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An Experimental Study of Agave and Coconut Fibre Concrete

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Abstract: ***Nowadays necessity of concrete is larger than the last decades. Mostly concrete is weak in tension and has some brittle characteristics. In order to overcome the weakness, regular concrete is therefore normally reinforced with steel bars. Researchers have attempted to enhance the tensile property by addition synthetic fibres, but as they are expensive, we are attempting to use alternative sources of natural fibres to incorporate tensile strength in conventional concrete. Agave Americana (Elephant Aloe Vera) and Coconut fibre was examined for its suitability for incorporation in cement concrete. The physical property of this fibre has shown no deterioration in the concrete medium. Fibres were brushed and lined up and cut to obtain 10 cm length for required aspect ratio. This Attempt was made to analyse the suitability of partial replacement of cement with infused with natural fibres of different percentage. Materials were mixed with agave fibres and coconut fibres of 0.5%, 1%, 1.5% and 2% of volume of concrete for M20 mix grade and casted in cubes, cylinders and beams. The strength characteristics like compressive strength, Split Tensile Strength and Flexural Strengths were analysed.***
Keywords: Agave fibre, coconut fibre, tensile strength of concrete, partial replacement

I. INTRODUCTION

Concrete is one of the most required building materials. It can be cast to fit any shape from a cylindrical water tank to a rectangular shaper beam or column in a high-rise building. The science of incorporating one or more materials in concrete to improve the tensile and compressive strength and satisfy design requirements is not new. Widely concrete is reinforced with steel bars. Over the years scientists have been doing research on reinforcing concrete with natural and synthetic fibres. The concept of replacing steel by incorporating the natural fibres in concrete is termed as Natural Fibre Reinforced Concrete (NFRC). Flexural tests show that agave fibre and coconut fibres composites have a higher flexural strength and modulus, due to improved fibre interaction. It was found that the standard deviation has decreased with an increase diameter of fibres.

The use of fibres in reinforced concrete flexure members increases ductility, tensile strength, moment carrying capacity and stiffness. The fibres improve post cracking behaviour of concrete. The work presented in this project reports is an investigation on the behaviour of concrete produced from blending cement with Agave and coconut fibre.

The objectives and scope of present study are:

1) To study the effect of Agave and coconut fibre reinforced concrete and investigate the optimum percentage of fibre mix.
2) To study the mechanical properties of concrete for Compressive test on concrete cubes (150x150x105mm).
3) To decrease the self-weight
4) To decrease an environmental effects
5) To increase structural performance and durability
6) To reduce the cost of building by using natural fibre materials
7) To strength, ductility, impact, resistance, tensile and bending strength are improved.

II. METHODS AND MATERIALS

In this paper presents the investigation on the behavior of concrete produced from mixing of cement with the combination of Agave and coconut fibre .The physical and chemical properties of Agave and coconut fibre were first investigated. Mix design was performed to produce high workability concrete (M20) for the control mixture with different percentages of fibre content. The effect of Agave and coconut fibre on concrete properties was studied by means of the fresh properties of concrete and the hardened properties i.e. Compressive strength, split tensile strength, flexural strength were studied.

A. *Cement*

The property of 53 grade cement was analyzed. The specific gravity of cement was 3.15. The Properties of cement were determined as per the IS 3812:2009 and given in the table.

Table 1 : Properties of cement

Sl.no	Properties	Observation	References
1.	Specific gravity	3.15	AS per IS 3812:2009
2.	Initial Setting Time	30 min	IS 4031:1988
3.	Final Setting Time	10 hours	

B. *Aggregate*

The river sand was used as a fine aggregate in this project. The fineness modulus and specific gravity are 2.72 and 2.56. Coarse aggregate passing through 20mm and retained 10mm sieve was used. Its specific gravity was 2.85. Its impact value and water absorption are 13% and 1.6%.

C. *Agave fibre*

Agave fibres are cellulosic in nature. The failure strength and modulus of elasticity depends on the amount of cellulose and the orientation of the micro-fibres.

Particulars Result

1) Diameter 0.2mm
2) Elongation 4%
3) Water Absorption 3%
4) Cellulose 70%
5) Tensile Strength 300 MPa
6) Density

Fig 1. Agave fibres

III. EXPERIMENTAL PROGRAMME

Experimental programme comprises of slump cone, compaction factor, compressive and tensile strength tests on cement concrete (M20) with mixture of agave and coconut fibre 0.5%, 1%, 1.5%

A. *Slump Cone and Compaction Factor Test Results*

Table 2 : Slump cone and *compaction factor* test results

Mix proportion	Slump value	Compaction Factor value
Conventional	165mm	0.85
0.5%	140mm	0.73
1%	110mm	0.68
1.5%	95mm	0.54
2%	70mm	0.46

B. Compressive Strength test Results

These specimens are tested by compression testing machine after the specimens are put in water for curing at 7 days, 14 days and 28 days.

