

FIBER REINFORCED CONCRETE WITH DIFFERENT ASPECT RATIOS

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Abstract- Concrete is globally used material. Concrete is good at compression and bad at tension so we are using the different types of fibers to improve the tensile properties. Now a days we are using both metallic and non-metallic fiber reinforced concrete material like glass, steel and sisal fibers. Sisal fiber is added to the concrete with different Aspect Ratios are 50, 75,100. The weight of sisal fiber based on weight of cement in concrete mix in M30 grade concrete. The Compressive strength of Concrete optimum at 50 A.R with 1.5 % which is 11.5% more than average compressive strength without fiber. The Split tensile strength of Concrete optimum at 50 A.R with 1.5 % of sisal fibre by the weight of cement which is 20.64% more than average concrete strength without fiber. The Flexural strength of Concrete optimum at 50 A.R with 1.5 % of sisal fibre by the weight of cement which is 7.092% more than average concrete strength without fiber. The main drawback in this study is more the sisal fiber the workability less.

Key words: Sisal fiber, Aspect Ratio, Fiber reinforcement, compressive strength, split tensile strength, flexural strength.

I. INTRODUCTION

Concrete plays a major role in construction field. Concrete is strong in compression and weak in tension .Now a days we are using so many natural materials in concrete mix to improve the properties and life span of the concrete. In fibre reinforced concrete we are using both metallic and non-metallic fibers. Sisal fibre is one of the natural fibre it improve the properties of the concrete. Sisal is the natural fibre extracted from the agave sisalana plant. This plant grows in the tropical and subtropical regions of the world. It grows in hard soils where normal plants may not be grown. This plants grown in 20 to 28°C and the average rainfallis 600 to 1500mm.

II. MATERIAL AND METHODOLOGY

A. Cement

We are using 53 grade Ordinary Portland cement. Properties are given below

Specific gravity of cement = 3.16

Initial setting time = 40min

Final setting time = 480 min

B. Fine aggregate

We are using locally available natural sand and properties are given below

Specific gravity = 2.5

Water absorption = 2.5%

C. Coarse aggregate

Aggregate must be equal to or better than the hardened cement to withstand the designed loads and the effects of weathering. The properties of coarse aggregate have given below

Specific gravity = 2.9
 Water absorption = 1.5%

D. Water

Distilled Water available in laboratory.

E. Sisal fibre

Sisal fibre is the natural fibre extracted from the agave sisilana plant. These are add to the concrete mix based on length and weight

Average Diameter of sisal fibre = 0.3 mm

F. Methodology

For the present work, we have used the sisal fibre in two combinations,

- 1) The Aspect ratio is varied as 50, 75 and 100 as well as
- 2) The percentage of the sisal is varied in four combinations such as 0.5%, 1%, 1.5% and 2%.

For each combination the samples are casted in M30 mix and tested for its Compressive, Tensile and flexural strength of the concrete specimen. First of all we have to evaluate the quantity of fibre used for each combination. The weight of the sisal fiber is taken as by the weight of cement. Table 3.1 gives the quantity required in grams for each combination. Slump cone test on fresh concrete in plastic stage is also conducted in order to determine the workability of concrete.

Table 1- Lengths of Sisal Fiber

Aspect Ratio	Length of the sisal fiber in mm
50	15
75	22.5
100	30

Table 2-Quantity of Sisal fiber

% of sisal fiber	Weight of sisal fiber in grams		
	For cube	For cylinder	For prism
0.5	10	15.2	14.35
1	20	30.4	28.7
1.5	30	45.6	43.05
2	40	60	57.4

III. RESULTS AND DISCUSSIONS

A. Compressive Strength Test:-

Compressive 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 sisal fiber by the weight of cement.

