various ages.

Index Terms **-** Portland pozzolana cement, length, banana fibre, compressive strength, split tensile strength, and flexural strength.

I. INTRODUCTION

1.1 General

In the current situation waste is main concern for sustainable environment and management. Decomposition & recycling are very much important. A common agricultural byproduct of banana farming is banana fibre. Banana fibers is lingo cellulosic fibers, which obtained from pseudo-stem of banana plant. In addition to having key qualities including low density, light weight, low cost, excellent tensile strength, and fire and water resistance, banana fibres are also environmentally benign. As social, economic, and environmental challenges develop in today's society, there is a growing need for affordable sustainable building materials. The research focuses on compressive performance of the blended concrete including banana fibre in terms of strength, split tensile strength, and flexural strength. The strength and durability of concrete have been improved via several studies and trials in modern construction technology. The two primary categories of fibres used in concrete are natural and synthetic. Vegetables, animal sources, and mineral sources are the sources of natural fibres. On the other hand, steel, natural polymers, and synthetic materials are used to make artificial fibres. There are many different types of fibres, including those made from the cocos nucifera (coconut) tree, the Musa acuminate (banana), steel, AR glass, jute, and other natural and synthetic materials. It provides resistance to suddenly applied loads, reduces shrinkage cracks, and increases concrete strength by reinforcing. The global yearly consumption of fibres used in concrete is 300,000 tones, despite the fact that the market for fibre reinforced concrete is relatively limited in comparison to the total output of concrete. Fiber reinforced concrete is a type of concrete that includes hydraulic cement, water, aggregate, and discrete, discontinuous fibres. However, in our project, we'll need to strengthen the banana fibre with concrete by using the banana fiber. These fibers have good tensile strength, flexure strength and have good tenacity property than other natural fiber like sisal fiber. Compared to steel, fibres are less susceptible to corrosion. Roof tiles, corrugated sheets, pipes, silos, and tanks have all been constructed using fibre reinforced concrete. Portland cement concrete has specific properties, like being strong in compression but weak in tension and having a propensity to fracture. The use of can be used to overcome the tension's weakness. material which is good in tension, like steel and fibers. The addition of fibres also changes how a fibre matrix composite behaves after it has broken, enhancing its properties. The goal of this study is to test the feasibility of using banana fibres to improve concrete.

1.1 Objectives

1. Using Musaacuminate (banana) fibre in various quantities and at various ages, the compressive and split tensile strengths of the concrete were measured.
2. Concrete with varied percentages of banana fibre reinforcement and concrete with a constant age are compared.
3. To determine the ideal amount of Musa acuminate (banana) fibres .

I. MATERIAL 'S EXPERIMENTAL PROPERTY

2.1 Cement

The primary binding component of concrete is cement. In order to achieve strength, binding materials in concrete are crucial. There are several strengths of cement available depending on the specifications of the concrete that will be used. For the experimental work, Portland Pozzolona cement of the Ultra Tech brand is used. The following is a list of the cement's tested qualities.

1. Normal consistency of cement- 32 %
2. Initial setting time- 110 min
3. Final setting time- 320 min
4. Soundness of cement- 2mm
5. Fineness of cement- 4%
6. Specific gravity of cement-3.11

2.2 Aggregate

Aggregates are the important constituent ingredient of the concrete. They give concrete body, lessen shrinkage, and have an economic impact. Before, aggregate was thought to be a chemically inert substance, but it is now known that some aggregates are chemically active and that some aggregates have chemical bonds at the interface between the aggregate and paste.

2.2.1 Fine aggregate

1. Zoning of sand- Zone 1
2. Water absorption- 1.75
3. Specific gravity- 2.62
4. Fineness modulus- 2.56
5. Free modulus- 0.5

2.2.2 Coarse aggregate

6. Specific gravity- 2.68
7. Water absorption- 1.6%
8. Fineness modulus- 6.71
9. Impact value- 19.5
10. Crushing value- 23%
11. Free moisture content- 0.1%

2.3 Water

Concrete was mixed with potable laboratory water, and specimens were dried using this method.

2.4 Banana Fiber

Synthetic fibre can be effectively replaced by banana fibre. The banana that was used for this project came from a nearby community. Using a cutting machine, fibres with a uniform length of 30 to 40 mm were produced. Important mechanical and physical characteristics of bananas were identified in their unprocessed state. .

