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STRENGTHENING THE PROPERTIES OF CONCRETE USING BANANA FIBER AND COCONUT FIBER

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ABSTRACT

This is an experimental studies on the properties of coconut fibers and banana fibers reinforced concrete with plain concrete of M20 grade. Fiber reinforced concrete is a composite material consisting of mixtures of cement, mortar, or concrete and discontinuous, discrete, uniformly dispersed suitable fibers. Natural fibers such as coconut fibers and banana fibers widely available worldwide in large quantity. This study deals use of agricultural waste material into concrete, which enhanced the properties of concrete and makes environment eco- friendly. The addition of coconut fibers and banana fibers improved the engineering properties of the concrete toughness and tensile strength. Coconut fibers and banana fibers are environmental friendly and present important attributes such as low density, light weight, low cost, non – corrosiveness, high tensile strength.In this study coconut fibers 80% and banana fibers 20% as composite were added to M20 grade concrete in different percentage 0%, 0.5% 1.5%, 2.0%, 2.5%, by weight of cement. The standard cubes, cylinders, and beams for conventional concrete and coconut fibers and banana fibers reinforced concrete were prepared and tested in the laboratory. Mechanical properties such as compressive, split tensile and flexural strength were determined. The result shows that, compressive strength, split tensile strength and flexural strength marginally improved.

1. INTRODUCTION

Concrete is the most widely used construction material all over the world with innovations in science and technology in construction industry, the scope of concrete as a structural material, has widened. Since concrete is weak in tension and flexure most commonly, it is reinforced using steel reinforcing bars. However usage of steel reinforcement is expensive. Considerable efforts have been made worldwide to add various types of fibers to concrete so to make it more strong durable and economical.Plain concrete is a brittle material. Concrete without any fibers will develop cracks due to plastic shrinkage, drying shrinkage and changes in volume of concrete. Development of these micro cracks causes elastic deformation of concrete. In order to meet the required values of flexural strength, fibers are used in normal concrete. The addition of fibers in plain concrete will control the cracking due to shrinkage and also reduce the bleeding of water in concrete.Natural fiber such as coconut fiber & banana fiber has certain physical and mechanical characteristics that can be utilized effectively in the development of reinforced concrete material.

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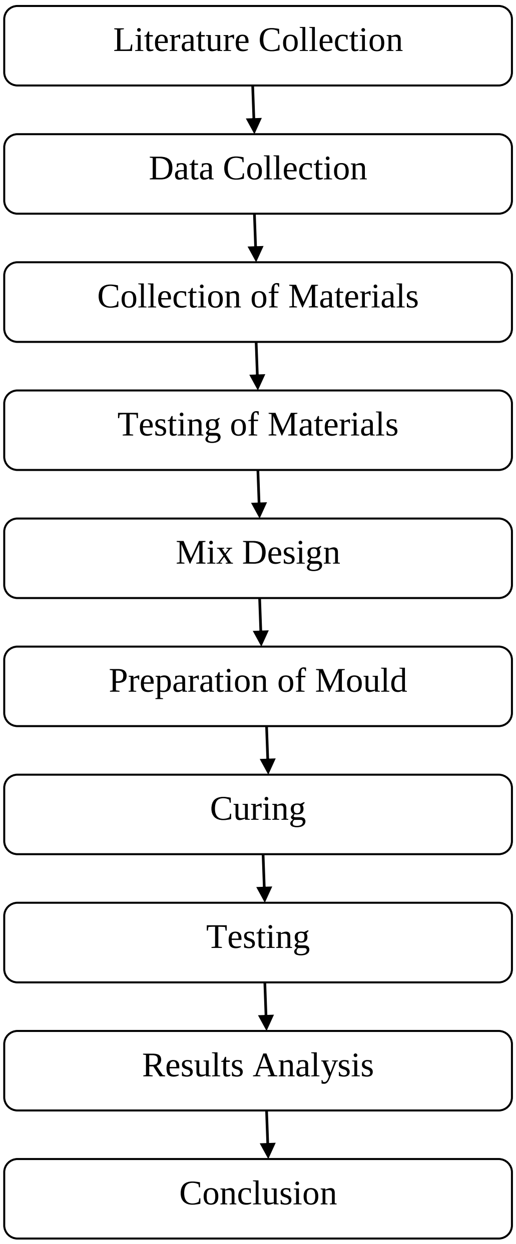
2. LITERATURE REVIEW

Kshitiye Nadgouda (2014) conducted a study on coconut fibre reinforced concrete. According to this investigation 3%, 5% and 7% coconut fibres (by weight of cement) was added with plain concrete grade M_{20} (by taking 1:1.5:3 as nominal mix)

Dhandhania VA and Sawant S (2014) conducted an experimental investigation on coconut fibre reinforced concrete. According to this investigation 0.25% and 1% coconut fibre (by weight of cement) was added with plain concrete grade M15 and standard sizes of concrete cubes were casted.

Aishwarya Sukumaran and Elson john (2014) conducted an experimental investigation by using steel fibres into the concrete. They investigated that steel fibres give better strength as compared to polypropylene fibres and also give the most strength in all types of fibres.

