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EXPERIMENTAL STUDY ON CONCRETE PROPERTIES USING PINEAPPLE LEAF FIBER

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ABSTRACT

In present constructions, the use of admixtures has increased for achieving various properties which cannot achieve by conventional properties. Nowadays, fibres are used as a reinforcing material in place of steel in concrete. These fibres could prevent cracking and improve the tensile strength of concrete. Fibres include natural fibre such as pineapple leaf fibre is an alternate non degradable matter which is not in demand of abundance and cheaper in the cost. This study presents the comparison on behaviour of Pineapple leaf Fibre composite in different fibre ratios with conventional concrete.

Key words: Natural fibres, Pinapple leaf fibre, conventional concrete.

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1. INTRODUCTION

Concrete is defined as material made-up of embedded filler in hard matrix concrete materials placed in between aggregate particles and glued them together. It essential for the binding embedded particles of concrete or fragments of the course aggregates. Concrete productions are made from several methods such as batching, mixing, consolidation, finishing and curing. Concrete is one among the foremost widely used artifact. It is composed of three main elements such as fillers, sand and cement, being the bonding factor and forms concrete. It has compressive strength and low tensile strength. To compensate for weak tensile strength they

are reinforced with fibres. Pineapple leaf fibre are used within the concrete to increase its tensile strength. This composite has a suitable property to reduce the cracking of the surface [1].

Concrete fibre has high energy absorption rate under impacts, so its not easily torn apart. Adding fibre to the concrete to improve its properties is a practise started in the early 60s during this past six decades a lot of advancement has been seen in addition of fibre to the concrete to obtain various desired quantities[2].The reason this practise was started to avoid the weak tensile strength of a raw concrete. Pineapple is a very common fruit and available all over the world. Its leave can be used to fibres which then can be added to the concrete. This provides a alternate was for using synthetic fibres and also using a biowaste to a good use [3].

In present, constructions are using various of additives to form various mixtures to achieve various properties which are better than a lot of conventional properties of concrete. Nowadays, fibres are used as a reinforcing material in place of steel in concrete [4]. These natural fibres such as pineapple leaf fibre available at a very low cost could prevent cracking and improve the tensile strength of concrete and also makes transforms it and homogeneous and isotropic it from a brittle to a more ductile material [5]

Linto Mathew etal.(2017) carried out a experimental investigate the mechanical properties of PALF fibre subjected to various test under high temperature. The study which determine on the structural properties of PALF is added concrete at normal temperature. In this study, PALF of specific ratio are randomly dispersed in concrete for the preparation of test specimens are used for various experimental tests [16]. From the test conducted, control mix compressive strength was obtained as 22.81MPa for 7 days normal curing and 34.29MPa for 28 days normal of curing. The compressive strength for various percentage addition of PALF had obtained [17]. The peak 7th day compressive strength which obtained for concrete mix ratio containing 0.10 fine adding of PALF as 27.31 MPa and it had been found to be 20% more than the control mix. And peak 28th day compressive strength has obtained for concrete mix ratio containing 0.10 fine adding of PALF as 40.53 MPa and it had been found to be 18% more than the control mix[18]. From this it is clear that by adding 0.1% pineapple fibre to M25 concrete we are able to replace M30 Concrete [6].

Vinod.b etal.(2014) carried out a study on Influence of fibre length on tribological behavior of short PALF reinforced Bisphenol-A Composite Studied wear and frictional properties unreinforced resin material and composite with different fibre length at varying load PALF of 8mm show less specific wear rate &coefficient of friction[7]

2. MATERIAL USED

OPC of 53 grade used as per code IS 12269:2013. From laboratory tests results fineness of cement obtained 7.33% and percentage of water for standard consistency is 30mm for 7mm penetration [13]. The initial setting time 30mins and final setting time 10 hours is within the limit of IS 4031-PART 3. M-Sand used as fine aggregate and granular stones used as coarse aggregate at size of 12.5-20mm size with specific gravity of 2.71.

2.1. Pineapple Leaf Fibre

Pineapple leaf fibre composite plays important role in bio composite and material science. PALF has been demonstrated as a decent substitute of manufactured filaments, on account of its prudent and inexhaustible nature.[8] Explicit quality of normal strands underpins in improving the physical and mechanical quality of polymer grid without utilizing any extra preparing [9]. PALF is one of the have additionally great potential as support in thermoplastic composite [10]. Utilizing these fibres in reinforced concrete reduced energy consumption, biodegradability and low disposal cost [11].The objective of current research characterising

the mechanical properties and physical properties of fibre with reinforced concrete at different ratio [14].

