"EXPERIMENTAL ANALYSIS ON STRENGTH CHARACTERISTICS OF FIBER MODIFIED CONCRETE"

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Abstract – In this study, the deformation and flexural properties of concrete elements reinforced with bamboo (Bambusa vulgaris), glass fiber and torsion reinforcement were relatively evaluated. Yield strength (YS), tear strength (UTS) and elongation were measured on nine samples of three materials using a universal tester. With a concrete strength of 25 N/mm2 at 7, 14 and 28 days, these beams are individually braced with equal amounts of bamboo, fiberglass and steel rods and the brackets are essentially aluminum bar, soft steel. Among the three material samples, reinforcement suitable for non-load bearing structure and lightweight reinforced concrete flexural structure are also found to be suitable in terms of bonding capacity and load carrying capacity.

Key Words: Deformation, concrete beam, reinforcement, Tensile strength, Fibre.

1. INTRODUCTION

Reinforced concrete (RC) structures account for the majority of constructions worldwide, and their performance is strongly influenced by the properties of the reinforcement. The transfer of stress from the concrete to the reinforcement is accomplished by effective bonding between the concrete and the reinforcement. Previous research on the chemical, physical and strength properties of rebar has shown the danger of maximizing profits at the expense of quality. It's a very difficult situation for the structure.

Reliability and durability of buildings and civil infrastructure should be high. Although extensive research has been conducted on synthetic and natural color reinforcing materials over the past few decades, natural reinforcement remains an active area of research.

2. RESEARCH OBJECTIVES

Following are the primary objective of the paper,

a) To determine the flexural properties of R.C.C beam using different composite materials as an replacement of main reinforcement in a beam.

b) To determine the variation in strength developed due to glass fiber, bamboo fiber as a main reinforcement in a beam.

c) To determine the cost effectiveness of these materials in an R.C.C. beam.

d) To justify the use of waste materials in construction industry.

3. MATERIAL USED

a) **CEMENT:-** Cement is a fastening material that hardens and hardens and can usually bond additional materials. For this task we will use conventional Portland concrete of class 43. Portland bond is the best known type of concrete for all applications worldwide. Other materials, such as claystone, are grounded to about 15000°C in a rotary kiln in a process called calcination. The following elements are called compound clinker when they are small spheres or pellets of various sizes. The clinker is cooled in a rotary cooler and ground in a crusher with 2-3% gypsum. The powder that follows is called Portland Concrete and is filled into a sealed package that repels moisture.

b) **COURSE AGGREGATE:-** Coarse aggregate is the main building material used to make concrete mixes. Coarse aggregate is made by crushing stones in a quarry. For this project, we used off-the-shelf 20 mm coarse aggregate, which is angular in shape and size. Coarse aggregate is well combined with other materials to achieve higher strength.

c) **SAND:-** Sand is a generic term for crushed stone grains. Sand is much finer than gravel, but larger than silt or clay. Sand is a key component of all building materials. Fine Aggregate or Sand: Aggregate passes through a No. 4 (4.75 mm) sieve and remains predominantly on a No. 200 (75 µm) sieve.

d) **GLASS FIBRE**:- This type of fiberglass is especially suitable for high-quality, lightweight caps. For these applications, stable glass fibers are preferred due to their superior quality and lower mass modulus. Fabrics woven from continuous yarns are 0.002 to 0.02 inches thick. In general, the orientation properties of the overlay depend on the type of weave used and the component settings.

e) BAMBOO FIBRE:- Bamboo fiber is a regenerated cellulose fiber made from bamboo. Flat crush is transmitted from bamboo stems and leaves through a system of soluble hydrolysis and multiple engineered smearing. Bamboo fiber conveys driving preparation techniques.

4. SAMPLE PRAPRATION

Samples are prepared in a testing laboratory where all ingredients are mixed in the proper proportions. After that, a beam is cast in the form of a sample with dimensions of 150 × 150 × 900 mm, taking into account the low-carbon steel fe250 clamp, and glass fiber, bamboo fiber, reinforcing bar and fiberglass-bamboo fiber composite are selected as the main reinforcement.

