



Analysis of Mechanical Properties of Timber and African Bamboo species

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Abstract

This study comparatively evaluated the mechanical properties of different bamboo species by using existing Adhesive which is available in market. The properties such as Tensile strength, compressive strength, shear stress and bending stress were tested on 40 Specimens of bamboo species with different adhesives. The test was carried out on Universal testing machine and bending machine. Ten specimens were prepared with the lap joint for testing. The different adhesives are reinforcing with the bamboo species for 20 days. It was observed that the mechanical properties of bamboo species are found to be better in the case of Asian Paints (Loctite touch) adhesive with some loading. The work is carried out on timber bamboo and African Bamboo. A natural material which is available in bulk and ease of use in the rural areas in the developing countries is bamboo. After some years steel reinforcement may no longer be available. Then we will have to find an alternative to steel. As bamboo being a natural material and is abundantly available in most of the part of earth it can be a replacement for steel in mechanical set ups of small sizes and less power.

Keywords: Mechanical properties, Specimen, Adhesive, and Tensile test, Compression test, Shearing test and Bending test, Reinforce, Interfacial bonding.

I. INTRODUCTION

Now a days the ore of metals are existing .The production of the Iron materials are reduced .To overcome this problem the bamboo set up are manufacture to sustain the mechanical applications. As bamboo have the features of growing fast with high yield, as well as high intensity, rigidity, thermal stability, and other strengths in physical performance. In this investigation is on developing appropriated bamboo adhesives as a bamboo joinery material. After some years steel reinforcement may no longer be available. Then we will have to find an alternative to steel, As bamboo being a

natural material and is abundantly available in most of the part of earth it can be a replacement for steel in reinforced concrete structure for green building and low cost housing purpose. Bamboo has new applications as an alternative to depleting wood resources and as an option to expensive construction and furnishing materials.

II. LITERATURE REVIEW

1. Utilization of bamboo as a low cost structural material.

Abdullah, A.A.A.(1983)

In: Proceedings of the Symposium on Appropriate Building Materials for Low Cost Housing, Nairobi, 7-14 Nov. 1983. (sponsored by CIB Rotterdam and RILEM, Paris) E & F N Spon, London and New York: 177-182.

The work being carried out at Universiti Pertanian Malaysia on the utilization of bamboo as a low cost material of construction is described. Mechanical properties as well as propagation techniques relating to some local species are presented.

2. An alternative to steel: Bamboo- A review. Authors:

Sandeep Bharadwaj, Rupali Sharma, Rajendra Kumar

Bamboo can be replacing steel in low and medium structures. It is environmental friendly, sustainable and low cost. Here discussed advances in bamboo material use in bridge components, as reinforcement in concrete known as bambcrete, as a replacement of structural steel in industrial structure.

3. Analysis of bamboo reinforced concrete column.

Authors: Ajinkya Kaware, U. R Awari, M. R. Wakchaure

African and timber bamboo are species of bamboo which has highest

value of tensile and compression strength.

4. Comparative analysis of tensile strength of bamboo and reinforcement steel bars as structural member in building construction.

Authors: Ogunbiyi Moses, S. Olawale, P. Simon, S. R. Akinole

Tensile strength tests were carried out on various steel and bamboo, the paper reviews that minimal breaking force of bamboo, it cannot be employed as a main structural member in building and other engineering works but can be used as portioning wall construction that is not heavy load bearing.

5. Development of layered laminate bamboo composite and their mechanical properties

Authors: C.S. Verma, V. M. Charia Mechanical properties of layered bamboo composites, laminates including tensile strength, compressive strength, flexural strength and screw holding capacity have been evaluated.

6. Strength of thermally treated glue laminates of bamboo bambusa vulgaris

Authors: Olajide O.B, Ogunsanwo O.Y, Aina K.S The strength of bamboo glue-lam is significantly affected by period of exposure to thermal treatment, also glueability of bambusa vulgaris laminates are affected by pressure.

7. Synthesis of low costs adhesives from pulp & paper industry waste.

Authors: R. K. Gothale, M. K. Mohan, P. Ghosh This study presents lignin extraction from commercial black liquor and utilizes it as a partial substitute in phenol formaldehyde resin synthesis.

8. Study on bonding strength of bamboo/bamboo unidirectional laminate with adhesives effect of pressing time on adhesives bonding strength.

Authors: Mansur Ahamd, Syaiful Osman Combination of commonly available bamboo and other more superior material is very promising as not only the demand for the use of lighter and stronger sandwich structure.

III. Comparison of steel and Bamboo mechanical properties

Table No 1. Comparison of Steel and Bamboo

Properties	Steel (KN/cm ²)	Bamboo (KN/cm ²)
Elastic Modulus	2100	2000
Tensile Strength	8-14	16
Compressive Strength	14	2-9
Bending Strength	14	6-27
Shear Strength	2-9	0-2

IV.OBJECTIVES OF THE STUDY

- To replace the steel by bamboo joints because the values of tensile, compressive, bending, shearing are very closer to mechanical properties of bamboo
- To do the comparative study mechanical properties of different bamboo
- To test the mechanical properties of bamboo using different adhesive
- To analysis of mechanical properties with the help of ANSYS software
- Formation of model to test the bonding strength of adhesives.

