Comparative Study of Conventional Concrete With Banana Fiber Modified Concrete

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Abstract- *In developing countries where concrete is widely used there is a steadily increasing the cost of concrete. His made construction is very expansive. This situation is due to less availability of ingredients of concrete.*

The large scale utilization of steel reinforcement in construction project is severally increased. We know that the fact that usage of steel as reinforcement increases the cost of the project.

Now days we are providing reinforcement through various other natural and synthetic fiber. The usage of natural fibers in the concrete as reinforcement is increasing day by day. Natural fibers such as Banana fiber, sisal fibers, coconut fibers, jute fibers etc., .Our project deals with the utilization of the natural banana fiber.

Banana fibers are the natural tree fiber. In our country we are producing 70 million of metric of banana every year. The availability of banana fibers are large in amount. By adding banana fiber the strength of the concrete is increased and also it is economical when compare to steel fiber reinforced concrete. In present project we are adding 0.2 of banana fibers in concrete and tests are conducted to determine the workability, compressive strength, and split tensile strength.

I. INTRODUCTION

In comparison to normal concrete, fiber reinforced concrete scores higher in toughness, and resistance to impact. Fiber reinforcing has added versatility into concrete so as to overcome its brittleness. Fiber is a small piece of reinforcing material possessing certain characteristics properties.

Addition of steel reduced the micro cracks but over a long period, steel gets corroded due to various actions. This made the need for enlightenment of usage of various organic and inorganic fibers which are ecofriendly and economic.

Natural fibers can be defined as bio-based fibers of vegetable and animal origin. This definition includes all natural cellulosic fibers such as banana, cotton, jute, sisal, coir, flax, hemp, ramie, etc., and protein based fibers such as wool and silk. Of these banana fiber is the most productive and abundantly available fiber.

This study advances the utility of banana fibers, thereby improving the mechanical properties of Concrete

Figure 1. Banana fiber

Table 1. Composition of banana fibers

S.no.	Constituents	Percentage
1	Cellulose	56%
2	Lignin	17%
3	Extractives	7%
4	Moisture	11%
5	Ashes	9%

II. EXPERIMENTAL DETAILS

In the present investigation the following materials were used

- Ordinary Portland Cement of 53 Grade cement conforming to IS:169-1989
- Fine aggregate conforming to IS: 2386-1963.
- Coarse aggregates
- Banana fibers
- Water.

1. CEMENT

The colour of OPC is grey colour and many types of cements are available in market. Ordinary Portland Cement of 53 Grade of brand name KPC, available in the local market was used for the investigation. The physical properties of the cement are listed in Table 1

Table 2. Properties of Cement

S.NO	Characteristics	Values obtained	Standard values
1	Normal consistency	33mm	33 to 35 mm
2	Initial setting time	130 min	Not be less than 30mins
3	Final setting time	270 min	Not be greater than 600min
4	Fineness Test	5%	Not more than 10%
5	Specific gravity	3.14	3.12 to 3.19

2. FINE AGGREGATE

Sand is an inorganic material. It consists of small angular or rounded or sharp grains of Silica. Sand is formed by decomposition of sand stone under the effect of weathering agencies. Various sizes or grades of sand are formed depending on the amount of wearing. The characteristics of sand are listed in Table 2.

Table 3. Characteristics of Sand

S.NO	CHARACTERISTICS	VALUE
1.	Specific gravity	2.65
2.	Water absorption	1.85%
3.	Fineness modulus	2.485

3. COARSE AGGREGATE

The aggregates are used in concrete for very specific purposes. The use of coarse aggregate in concrete provides significant economic benefits for the final cost of concrete. Aggregates typically make up about 60 to 75% of the volume of concrete mixture. The aggregates of size 20mm are used in this project.

Table 4 The Characteristics of Coarse aggregate

S.NO	CHARACTERISTICS	VALUE
1.	Specific gravity	2.67
2.	Water absorption	2%
3.	Impact value	28%

4. WATER

The water used for mixing and curing should be clean and free from injurious quantities of alkalis, acid, oils, salt, sugar, organic materials, vegetable growth and other substances that may be deleterious to bricks, stone, concrete or steel. Potable water is generally considered satisfactory for mixing. The pH value of water should be not less than 6.