Table 3-Compressive Strength of Sisal Fiber for 28 days

Aspect Ratio of sisal fibre	Compressive Strength of Sisal fiber for 28 days			
	0.5	1	1.5	2
0	36.4	36.4	36.4	36.4
50	39.2	39.8	40.6	37.4
75	38.4	38.76	39.2	36.03
100	35.32	36.4	37.4	34.58

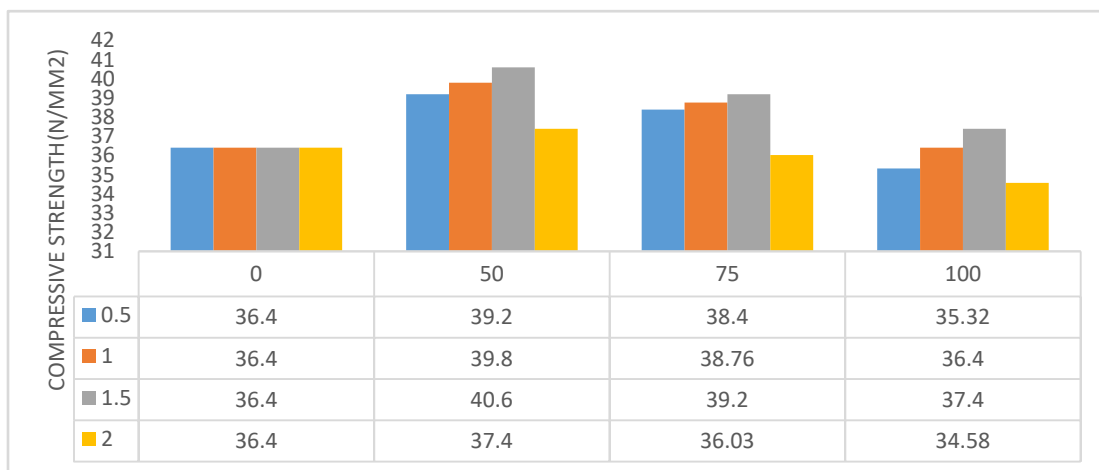


Figure 1:

Compressive Strength of Sisal fiber

From the above results the Compressive strength of the concrete at 50 Aspect Ratio of 1.5 % of sisal fiber weight by cement have shown a significant improvement further which gradually decreased from 75 Aspect ratio to 100 Aspect ratio.

B. Split Tensile Strength Test:-

Split tensile 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 sisal fiber by the weight of cement.

Table 4- Split Tensile Strength of Sisal Fiber for 28 days

Aspect Ratio of sisal fibre	Tensile Strength of Sisal fiber for 28 days			
	0.5	1	1.5	2
0	3.1	3.1	3.1	3.1
50	3.54	3.69	3.74	3.65
75	3.42	3.53	3.61	3.47
100	3.28	3.37	3.46	3.35

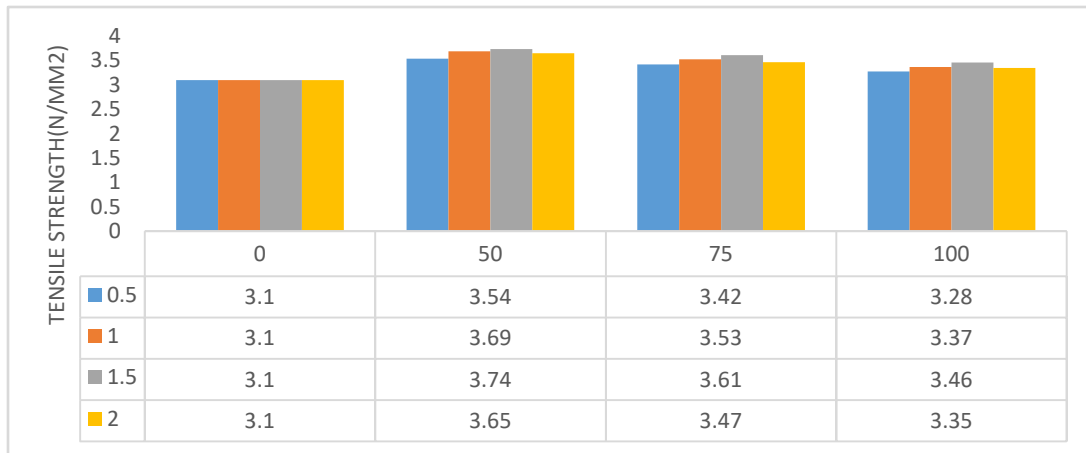


Figure 2: Tensile Strength of Sisal fiber

From the above results the Split Tensile strength of the concrete at 50 Aspect Ratio of 1.5 % of sisal fiber weight by cement have shown a significant improvement further which gradually decreased from 75 Aspect ratio to 100 Aspect ratio.