Table 3 : Compressive strength test results

Mix proportion	7 Days (N/mm^2)	14 days (N/mm^2)	28 days (N/mm^2)
Conventional (%)	15.2	18.4	21.2
0.5%	16.1	19.5	23.4
1%	17.8	20.4	24.4
1.5%	14.6	15.3	12.5
2%	12.3	13.9	11.4

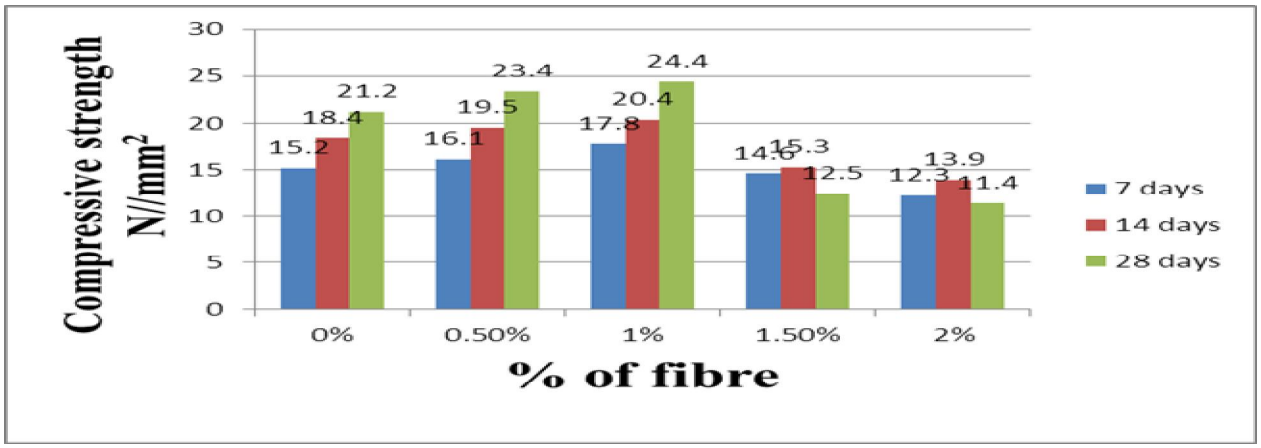

Fig 2.: Compressive strength test results

C. Split Tensile Strength Test Results

These specimens are tested by Split tensile testing machine after the specimens are put in water for curing at 7 days, 14 days and 28 days.

Table 4 : *Split tensile strength test results*

Mix proportion	7 Days (N/mm^2)	14 days (N/mm^2)	28 days (N/mm^2)
Conventional (%)	2.03	2.78	3.12
0.5%	2.36	2.82	3.56
1%	2.53	2.97	3.69
1.5%	1.98	2.15	2.43
2%	1.60	2.04	2.25

