

EXPERIMENTAL INVESTIGATION ON STRENGTH CHARACTERIZATION OF PALM BASED CONCRETE

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Abstract

Many Researches has been conducted on natural and artificial fibers the present experimental investigation is carried out by using natural fiber called palm fiber. The palm fiber is used in the concrete will emphasis the mechanical properties of concrete. As we know that concrete is weak in tension and strong in compression, in order to use the concrete in such a situations that it has to carry the tensile and flexural forces which are coming on to the structural member, then there is a necessity to enhance the tensile strength of concrete. Here in this project palm fibre has been used, which has good tensile properties. For the same, 0.25%, 0.50%, 0.75% and 1% of fibers used by weight of the cement in concrete and also, investigated the compressive, spilt tensile and flexural strength strength of concrete. Based on the results reports, 0.50% of plam fiber based concrete samples shown optimum strength as compared to others.

Key words: *Palm fiber, Natural fiber, Compressive strength, Split tensile strength, Flexural strength.*

I. INTRODUCTION

Since early 2000's world's population has dramatically increased and the total world's population is estimated to be around 7.7 billion as per the statistics of April 2019. Due to the increase in the population, there is a higher demand for housing, residential or commercial buildings. This shortage of housing has led to the increase in construction companies for building adequate number of housing. Due to the increase in constructions, there is a greater demand for the construction material. But the production of construction materials such as cement, aggregate and sand in higher volumes is causing in depletion of natural resources which in turn is causing significant change in the climate. Taking the material shortage into consideration, engineers are looking for various other alternatives to reduce the usage of the traditional material. Engineers are working together to develop a sustainable system which can utilise the material that is readily available and which is considered as waste, and to convert it into a useful product to utilise in the construction. Thereby the natural resources will be preserved and excess waste which is land filled will be utilised.

For the past few decades there has been a tremendous growth in the utilization of natural fibres in the construction of low cost buildings. Knowing the physical, chemical and mechanical properties of the natural fibre and their behavioural studies have greatly increased. Many attempts are made for improving the durability of the natural fibres. In the present study, palm fibre is used as an additive in concrete. The palm fibre is added to the concrete in terms of percentage by weight of cement that is used in construction. Several trails and experiments are done by adding different percentages of palm fibre and have reached an optimum percentage. By adding (0.25, 0.50, 0.75, 1) % of palm fibre to the concrete mix has led to the greater performance of concrete in terms of strength and durability when compared to the nominal mix.

II. MATERIALS AND METHODOLOGY

In these work used Ordinary Portland cement (53 grade) and all its physical and chemical properties are conducted according to (IS12269-2013). The Specific gravity of cement was 3.16(1S2386-3(1996)). Initial setting time was 40min and Final setting time was 480 min. the locally available natural sand was used as a Fine aggregate. Specific gravity of fine aggregate is 2.5 and water absorption is 2.5%. The coarse aggregate is taken from crushed stones. The Specific gravity of coarse aggregate is 2.9 and Water absorption is 1.5% Normal Water is available in laboratory. Palm fibre is the natural fibre extracted from the Tad tree. These are added to the concrete mix based on length and Diameter of palm fibre is 0.3 mm. Fiber is taken as according to the weight of the cement. Palm fiber consists of cellulose (40-52) % and hemi cellulose (42-43) %.

TREATMENT OF PLAM FIBER

Plam fiber is natural fiber, but this fiber has hydrophilic behaviour. The hydrophilic behaviour of fiber produces poor adhesion between fiber and matrix, when the natural fiber faced to developed composite material. To overcome this problem the present project work conducted chemical treatment to the palm fiber. For the same, the palm fibers are immersed in 4% NaOH solution for an hour. After words, the fibers are taken out from the solution and dried 3hrs at 60°C in hot air oven.

III. MIX CALCULATION

Mix	Cement	PF	FA	CA	WATER	SP
PF0%	437.89	0	642.28	1265.66	153.26	8.75
PF0.25%	437.89	0.25	642.28	1265.66	153.26	8.75
PF0.50%	437.89	0.50	642.28	1265.66	153.26	8.75
PF0.75%	437.89	0.75	642.28	1265.55	153.26	8.75
PF1%	437.89	1	642.28	1265.55	153.26	8.75

Grade of concrete is M45, Compressive test on concrete cubes ($150 \times 150 \times 150$ mm), Split tensile strength on cylinders ($\varnothing$ 100 mm & 200 mm long), Flexural strength on prisms ($500 \times 100 \times 100$ mm).