5. MIX PROPORTIONS

In this project following are the mix proportions drawn for M 20 grade concrete by using ACI method

1 : 1.67 : 3.28 : 0.5

III. RESULTS AND DISCUSSION

1. RESULTS AND DISCUSSION WORKABILITY RESULTS

Table 5. Table Showing Compacting Factor Values

s.no	% of Banana fibers	Compacting factor
1.	0	0.86
2.	0.2	0.83
3.	0.4	0.81
4.	0.6	0.80
5.	0.8	0.78

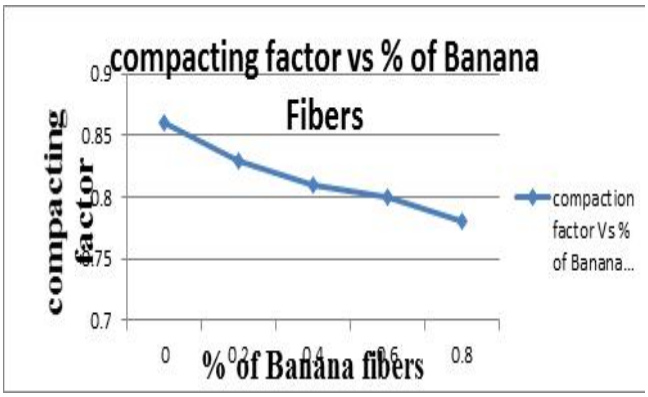

Figure 2. showing compacting factor vs % of Banana fibers

Discussion on Compacting Factor

The compacting factor for the concrete mix gradually increased with the increase in % of Banana fibers added to the concrete mix.

As the table and graphs shows the concrete mix prepared by adding banana fibers is having the more compacting factor. It means it is less workable. If there is a need of concrete which should have a less workability the mix with banana fibers can be adopted.

To increase the workability of the mix with the higher percentages of banana fibers we can use various types of plasticizers based on the type of work for which the mix is used.

Lesser compacting factor can be seen in the concretes with increase in the percentages of banana fibers in the concrete mix.

2. RESULTS AND DISCUSSION ON COMPRESSION TEST

The following are the results of compressive strengths of all concrete mixes prepared by adding banana fibers with various percentages.

Table 6. Compressive Strength for All Samples

SAMPLE NO.	% OF BANANA FIBER	28 days Compressive strength
Sample 1	0	39.22
Sample 2	0.2	42.77
Sample 3	0.4	47.66
Sample 4	0.6	44.73
Sample 5	0.8	41.84

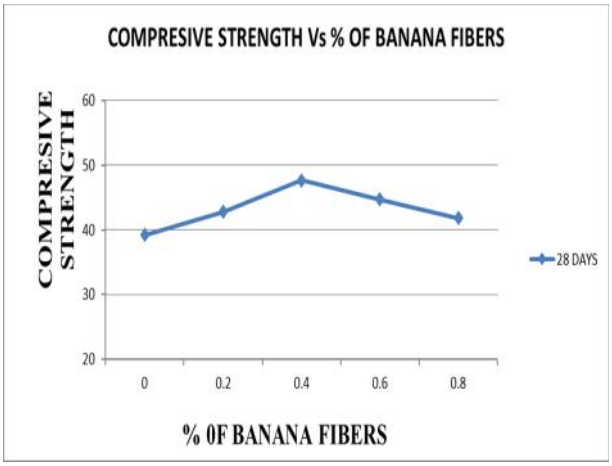

Figure 3. showing compressive strength at 28 days of curing vs % of Banana fibers

Discussion on Compression Value

The compressive strength for the concrete mix gradually increased with the increase in % of banana fiber added up to 0.4% of banana fiber and then decreased with increase in % of banana fiber.

As the table and graphs shows the concrete mix prepared by replacing the 0.4% of sand by the Banana fiber is having the more compressive strength. If there is a need of concrete with high compressive strengths in same grade of concrete the mix with 0.4% Banana fiber can be adopted.

But through graphs we cannot judge the exact % at which the compressive strength is highest. Through the graph it can be said that the high compressive strength mix can be get at the percentage between 0.3 and 0.5. But through our experiment we adopt that high compressive strength mix can be obtained by replacing 0.4% of fine aggregate by Banana fiber.

