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An Experimental Investigation on Banana Fibre Concrete with Nano Silica

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Abstract: ***The combined impact of using banana fibres (BF) and nano-silica (NS) on the mechanical properties of hardened concrete is examined in this study. In order to partially replace cement, NS has been used in amounts of 0, 2, 2.5, 3, 3.5, 4, and 4.5% by weight, and BF has been used in amounts of 1, 2, 3, 4, and 6% by volume. Banana fibres measuring 40 mm in length were used in the current experiment. A variety of NS and BF combinations are used to calculate the test values for compression strength, split tensile strength, and pulse velocity. Due to its tiny particle size, nano-silica can change the properties of concrete by changing its microstructure. Because of NS's high pozzolanic activity, which supports the generation of more C-S-H gel in the presence of nanoparticles, a noticeable improvement in the strength qualities of concrete is shown when NS is utilised. The strength and longevity of the concrete will be greatly enhanced by the use of NS. On the other hand, the inclusion of banana fibres to the concrete gradually reduces permeability and improves crack resistance.***
Keywords: Banana fibre, Nanosilica, Pozzolanic, Compressive strength, Split tensile strength.

I. INTRODUCTION

Through several studies and trials to increase the strength and durability of concrete, construction technology has improved. Natural and artificial fibres are the two main categories for materials used in concrete. Vegetables, animal sources, and mineral sources are the sources of natural fibres. Steel, natural polymers and synthetic materials are used to make the artificial fibres. There are many different types of fibres, including jute, steel, natural fibres like coconut and banana, and synthetic fibres like nylon and polyester. Banana fibre provides resistance to abruptly applied stresses, prevents shrinkage cracks, reduces permeability, and eventually lessens water bleeding. Finding out how Nano-Silica (NS) behaves in concrete and how it affects the strength qualities has attracted a lot of study attention. In addition to working as a cementitious Pozzolonic additive, nano-silica fibres also have the astonishing ability to improve the pore structure of concrete. When the microstructure of the cement paste is densified, nano-silica can be extremely important. In this investigation, different combinations of Nano-Silica and Banana Fibers are used in concrete to create concrete with higher characteristics than conventional concrete. The strength properties of concrete are investigated and determined experimentally.

II. OBJECTIVES

This project's major goal is to conduct an experimental examination of the behaviour of nanoconcrete reinforced with banana fibre.

1) To test the strength of the Musa acuminate (banana) fibre in various quantities and ages on the compressive and split tensile properties of Nano-Silica concrete.
2) Nano-silica reinforced concrete reinforced with banana fibres is compared to regular concrete with varying percentages and ages.
3) Determine the ideal proportion of Musa acuminate (banana) fibres.

III. MATERIALS

1) *Nano-Silica Particles:* Nanomaterials like Nano-Silica, Nano Fibers, and other nanomaterials are used in concrete when nanotechnology is employed. Superior concrete composites can be created by using nanomaterials. Cement is more effectively hydrated when NS is added to concrete and mortar. In order to increase strength and decrease free calcium hydroxide, more calcium silicate hydrates are generated as a result of pozzolanic activity. This assists in lowering the demand for cement.Concrete becomes more durable as a result of NS's improvement to its microstructure and reduction in water permeability. It is possible to make concretes with strengths up to 100 MPa, great workability, anti-bleeding characteristics, and quick demoulding times. Nano-silica can be added to eco-concrete mixtures as an ingredient. Calcium silicate hydrate is created through the reaction of cement with water, and it also produces calcium hydroxide and other byproducts that give concrete its strength and other mechanical qualities.

2) *Banana Fibre:* Synthetic fibre can be effectively replaced by banana fibre. The banana used for this project is procured from Cherukupalli, a nearby community. The fibres are chopped on a cutting machine to a uniform length of 40mm. Important mechanical and physical characteristics of bananas were identified in their unprocessed state.

IV. EXPERIMENTAL RESULTS

A. Compressive Strength Results

With the addition of banana fibres, the compressive strength of nano-silica concrete has increased. The outcomes for the compressive strength after 28 days as shown in table 1.

B. Split Tensile Strength Result

The split tensile strength of the Nano-Silica concrete is adequately increased by the addition of banana fibres. The findings for the split tensile strength after 28 days as shown in table 1.