% of palm fiber	Weight of palm fiber in grams		
	For cube	For cylinder	For prism
0.25	15	39.65	24.8
0.50	30	79.28	49.6
0.75	45	118.93	74.4
1	60	158.58	99.2

Table 1-Quantity of palm fiber

IV. RESULTS AND DISCUSSIONS

A .Compressive Strength Test:-

Compressive strength of concrete mix containing different mix is 75. Aspect Ratio (based on length) with 0.25, 0.5, 0.75, 1% of Palm fiber by the weight of cement.

S.NO	PERCENTAGE OF FIBER	7 DAYS	28 DAYS
1	PF 0%	35.84	55.77
2	PF 0.25%	37.62	56.34
3	PF 0.50%	41.47	58.26
4	PF 0.75%	24.44	52.16
5	PF 1%	19.99	48.29

Table 2-Compressive Strength of palm Fiber for 7 and 28 days

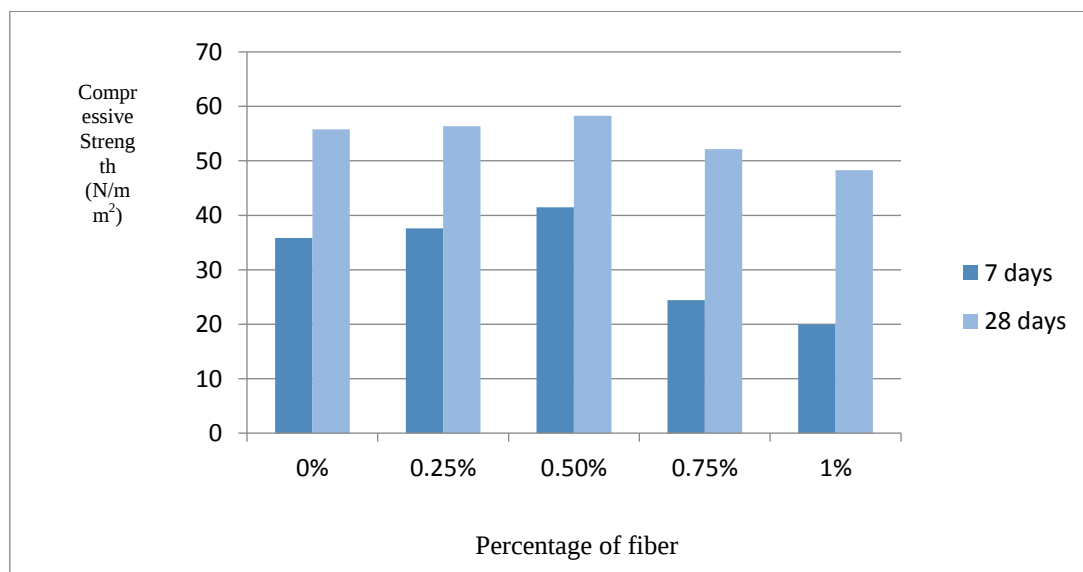


Figure 1: Compressive Strength of palm fiber

From the above results the Compressive strength of the concrete at 0.50% fiber weight by cement have shown a significant improvement further which gradually decreased from 0.75% to 1%.

B. Split Tensile Strength Test:-

Split tensile strength of concrete mix containing different mixes are 75 Aspect Ratio with 0.25, 0.50, 0.75, 1% of palm fiber by the weight of cement.

s.no	Percentage of fiber	7days	28days
1	PF0%	3.24	5.52
2	PF0.25%	3.31	5.67
3	PF0.50%	3.57	5.91
4	PF0.75%	3.20	5.31
5	PF1%	2.98	4.72