The decrease in the compressive strength is may be due to balling of fibers. If we avoid the balling of the fibers, the strength may increase.

High compressive strength can be seen in the concretes with 0.4% of Banana fiber addition.

3. RESULTS AND DISCUSSION ON SPILT TENSILE TEST

The following are the results of spilt tensile strengths of all concrete mixes prepared by adding banana fibers with various percentages.

Table 7. Spilt tensile Strength for All Samples

SAMPLE NO.	% OF BANANA FIBER	28 days Spilt tensile strength
Sample 1	0	4.12
Sample 2	0.2	4.44
Sample 3	0.4	4.58
Sample 4	0.6	4.73
Sample 5	0.8	4.89

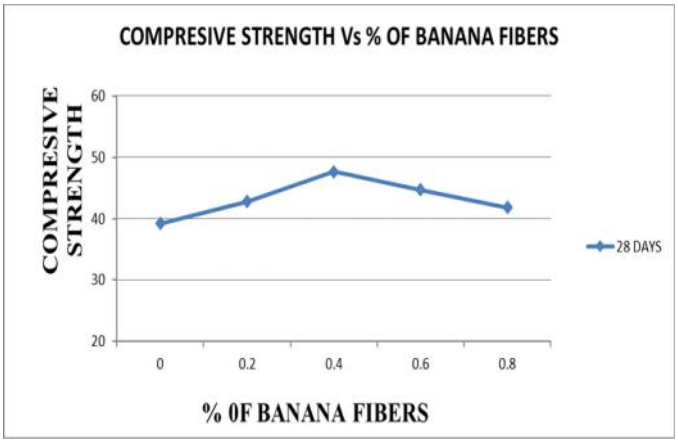

Figure 4. showing Tensile strength at 28 days of curing vs % of Banana fibers

Discussion on spilt tensile test

The Tensile strength for the concrete mix gradually increased with the increase in % of banana fiber added to the concrete mix.

As the table and graphs shows the concrete mix prepared by adding the Banana fiber is having the more Tensile strength. If there is a need of concrete with high tensile strengths in same grade of concrete the mix with any % of Banana fiber can be adopted.

But through graphs we cannot judge the exact % at which the Tensile strength is highest. Through the graph it can be said that the high Tensile strength mix can be attained with higher percentages of banana fiber.

High Tensile strength can be seen in the concretes with higher % of Banana fiber addition.

IV. OVERALL CONCLUSION

- Addition of Banana fiber to the conventional mix by 0.4% gives the maximum compressive strength.
- The concrete mix is less workable when Banana fibers are added to the mix as the slump values and compacting factor values are low when compared to conventional mix. The lower workability is supplemented by the use of super plasticizers.
- The mix with high % of banana fiber gives high tensile strength to the mix. Higher the % of banana fiber, Higher is the tensile strength.

REFERENCES

[1] Karnani R, Krishnan M and Narayan R, "Biofiber-reinforced polypropylene composites" polymer Engineering and science, 37(2), 1997.

[2] Joseph K, Mattoso L. H. C, Toledo R. D, Thomas S, Carvalho L.H. de, Pothen L, Kala S and James B, "Natural fiber reinforced thermoplastic Composites. In Natural Polymers and Agrofibers Composites", ed. E. Frollini, A.L. Leão and L.H.C. Mattoso, 159-201, 2000, Sãn Carlos, Brazil: Embrapa, USP-IQSC, UNESP.

[3] Van de Velde K and Kiekens P,Thermal degradation of flax : The determination of kinematic parameters with thermogravimetric analysis ,83 (12), Journal of Applied Polymer Science.

[4] Frederick T.W and Norman W, "Natural fibers plastics and composites", Kluwer Academic Publishers, New York .

[5] Mansur M.A and Aziz M.A, "Study of Bamboo-Mesh Reinforced Cement composites" Int. Cement Composites and Lightweight Concrete".

[6] Gowda T.M, Naidu A.C.B, and chhaya R, "Some mechanical Properties of untreated Banana Fabric-Reinforced Polyester Composites", Journal of Composites Part A: Applied Science and Manufacturing.