Table 1. Results of compressive strength, split tensile strength values of NanoSilica concrete reinforced with banana fibre

S.No	Combined % of NS & BF	Compressive strength results, N/mm^2			Split tensile strength results, N/mm^2		
		28 days	56 days	90 days	28 days	56 days	90 days
1	Normal Concrete	40.80	44.47	47.64	4.02	4.37	4.71
2	1+2	44.79	48.80	52.29	4.46	4.83	5.23
3	2+2.5	51.41	56.02	60.14	5.26	5.72	6.13
4	3+3	57.63	62.73	67.19	5.75	6.26	6.72
5	4+3.5	53.89	58.65	62.91	5.69	6.18	6.64
6	5+4	50.09	54.47	58.57	4.94	5.38	5.78
7	6+4.5	47.85	52.08	55.96	4.61	5.02	5.39

V. CONCLUSIONS

A. The compressive strength of normal concrete at 28, 56 and 90 days is 40.80, 44.47 and 47.64 N/mm^2.
B. The split tensile strength of normal concrete at 28, 56 and 90 days is 4.02, 4.37 and 4.71 N/mm^2.
C. At combination of 3% of NS and 3% of BF the compressive strength results for 28, 56 and 90 days is 57.63, 62.73 and 67.19 N/mm^2.
D. At combination of 3% of NS and 3% of BF the split tensile strength results for 28, 56 and 90 days is 5.75, 6.26 and 6.72 N/mm^2.

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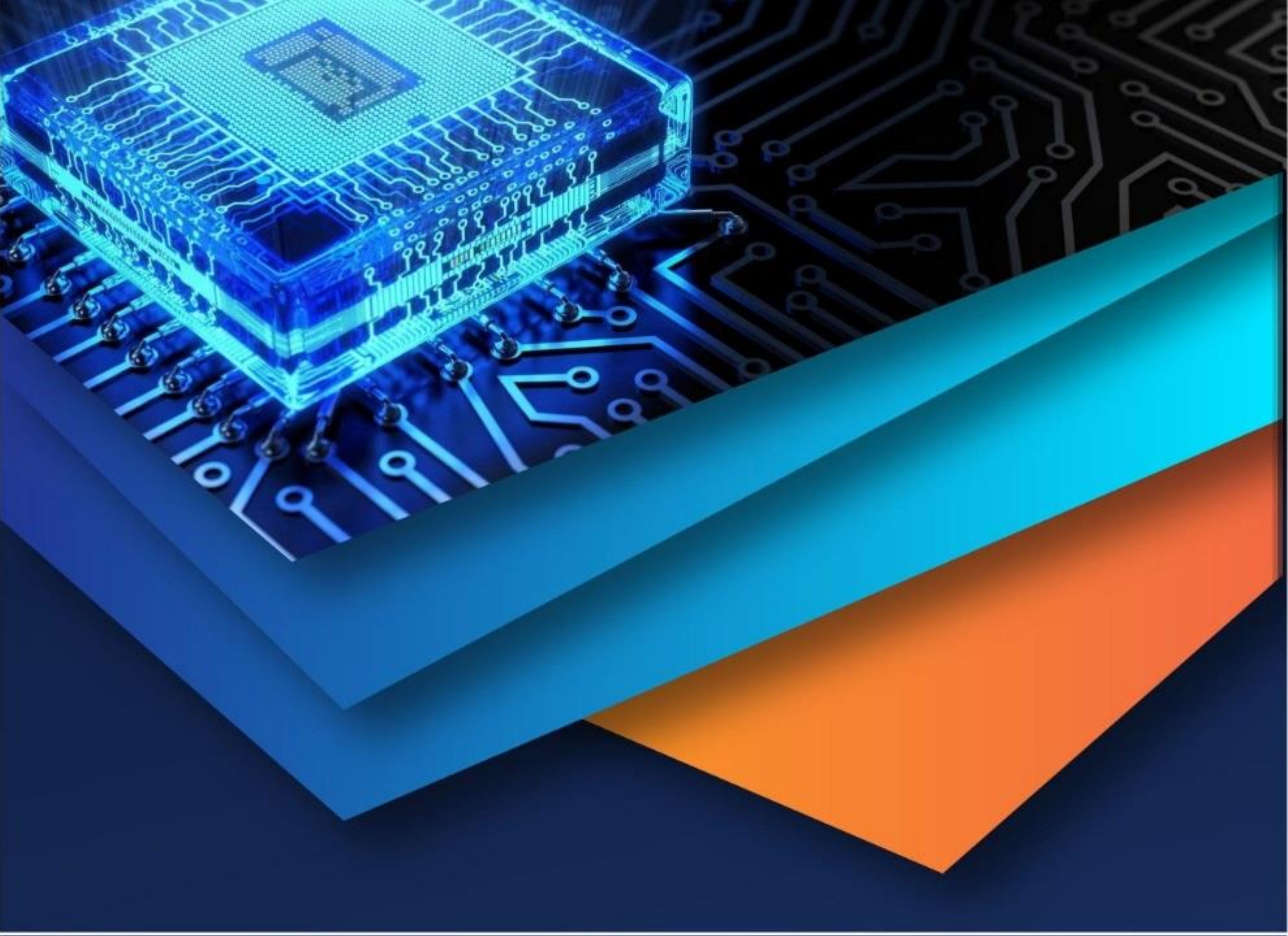

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