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 sisal fiber by the weight of cement.

Table 5- Flexural Strength of Sisal Fiber for 28 days

Aspect Ratio of sisal fibre	Flexural Strength of Sisal fiber for 28 days			
	0.5	1	1.5	2
0	5.64	5.64	5.64	5.64
50	5.78	5.82	6.04	5.82
75	5.76	5.76	5.81	5.65
100	4.68	5.01	5.62	5.31

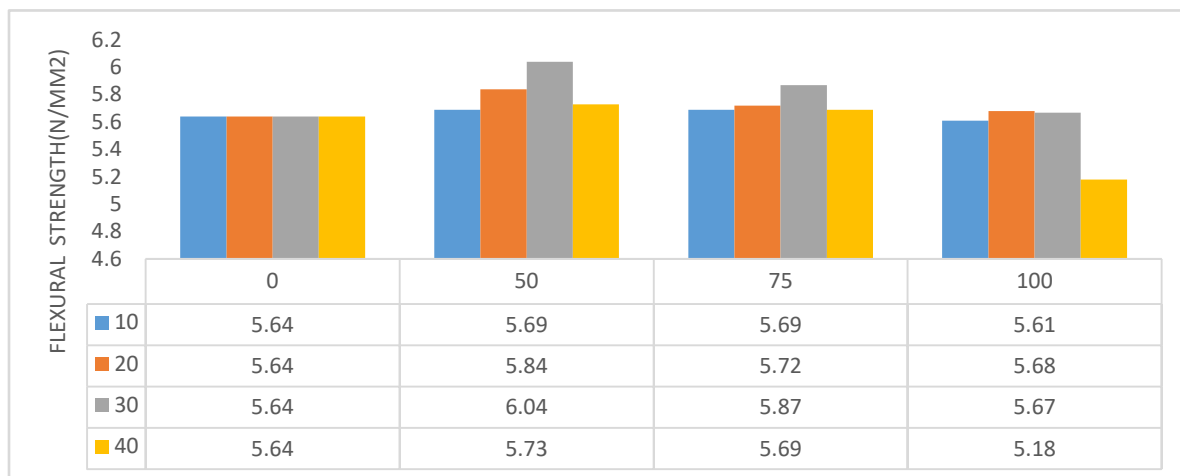


Figure 3: Flexural Strength of Sisal fiber

From the above results the Flexural strength of the concrete at 50 Aspect Ratio of 1.5 % of sisal fiber weight by cement have shown a significant improvement further which gradually decreased from 75 Aspect ratio to 100 Aspect ratio.

IV. CONCLUSION

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

- The strength of concrete increases at 1.5% of sisal fiber by the weight of cement is taken as constant and vary the aspect ratios
- The maximum compressive strength is observed at 1.5 % fibre with 50 Aspect ratio which is 11.5% more than the average compressive strength without Sisal fibre.
- The maximum tensile strength is at 1.5% fibre with 50 Aspect ratio which is 20.64% more than the concrete strength without Sisal fibre.
- The maximum flexural strength is at 1.5% fibre with 50 Aspect ratio which is 7.092% more than the concrete strength without Sisal fibre.

V.FUTURE SCOPE OF WORK

In this project we use only one fiber. For further increasing of mechanical strength and workability we use two or more fibers in the mix. Here we partially replaced the surkhi sand in the place of fine aggregates. By using of both ceramic powder and surkhi sand are fully replaced by fine aggregates and it is also increase workability.

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