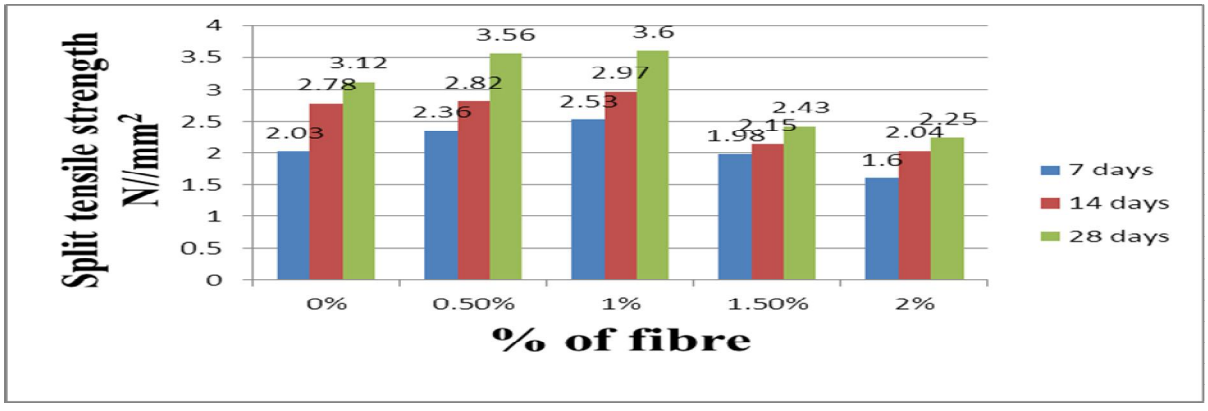

Fig 3.: Split tensile strength test results

IV. CONCLUSION

Agave fibre and coconut fibre being low in density reduces the weight of the fibre reinforced concrete. The compressive and tensile strengths of the concrete get the maximum value at the 1% of fibre content. Since by addition of fibres in the concrete the strengths of the specimens get decreasing and it can be conclude that the fibre should not be used beyond 1%. Tensile strength was higher than conventional concrete for 0.5% and 1% addition of agave fibre at 7, 14 and 28 days of curing ages. Addition of agave fibre greater than 1% had lower strength than conventional concrete. The results demonstrated that, irrespective of agave fibre percentage addition there was good relationship between compressive strength and tensile strength.

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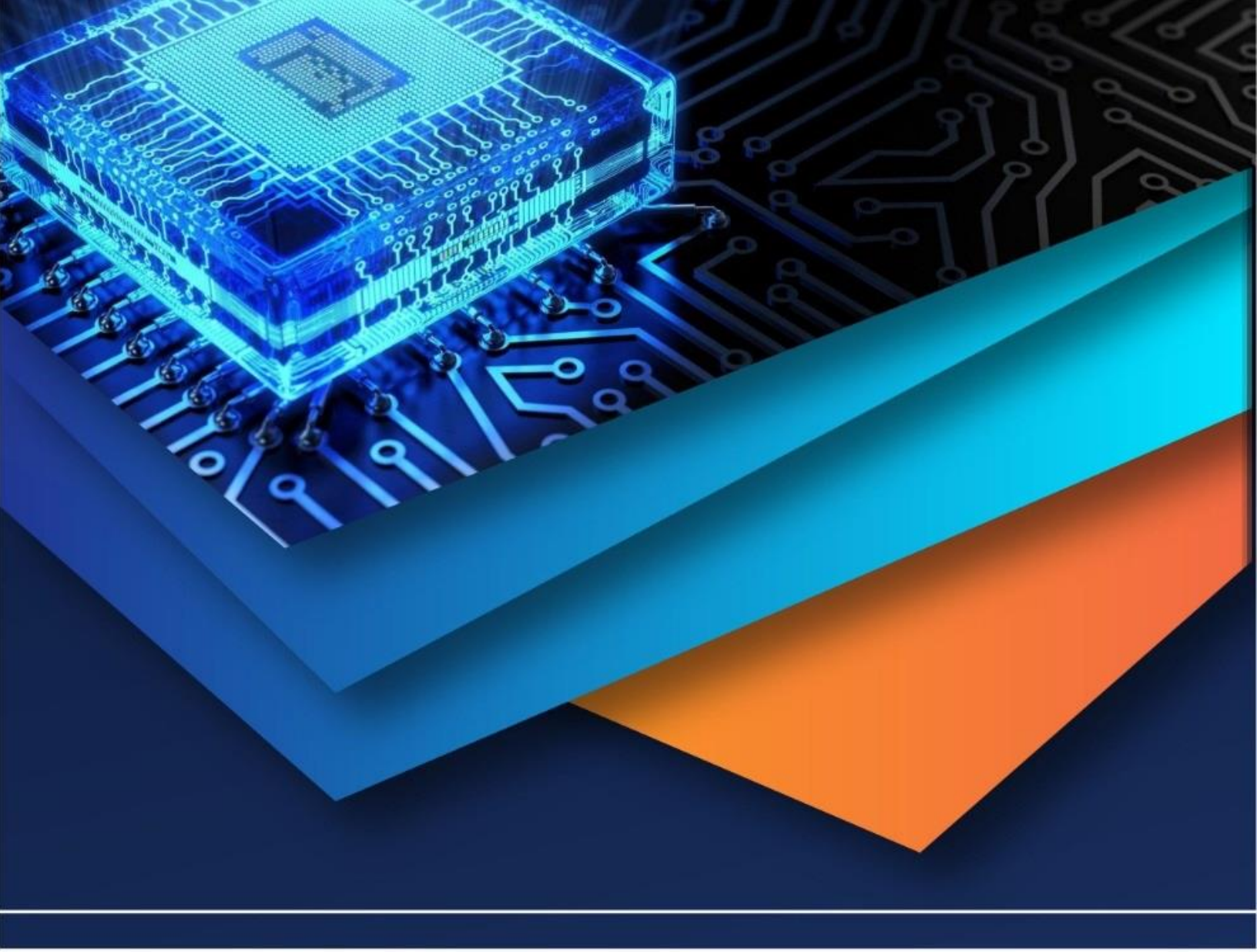

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