3. METHODOLOGY



4. RESULT ANALYSIS

4.1 RESULTS OF NATURAL FIBER IN FRC

4.1.1 Compressive Strength Test

Compressive Strength test was carried out on cube specimen of dimensions 150 x 150x150 mm. The compressive test specimen were cured and tested for 7 days and 28 days in CTM.

Fibres do little to enhance the static compressive strength of concrete, with increases in strength. Even in members which contain conventional reinforcement in addition to the steel fibres, the fibres have little effect on compressive strength.

CUBE – COMPRESSIVE STRENGTH FOR 28 DAYS

Table 1.1 compressive strength of concrete for with and without fibres(28 DAYS)

S.No	Coconut fibre & Banana fibre in Percentage (%)	Compressive strength (Mpa)			Average
		Cube 1	Cube 2	Cube 3	
1	0	26.2	25.9	25.8	25.97
2	0.5	26	26.1	26.04	26.05
3	1.0	26.09	26.18	26.04	26.10
4	1.5	25.9	25.8	25.7	25.8
5	2.0	25.6	25.5	25.4	25.5
6	2.5	24.8	24.7	24.9	24.8

4.1.2 SPLIT TENSILE STRENGTH

All the cylinders were tested in a 'compressive testing machine' to determine the compressive strength of the cylinders. The procedure is as follows:

Split tensile test of cylinder are made as soon as practicable after removal from curing pit. Centre one of the plywood strip along the centre of the lower platen. Place the specimen on the plywood strip and align so that line mark on the specimen are vertically and centred over the plywood strip. The second plywood strip is placed length wise on the cylinder centred on the lines marked on the ends of the cylinder. Then load is applied continuously. The load is increased until the specimen fails and record max load carried by the each specimen during the test. Also note the type of failure and appearance of cracks. Split tensile strength can be calculated.

Split tensile strength = 2P/3.14 DL

where ,

P = Load,

D = Diameter of the specimen,

L = Length of specimen.

P = 191000 N, D = 150mm, L = 300mm

Split tensile strength = (2 x 191000) / (3.14 x 150 x 300)

= 2.7 N/mm^2

CYLINDER – SPLIT TENSILE STRENGTH FOR 28 DAYS

Table1.12 Split tensile strength of cylinder

S.No	Coconut fibre & Banana fibre in Percentage (%)	Compressive strength (Mpa)			Average
		Cylinder 1	Cylinder 2	Cylinder 3	
1	0	2.4	2.7	2.5	2.53
2	0.5	2.8	2.5	2.6	2.63
3	1.0	2.9	2.7	2.8	2.80
4	1.5	2.5	2.2	2.4	2.37
5	2.0	2.4	2.5	2.0	2.30
6	2.5	2.1	2.0	2.1	2.07

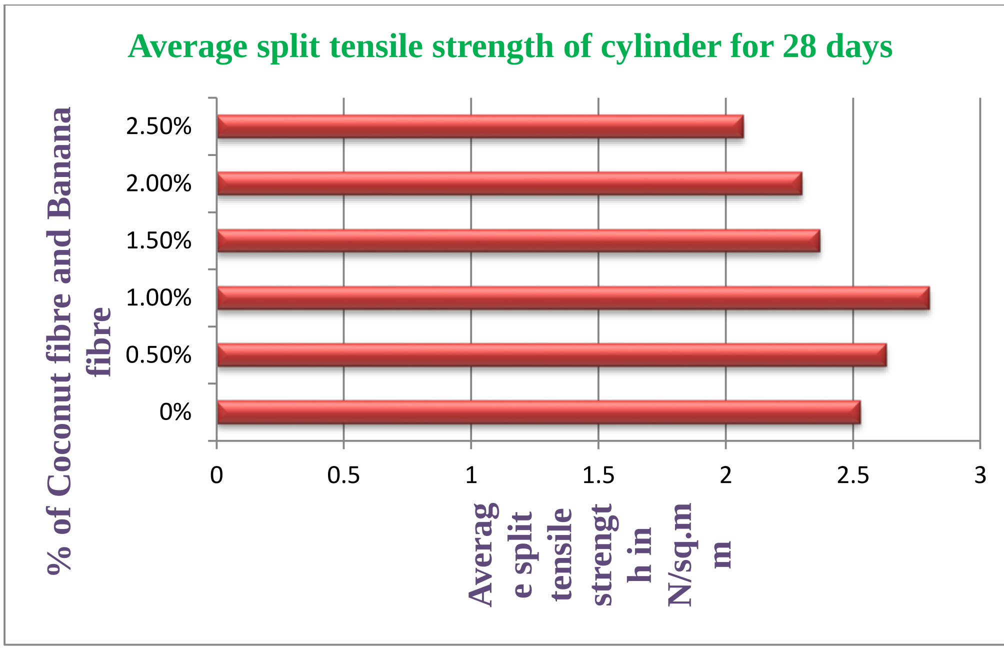


Fig 1.16 percentage of fibre vs split tensile test

4.1.3 FLEXURAL STRENGTH TEST ON BEAM FOR DEFLECTION

As expected, the flexural cracks are initiated in the pure bending zone. As the load increased, existing cracks propagated and new cracks developed along the span. In the case of beams with larger tensile reinforcement ratio some of the flexural cracks in the shear span turned into inclined cracks due to shear effect of shear force. Near peak load the beam deflected significantly, thus loading that the tensile steel must have yielded at failure. The final failure of the beams occurred when the concrete in the compression zone crushed, accompanied by buckling of the compressive steel bars.