The mechanical properties of PALF tested in laboratory and test results are tabulated in table 1, Crushing strength and water absorption pictures shown in fig 2.

Figure 1 Pineapple Fibre

Table 1 Properties of PALF fibre

S.No	Properties of PALF fibre	Value of PALF Fibre
1	Density (g/cm^3)	1.5
2	Length (mm)	6
3	Diameter(µm)	5
4	Tensile Strength (MPa)	165
5	Tensile Modulus (GPa)	7.25
6	% of Elongation	13
7	Water Absorption	7%
8	Crushing Value (MPa)	15.71

Figure 2 Crushing strength and water absorption test

3. CASTING OF CONCRETE SPECIMEN

The size of Cubes 150mmx150mmx150mm, Cylinders 150mm diameter and height 300mm and rectangular beam size of 150mmx150mmx70mm are casted for both normal and Pineapple fibre reinforced concrete at M20 grade mix of ratio 1:1.5:3 is used [12]. The water –cement ratio required for mean strength of 20 MPa is 0.45.Fiber cement ratios of 0%,0.5%,0.10%,0.15%,0.20% were used.

Figure 3 Specimens of Cube, Cylinder and Beam

Figure 4 Curing Process of Palm reinforced cubes

4. RESULTS AND DISCUSSIONS

4.1. Compression Test

The cube-compressive test was conducted in compression testing machine as per IS 416-1964.The cube specimens were tested on compression testing machine of capacity 1000KN [16]. The table 2 shows the Maximum Compressive strength obtained in water cement ratio of 0.45 and the table 3 shows Maximum value of compressive strength obtained at 0.1% of fiber-cement ratio in 28 days

Table 2 Maximum Compressive strength obtained in water cement ratio of 0.45

S.No	Water content	Conventional concrete Compressive Strength (MPa)	
		7 days	28days
1	0.45	20.96	20.3
2	0.5	15.18	16.33
3	0.55	11.476	12.93

Table 3 Maximum value of compressive strength obtained at 0.1% of fiber-cement ratio in 28 days

S.No	Fiber Cement Ratio(%)	28 Day Compressive Strength (MPA)		
		Sample 1	Sample 2	Average strength
1	0.05	31.55	31.2	30.8
2	0.1	34.25	34.0	33.8
3	0.15	32.0	31.6	32.75
4	0.2	28.88	27.5	27.65

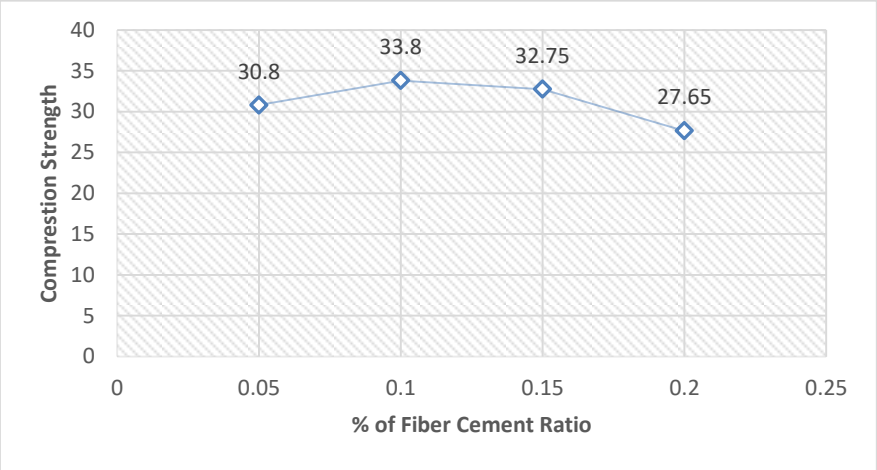

Figure 5 Compression strength vs. % of fibre cement

4.2. Flexural Test

The flexural strength of the concrete beams which tested and the result has been tablutate in the table 4 and the beam which is loaded in the utm which forms crack which has shown in the figure 6. The experimental value has been tabled and ploted as graph which shown in figure 7.