5. EXPERIMENTAL WORK

Following test are performed on the material selected for gradation

a) Aggregate Impact Test

b) Flakiness Index Test

c) Testing on universal testing machine

6. RESULT ANALYSIS

Test results after 7 days

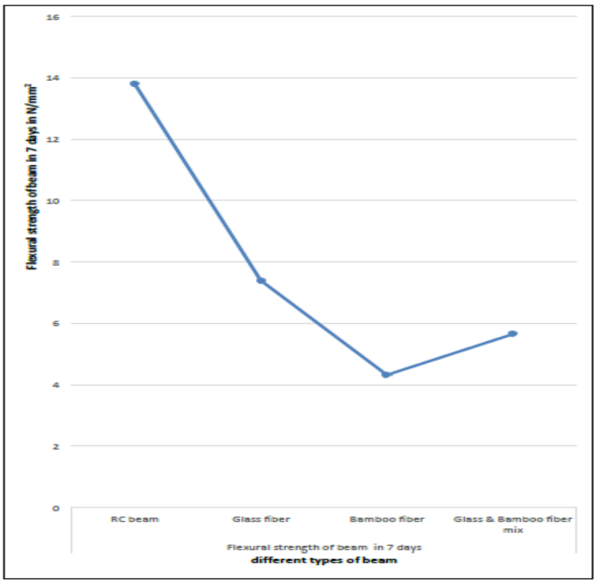
Table1: Failure load for Beam

Beam	First Crack load (KN) Fc	Ultimate Load failure (KN) Fu	Fc/Fu	Flexural Strength (N/mm2)
Reinforced Beam	19	33	0.57	12.1
Glass Fibre Beam	12	18	0.67	6.4
Bamboo fibre Beam	7	7.5	0.933	3.21
Glass and Bamboo fibre Beam	9.8	12	0.73	5.45

Table 2: Failure mode and crack characteristics

Beam No.	Mode of Failure	type of crack at failure	experimental min. crack width
Reinforced beam	Shear	Diagonal	9.1
glass fiber beam	Flexural	Vertical	6.4
bamboo fibre beam	Shear	Vertical	7.2
Glass & Bamboofiber mix	Shear	Diagonal	6.1

Figure 1: Flexural strength 7 days



Test results after 14 days

Table 3: Failure load for Beam

Beam	First Crack load KN Fc	Ultimate Load Failure KN Fu	Fc/Fu	Flexural Strength (N/mm2
Reinford Beam	20.5	33.8	0.606	12.6
Glass Fibre Beam	13.2	18.7	0.705	6.8
Bamboo Fibre Beam	7.6	8	0.95	3.89
Glass and Bamboo Fibre Beam	10.7	13.7	0.82	5.4

Table 4: Failure mode and crack characteristics

Beam No.	Mode of Failure	type of crack at failure	experimental min. crack width
Reinforced beam	Shear	Diagonal	8.7
glass fiber beam	Flexural	Vertical	6.3
bamboo fibre beam	Shear	Vertical	6.9
Glass & Bamboofiber mix	Shear	Diagonal	6.1