V.EXPERIMENTAL INVESTIGATION

Material

Mechanical Properties of the Bamboo species with different Adhesives determine using

Length 25 cm, Width 7cm , Radius of Bamboo 50 cm. Testing is carried out in Lap Joints 7 cm adhesive placed in between two samples. [1]

Preparation of the sample

Table No 2. Specimen preparation

Sr.No	Test	No.of Samples
1	Tensile Test	10x5=50
2	Compressive Test	10x5=50
3	Shear Test	10x5=50
4	Bending Test	10x5=50

Different types of adhesives were used for making lap joint.

The details of different Adhesives are used for the preparation of the samples. These adhesives are already exist in the market

- 1) Fevicol SR998
- 2) Asian Paints (Loctite touch)
- 3) Araldite
- 4) Dendrite Supreme
- 5) Fevicol Heat X (Heat Proof)



Figure 1. Sampling

Testing on Machines

Tensile Testing

A universal testing machine (UTM), also known as a universal tester, materials testing machine or materials test frame, is used to test the tensile strength and compressive strength of materials.



Figure 2. Tensile Strength Testing

Compression Testing

The ability of a material to resist a force that tends to push it apart. It is usually expressed as the measure of the largest force that can be applied in this way before the material breaks apart.

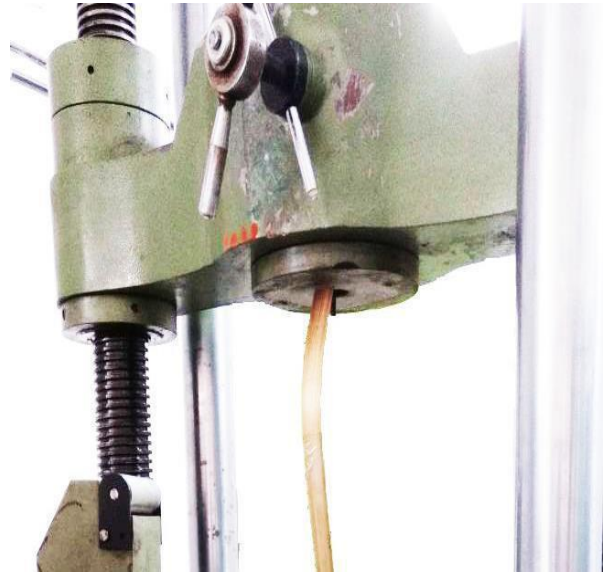


Figure 3. Compressive Strength Testing

Bending Testing

Bending strength is a measure of the tensile strength of concrete beams or slabs. Flexural strength identifies the amount of stress and force on unreinforced concrete slab, beam can withstand such that it resists any bending failures.

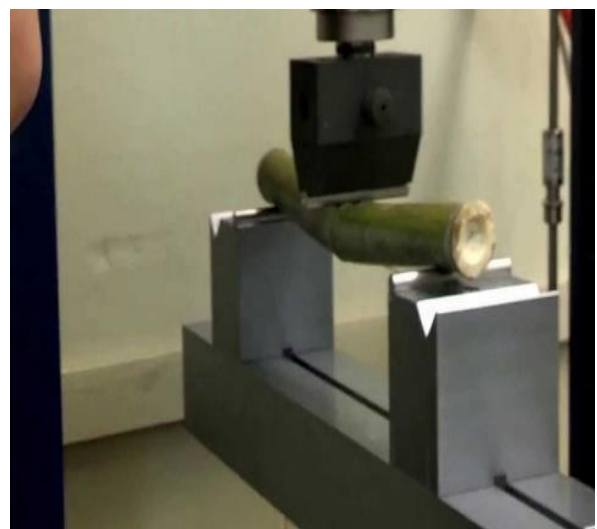


Figure 4. Bending Strength Testing

3. It is also observed that compressive strength is greater than the tensile strength
4. It also shows that the shear and bending strength is more in Asian Paints (Loctite Touch) adhesives.

Shearing Testing

Shear strength is the strength of a material or component against the type of yield or structural failure where the material or component fails in shear. A shear load is force that tends to produce a sliding failure on a material along a plane that is parallel to direction of the force.



Figure 5. Shearing Tensile Strength Testing

Experimental Calculations

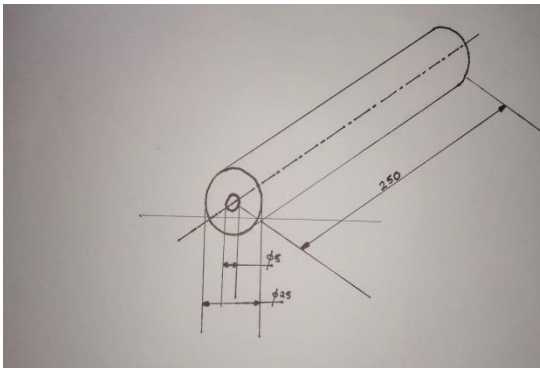


Figure 6. Diagrammatic representation of bamboo

Length (L) = 250mm

Do = 25mm

Di = 5mm

Conclusion

The experimental investigations on the effect of adhesive on mechanical behavior of bamboo species leads to the following conclusions:

1. The present study shows that the tensile strength of bamboo species are strong in Asian Paints (Loctite Touch) adhesives.
2. The current study reveals that the compressive strength of bamboo species are also strong in Araldite and Asian Paints (Loctite Touch) adhesives.

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