Table3- Split Tensile Strength of palm Fiber for 7 and 28 days

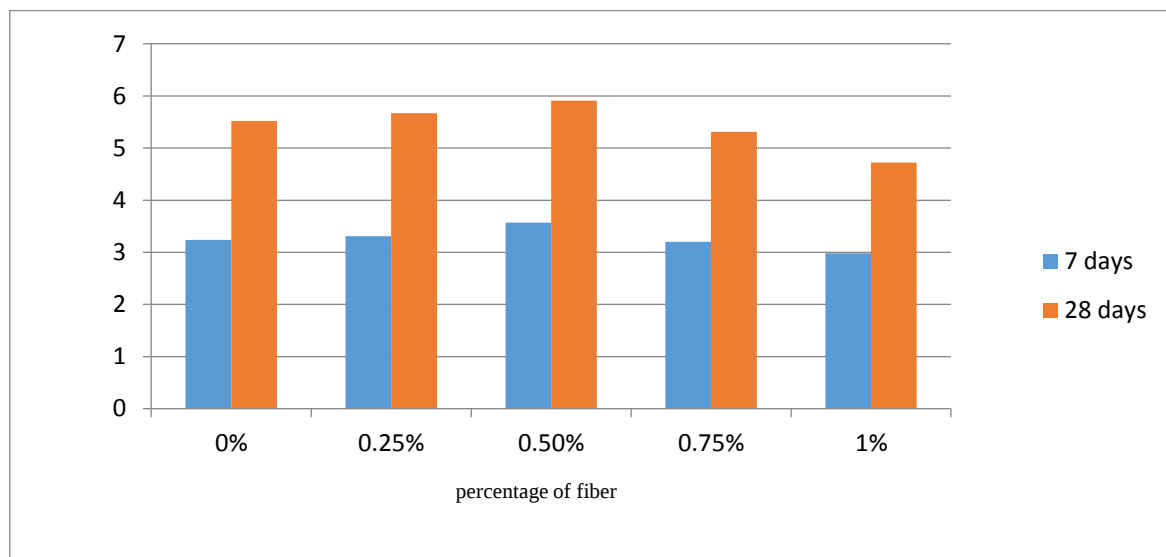


Figure 2: Tensile Strength of palm fiber

From the above results the Split Tensile strength of the concrete at 0.50% fiber weight by cement have shown a significant improvement further which gradually decreased from 0.75% to 1%.

C. Flexural Strength Test:-

Flexural strength of concrete mix containing different mixes are 0, 50, 75, 100 Aspect Ratios (based on length) with 0.5, 1, 1.5, 2% of palm fiber by the weight of cement.

s.no	Percentage of fiber	7 days	28 days
1	PF0%	4.19	5.24
2	PF0.25%	4.29	5.27
3	PF0.50%	4.5	5.35
4	PF0.75%	3.46	5.05
5	PF1%	3.12	4.86

Table 4- Flexural Strength of palm Fiber for 28 days

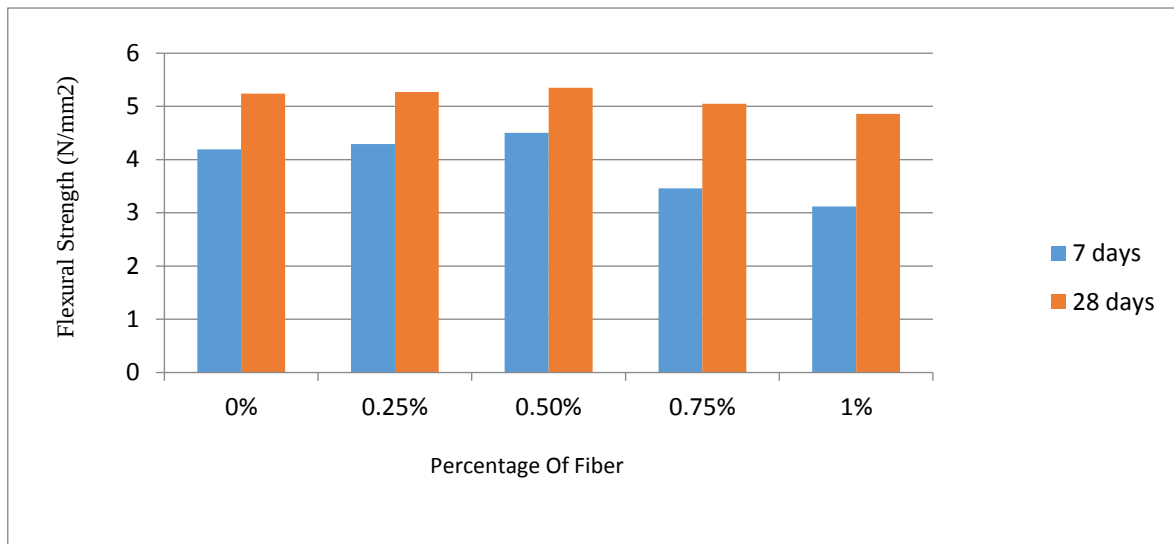


Figure 3: Flexural Strength of palm fiber

From the above results the Flexural strength of the concrete at 0.50% fiber weight by cement have shown a significant improvement further which gradually decreased from 0.75% to 1%.

V. CONCLUSION

This paper shows that the how the strength increases by fiber reinforced concrete with the aspect ratio of 75 and %of palm fiber by the weight of cement.

- The strength of concrete increases at 0.5% of palm fiber by the weight of cement is taken as constant and also the aspect ratio remain constant
- The compressive strength is increases 4.46% at 0.50% compared to conventional concrete.
- The split tensile strength is increases 7.06% at 0.50% compared to conventional concrete.
- The flexural strength is increases 2.09% at 0.50% compared to conventional concrete.

VI. FUTURE SCOPE OF WORK

In this project we use only one fiber. For further increasing of mechanical strength we use two or more fibers in the mix.

VII. REFERENCES

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