Table:1.14 Flexural Strength of FRC with Coconut Fibre and banana fiber

Conventional concrete		Coconut and banana fibre concrete(1%)	
Load(KN)	Deflection(mm)	Load(KN)	Deflection(mm)
0	0	0	0
10	0.19	10	0.11
20	1.35	20	1.07
30	2.51	30	1.29
40	3.20	40	2.20
50	4.03	50	3.79
55	4.51	55	4.01

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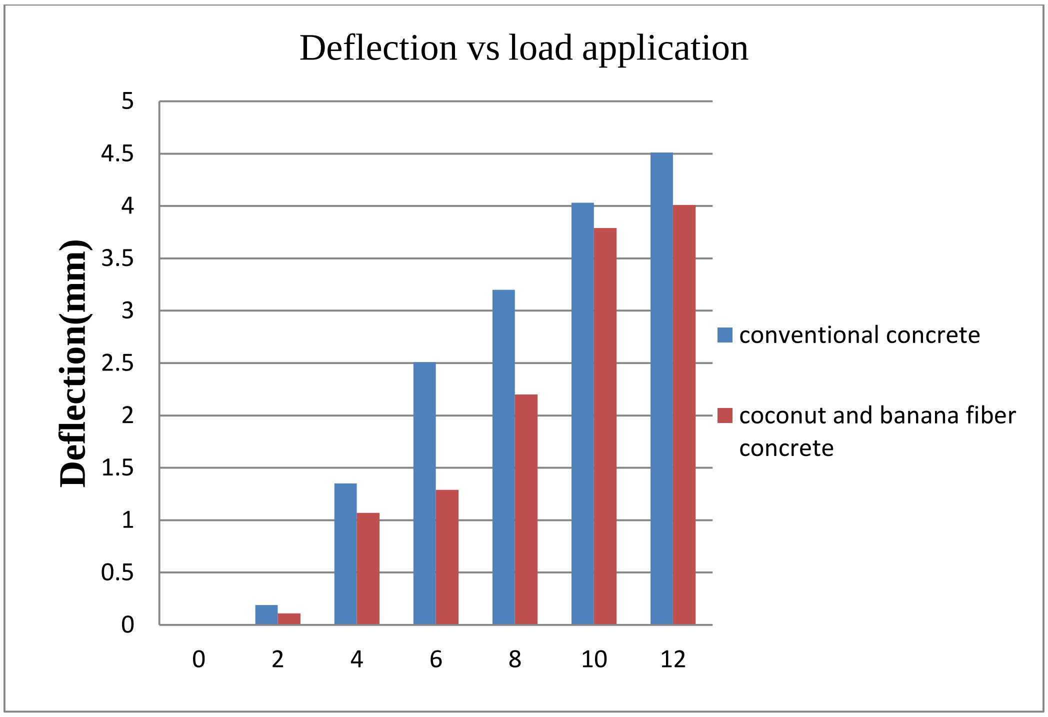

CONCLUSION

The following conclusions obtained from the experimental investigation,

i. It is observed that the workability of fibre reinforced concrete gets reduced as the percentage of natural fibres increases.

ii. It is observed that compressive strength and split tensile strength on higher side for 1% fibres as compared to that produced from 0%, 0.5%, 1.5%,2% and 2.5% fibres

iii. It is observed that flexural strength are on higher side for 1% fibres as compared to that produced from 0%, 0.5%, 1%,2% and 2.5% fibres.

iv. It is observed that compressive strength increases with addition of natural fibres. Compressive strength goes on increasing by increase in natural fibre percentage up to the optimum value. The optimum value of fibre content of steel fibre reinforced concrete was found to be 1%.

v. It is observed that flexural strength increases with addition of steel fibres. The flexural strength of concrete goes on increasing with the increase in fibre content up to the optimum value. The optimum value for flexural strength of steel fibre reinforced cement concrete was found to be 1%.

vi. It is observed that split tensile strength increases with addition of natural fibres. The tensile strength of concrete goes on increasing with the increase in fibre content up to the optimum value. The optimum value for tensile strength of natural fibre reinforced cement concrete was found to be 1%.

vii. Finally this project concludes the making of natural fibre concrete, the test results show that the addition of natural fibre resulted in a significant increase in concrete compressive strength compared with the control concrete.

viii. Although the compressive strength values have considerably increased with the addition of used natural fibres, their values are still in the reasonable range for a 0.5%, 1%, 1.5% , 2% and 2.5% values because the intended compressive strengths of (30MPa) flexure strength (8MPa) and tensile strength(4MPa)was achieved in this type of specimen.

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