Figure 2: Flexural strength 14 days

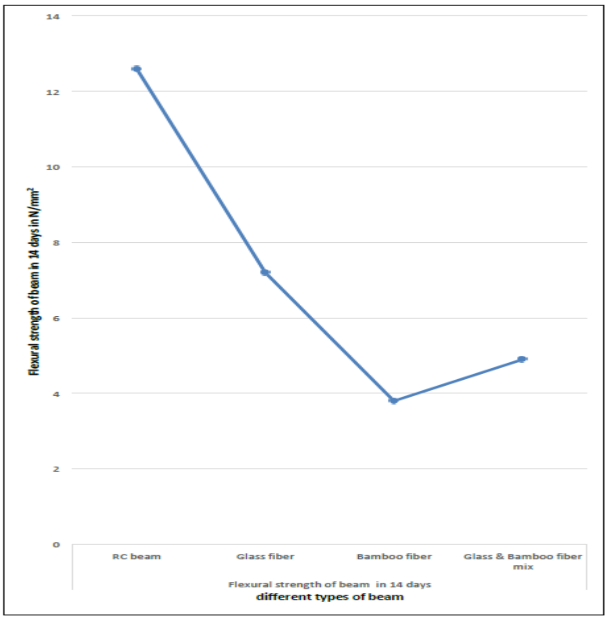


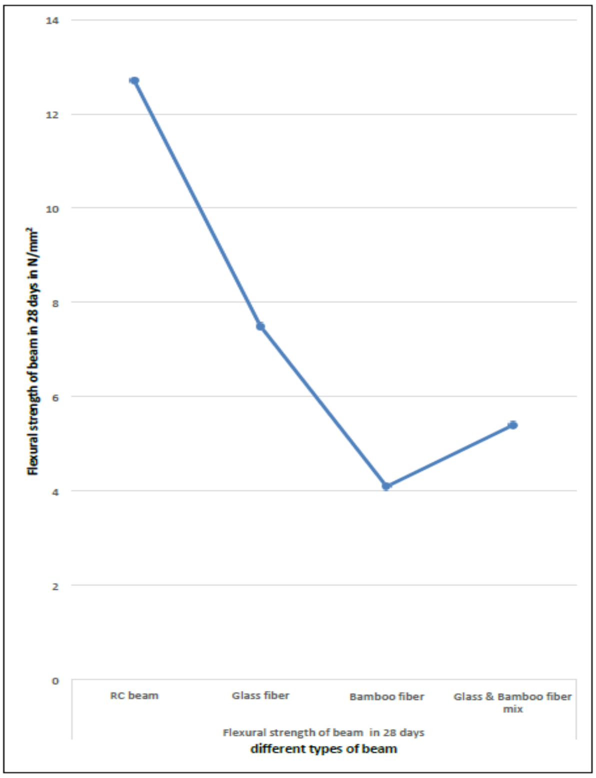
Table 5: Failure load for Beam

Beam	First Crack load KN Fc	Ultimate Load Failure KN Fu	Fc/Fu	Flexural Strength (N/mm2
Reinforced Beam	22.4	33.8	0.662	13.8
Glass Fibre Beam	14.3	18.7	0.764	7.4
Bamboo Fibre Beam	8.4	8	1.05	4.32
Glass and Bamboo Fibre Beam	11.5	14.65	0.86	5.65

Table 6: Failure mode and crack characteristics

Beam No.	Mode of Failure	type of crack at failure	experimental min. crack width
Reinforced beam	Shear	Diagonal	8.5
glass fiber beam	Flexural	Vertical	6.15
bamboo fibre beam	Shear	Vertical	6.8
Glass & Bamboofiber mix	Shear	Diagonal	6.35

Figure 3: Flexural strength 28 days



7. CONCLUSION

The following observation we did in laboratory and prepared a comparative study, and concluded that R.C.C. beam is comparatively more stable in load resisting but in comparison we can also prefer glass fiber or Glass fiber and bamboo fiber mix one as depends on load resisting requirements, following are the conclusions mentions below as per results find out in 7 day, 14 day and 28 days sample:

- The strength characteristics of the three stiffeners are normally distributed, and the stress ratio satisfies the minimum required value of 1.08. The strength of fiberglass and bamboo is 45% and 17%, respectively, of the strength of steel reinforcement.

- The bamboo elongation did not meet the 12% ductility requirement, the glass fiber slightly met the requirement, but the steel reinforcement fully met the requirement.
- Bamboo and fiberglass can only be used for lightweight reinforced concrete structures. The flexural stiffness of reinforced concrete beams made of bamboo and glass fiber was about 13.5% and 33%, respectively, compared to those of conventional steel bars.
- The primary cracking loads of bamboo and glass fiber RC beams were 31% and 55%, respectively, of the existing steel RC beams. The experimental ultimate breaking loads of reinforced concrete beams made of bamboo and glass fiber were 21% and 48% of those of existing reinforced concrete beams.
- The bamboo and steel reinforced concrete beams had a residual bearing capacity of 40% after the first crack, and the glass fiber reinforced concrete beams exhausted 75% of their bearing capacity after the first crack.
- The failure mode of bamboo and steel RC beams is a diagonal crack due to a short span pattern that allows a relatively high tensile strength and a relatively high tensile strength than glass fiber RC beams that are fractured due to bending (vertical cracking). It was the flyer that was displayed.

8. FUTURE SCOPE

- In this study bamboo and glass fiber is taken in future other recycling materials can be selected.
- In future we can consider finite element analysis of these beams using analysis tools.

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