Banana fibre properties Physical Properties-

1. Density (kg/m^3)=1350
2. Moisture Content (%)=11
3. Tensile Strength (Mpa)=56
4. Elongation (%)=2.6
5. Young's Modulus (Gpa)=9 to 16
6. Tenacity (Mpa)=530 to 700

Chemical Properties

1. Cellulose (%)=56
2. Lignin (%)=11
3. Pectin (%)=4
4. Ashes (%)=5

III.EXPERIMENTAL INVESTIGATION OF CONCRETE

3.1 Mix Proportion

In order to obtain the appropriate strength and workability, concrete mix design, also known as proportioning, entails determining the amount of cement, water, fine and coarse aggregate in the concrete mixture. The process for creating concrete mix designs for M30 concrete by use of Indian standard 10262-2009.

3.2 Property of fresh concrete

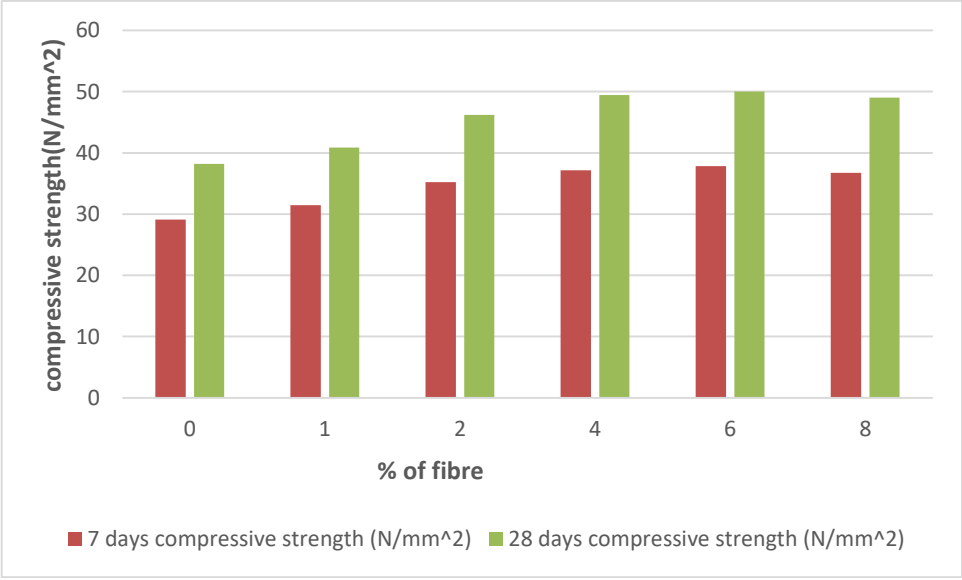
3.2.1 Workability

The slump value is used to determine a concrete's freshness quality. By using a truncated cone and a tamping rod, the IS 7320-1974 slump value is used to assess the slump value of fresh concrete. The slump value of concrete reduces as banana fibre content rises.

3.3 Hardened Concrete

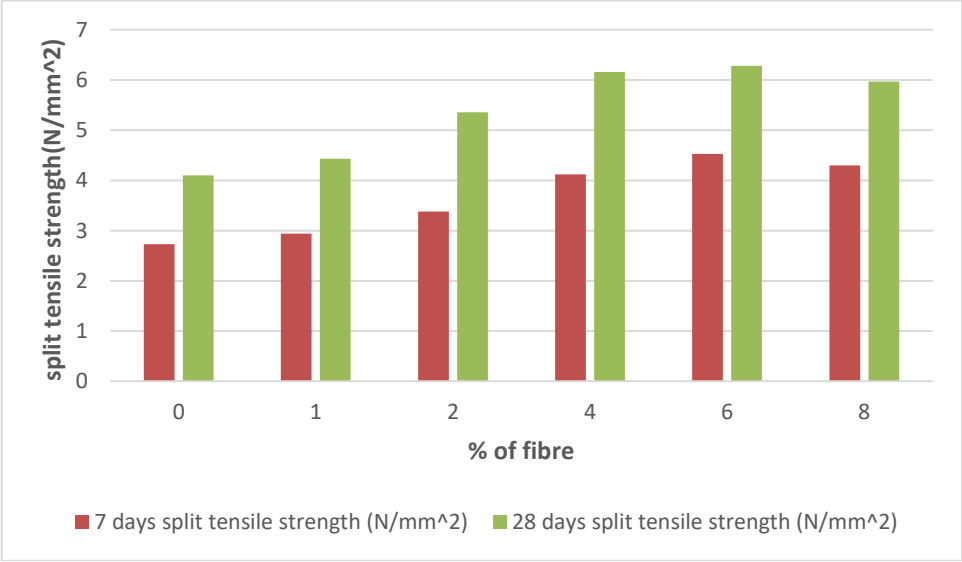
The tables and graphs below display the compressive strength, split tensile strength, and flexure strength of cured concrete at various banana fibre addition rates.