Figure 6 Testing of PALF reinforced beam

Table 4 The Average Flexural strength of Concrete

S.No	Fiber Cement Ratio(%)	Flexural Strength at 28 days (MPa)		Average Flexural Strength
		Sample 1	Sample 2	
1	0.05	4.50	4.72	4.61
2	0.1	6.73	7.21	6.83
3	0.15	8.9	8.45	8.67
4	0.2	7.44	7.86	7.59

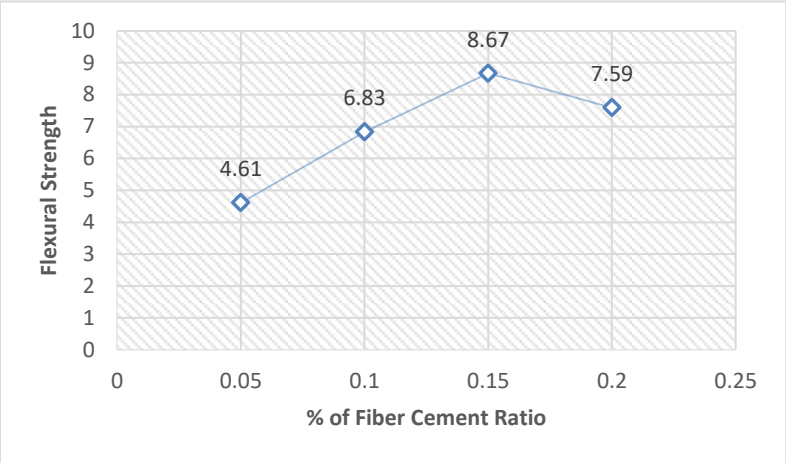

Figure 7 Flexural Strength vs. % of fibre cement

4.3. Tensile Strength

As per the codal procedure the split-tensile strength of the concrete cylider which tested and the result has been tabulate in the table 5 and the beam which is loaded in the utm which forms crack which has shown in the figure 8. The experimental value has been tabled and plotted as graph which shown in figure 9.

Figure 8 Testing of PALF reinforced Cylinder

Table 5 Tensile strength of the concrete

S.No	Fiber Cement Ratio (%)	Tensile Strength at 28 days (MPa)		Average Tensile Strength
		Sample 1	Sample 2	
1	0.05	2.475	2.405	2.428
2	0.1	2.902	2.785	2.83
3	0.15	3.346	3.413	3.367
4	0.2	3.197	3.024	3.111

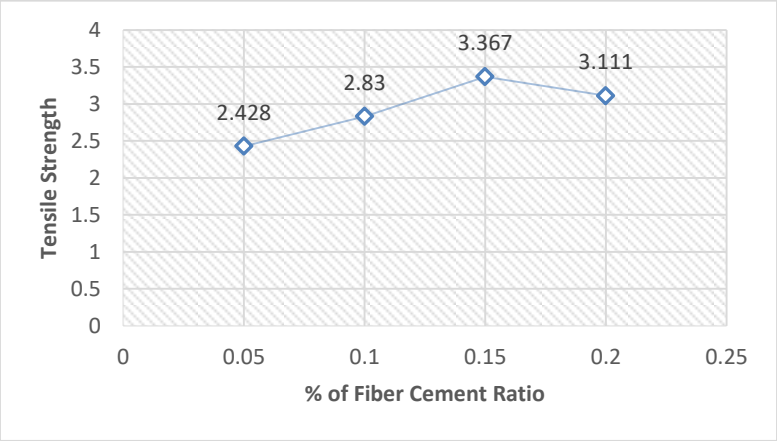

Figure 9 Tensile strength vs. % of fibre cement

5. CONCLUSION

The compressive strength was increased up to 30.62% on addition of PALF fibre at 0.1%. The flexural strength was increased up to 46.858% as compared to conventional concrete. The tensile strength was increased up to 14.20% while adding PALF. PALF Fibre has a hardness ranging in 60-70. PALF reinforced concrete increases its mechanical properties as compared to conventional concrete. Aggregate along the PALF gives less crushing value as compared to conventional aggregate.

PALF reinforced concrete can be used in airport and shopping mall pavements hence it has less crushing value and high strength as compared to conventional concrete. Hence PALF is cheap and easily available material, which can be used in concrete to increase its properties

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