

EXPERIMENTAL INVESTIGATION ON CONCRETE USING FIBER AND COAL ASH

SARAVANAN.T , SELVAM.K , SRINIVASA PRASATH.M.N , VIGAYENDRAN.G

Abstract— The objective of this paper is to investigate and compare the compressive, flexural strength of natural fiber and admixture. Concrete is an extensively used construction material for its various advantages such as low cost, availability, fire resistance etc. But it cannot be used alone everywhere because of its low tensile strength. Today construction industries are facing problems of cracking and tensile strength problems. To circumvent this, fiber is most commonly used in construction industries. Fibers are generally used as resistance of cracking and strengthening of concrete. Normally various fibers are used in the concrete mix to enhance the tensile strength and resistance recently. In this study, the bamboo fiber with the addition of admixture are incorporated to concrete to enhance the tensile properties.

Key Words- natural fiber,tensile strength,bamboo fiber.

I. INTRODUCTION

Fibers are usually used in concrete to control cracking due to plastic shrinkage and to drying shrinkage. They also reduce the permeability of concrete and thus reduce bleeding of water. Some types of fibers produce greater impact-, abrasion-, and shatter-resistance and also increases the tensile strength in concrete. On other hand concrete admixtures (additives) enhances the properties of concrete for applications in construction with special requirements. Concrete additives are used to achieve desired workability in case of low water cement ratio, and to enhance setting time of concrete for long distance transportation of concrete.. Concrete is a composite material, comprising a matrix of admixture and a binder which holds the matrix

together. Many types of concrete are available, determined by the formulations of binders and the types of aggregate used to suit the application for the material. These variables determine strength, density, as well as chemical and thermal resistance of the finished product.

II. OBJECTIVE

1. Study the mix design aspects of the bamboo fiber with the addition of coal ash as admixture.
2. To carry out strength test (compression and split tensile) on concrete replaced with various proportions of bamboo fiber for various curing periods of 7, 14 and 28 days.
3. To evaluate the cost reduction and management of materials without compensating the strength properties of concrete.

III. EXPERIMENTAL PROGRAMME

Twenty onespecimens were casted and tested in laboratory. Bamboo fiber is replaced in concrete by various proportions such as 0%, 1%, 2%, 3% to the weight of concrete and the coal ash is added 10% to the weight of cement. The study has made for the 7, 14, 28 days compressive strength and tensile strength.

Test materials are given below:

A. Cement

Ordinary Portland cement (53 grade) whose, initial setting time is 45 minutes, final setting time is 200 minutes is used.

B. Fine aggregate

In this study zone II sand is used whose specific gravity is 2.45, fineness modulus is 2.6 is used.

Coarse aggregate of size 20mm is used which has specific gravity 2.8, fineness modulus 4.76 as per IS 383.

Saravanan.T , Department of Civil Engineering , New Prince Shri Bhavani college of Engineering & Technology , Gowrivakkam.

Selvam.K , Department of Civil Engineering , New Prince Shri Bhavani college of Engineering & Technology , Gowrivakkam.

Srinivasa Prasath.M.N , Department of Civil Engineering , New Prince Shri Bhavani college of Engineering & Technology , Gowrivakkam.

Vigayendran.G , Department of Civil Engineering , New Prince Shri Bhavani college of Engineering & Technology , Gowrivakkam.

C. Water

Portable water free from harmful oils, alkalis, sugar, organic impurities are used for proportioning and curing of concrete.

D. COAL ASH

Coal ash is also known as fuel-ash, is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases. Ash which does not rise is termed bottom ash.

E. BAMBOO FIBRE

Bamboo as a building material has high tensile strength and low weight has been one of the most used building material as support for concrete, especially in those locations where it is found in abundance. Normally various fibers are used in the concrete mix to enhance the tensile strength and resistance recently.

F. MIX DESIGN

Table 1 Mix Proportions Of Concrete

Samples	Bamboo fiber(%)	Coal ash(%)
S1(conventional)	0%	0%
S2	1%	10%
S3	2%	10%
S4	3%	10%

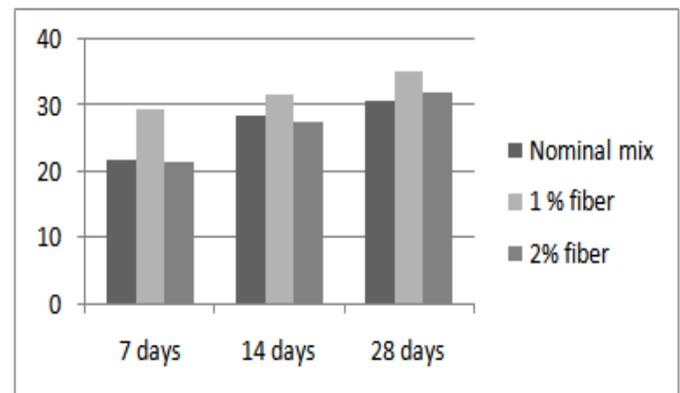
IV. RESULTS AND DISCUSSION

A. COMPRESSIVE STRENGTH

The test was carried out for compressive strength of M₂₀ grade of concrete. The compressive strength of high performance concrete with bamboo fiber and coal ash is given below:

Table 2 Compressive Strength Of Concrete

Samples	Compressive strength(N/mm ²)		
	7 days	14 days	28 days
S1	21.77	23.45	25.62
S2	20.34	21.56	25.34
S3	42.96	51.21	65.48
S4	41.32	48.41	62.58



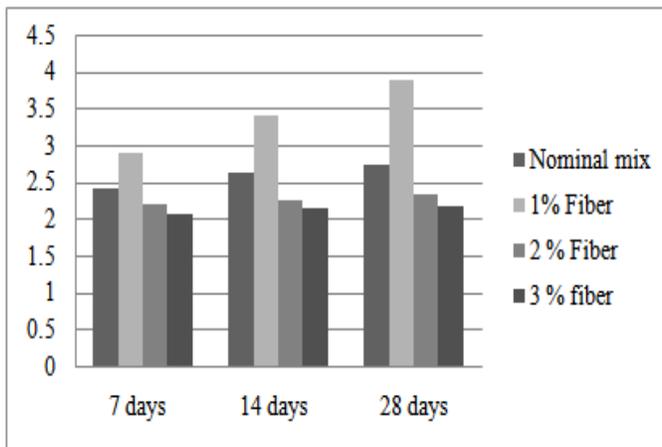
Graph 1 Compressive Strength Of Concrete

B. SPLIT TENSILE STRENGTH

The test was carried out according to IS 5816:1999 to obtain split tensile strength of M₂₀ concrete the test results were given in the table 3. The tensile strength of concrete is one of the basic and important properties which greatly affect the extent and size of cracking in structures. Moreover, the concrete is very weak in tension due to its brittle nature. Hence it is not expected to resist the direct tension. So, concrete develops cracks when tensile forces exceed its tensile strength.

Table 3 split tensile strength of concrete

Samples	Compressive strength(N/mm ²)		
	7 days	14 days	28 days
S1	2.40	2.62	2.73
S2	2.90	3.40	3.88
S3	2.19	2.26	2.32
S4	2.06	2.13	2.18



Graph 2 Split Tensile Strength Of Concrete

V. Conclusion

Based on the experimental study done on the behavior of concrete by addition of bamboo as fiber the following conclusion was drawn. The cube compressive strength increases by nearly 10% to 15% for 1% addition of bamboo fibers when compared to conventional concrete specimen. It is found to decrease by 7N/mm² to 9 N/mm² for addition of bamboo fibers when compared to conventional concrete specimen. It is found to decrease drastically by 12 N/mm² to 15 N/mm² for 3% addition of bamboo fibers when compared to conventional concrete specimen. The cylinder compressive split tensile strength increases by 15% for 1% of addition of bamboo fibers to concrete when compared. The remaining addition of fibers shows a decreased value when compared to conventional specimen.

Thus addition of 1% of bamboo fiber has shown a positive trend. It is evident that the addition of 1% bamboo fiber has increased the strength of the concrete. It is also an environmental friendly method since the availability of bamboo is in abundance and can be put to a greater use. Hence it has paved a path for an exclusive study of bamboo as fiber in the concrete technology.

References

[1] EkhlaashAbout Osman Al-Bahadly, The Mechanical Properties of Natural Fiber Composites, PhD Thesis Swinburne University of Technology(2013).
 [2] Masakazu Terai.and Koichi Minami,K ., Basic Study on Mechanical Properties Of Bamboo Fiber Reinforced Concrete,ResearchGate publication, 263496840 (2014).

[3] Gulshan Kumar, Review on Feasibility of Bamboo in Modern Construction. International Journal of Civil Engineering (SSRG-IJCE), 66-70.(April 2015).
 [4] NithiPlangsriskul, N. D.. Materials Characterization of Bamboo and Analysis of Bonding Strength and Internal Strength as a Structural Member in Reinforced Concrete. Senior Project, California Polytechnical State University.(2011).
 [5] AhsanaFathima..Behavioural Study of Steel Fiber And Polypropylene Fiber Reinforced Concrete. International Journal of Research inEngineering& Technology, Vol 2 Issue 10, 17-24.(2014).
 [6] T.C.Fergussons.. Viability of Bamboo Reinforced Concrete for Residential Housing in Indonesia,. Bachelor of Engineering Thesis, Charles Darwin University.(2015).
 [7] S.M. Dewi, The Use of Bamboo Fiber to Reduce Craks in Reinforced Concrete Beam (in Bahasa Indonesia), Research Report, BrawijayaUniversity.(2016).