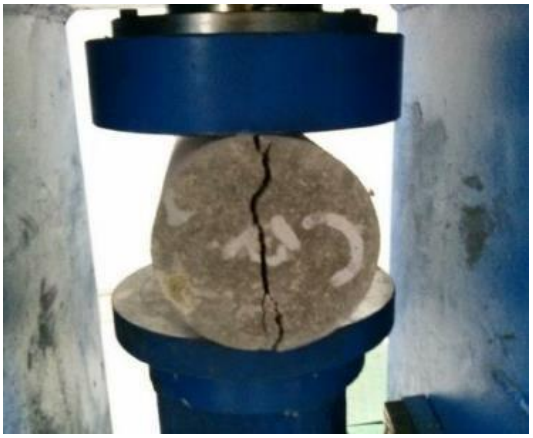
Sl. No.	% of fibres	7 days compressive strength (N/mm^2)	28 days compressive strength (N/mm^2)
1	0	29.11	38.22
2	1	31.44	40.89
3	2	35.21	46.20
4	4	37.14	49.43
5	6	37.86	50.02
6	8	36.72	49.01



3.3.2 Split tensile strength of FRC with banana fiber

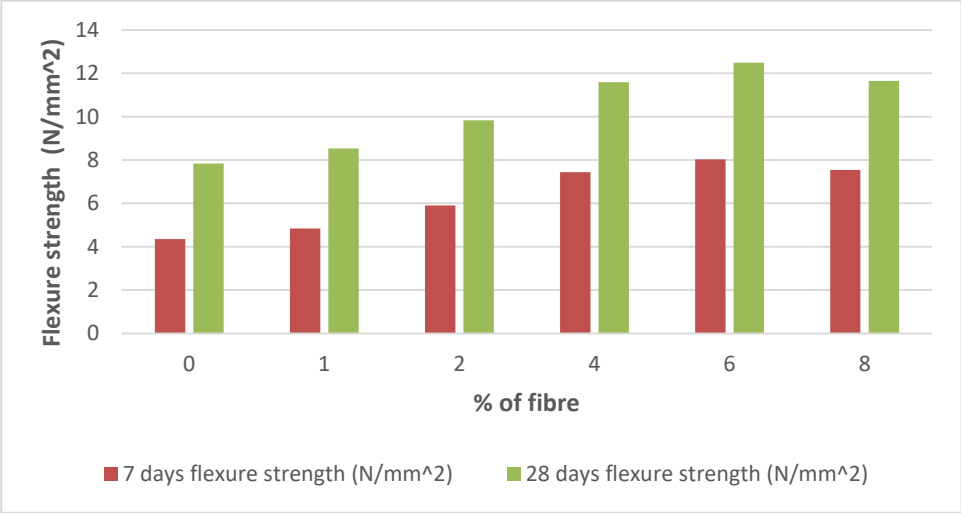
Sl. No.	% of fibres	7 days split tensile strength (N/mm^2)	28 days split tensile strength (N/mm^2)
1	0	2.73	4.10
2	1	2.94	4.43
3	2	3.38	5.36
4	4	4.12	6.16
5	6	4.53	6.28
6	8	4.30	5.97





3.3.3 Flexure strength of FRC with banana fiber

Sl. No.	% of fibres	7 days flexure strength (N/mm^2)	28 days flexure strength (N/mm^2)
1	0	4.36	7.84
2	1	4.84	8.54
3	2	5.90	9.83
4	4	7.44	11.59
5	6	8.03	12.50
6	8	7.55	11.65



IV. CONCLUSION

The results of an experimental examination into the strength properties of concrete are strengthened using banana fibre. When banana fibre was added to the mixture, it demonstrated good compressive, tensile, and flexural strength properties. This might be as a result of the formation of the CSH gel. The results demonstrate that banana fibre increases concrete strength by up to 6%. Concrete's strength declines after this point. Given that India is one of the largest banana-producing nations in the world, using banana fibre and waste to make useable components would be quite appealing for the economy. If a suitable cost-effective design approach of fibre separation and its composite manufacture could expand banana fiber's application to a higher extent, banana fibre and its composites may become even more alluring. We therefore draw the conclusion that further, methodical study will broaden the application of banana fibre and its composites and ensure their better future.

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