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Comparative Study of Mechanical Properties of Different Adhesives on Timber Bamboo

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Abstract – This study comparatively evaluated the mechanical properties of different adhesives on Bamboo species. Tensile strength, compressive strength, shear stress and bending stress of 40 Specimens of bamboo species with different adhesives were determined using a 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 25 days. It was observed that the mechanical propertied of bamboo species are found to be better in the case of Asian Paints (Loctite touch) adhesive with same loading. The work is carried out on timber bamboo. A natural material which is available in bulk and ease of use in the rural areas in the developing countries is bamboo. Bamboos occur mostly in tropical and subtropical areas, from sea level to snowcapped mountain peaks, with a few species reaching into temperate areas. 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 such as the base for the machine in small sizes etc.

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

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INTRODUCTION

With the decrease in wood resources, using wood efficiently and developing bamboo resources are becoming more and more important.[1] Dendrocalamus strictus, bambusa vulgaris schard are species of bamboo which have highest value of tensile and compression strength. 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 manufactured 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.[2] The present study is based on mechanical properties of bamboo species related to the different adhesives. The aim of this study is to find out suitable adhesives for bamboo joints.

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, a FE software
- Formation of model to test the bonding strength of adhesives

EXPERIMENTAL INVESTIGATION

Material

Mechanical Properties of the Bamboo species with different Adhesives determine using Length 20 cm, Width 7cm, Radius of Bamboo 50 cm. Testing is

carried out in Lap Joints7 cm adhesive placed in between two samples. [1]

PREPARATION OF THE SAMPLE

Table1 *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

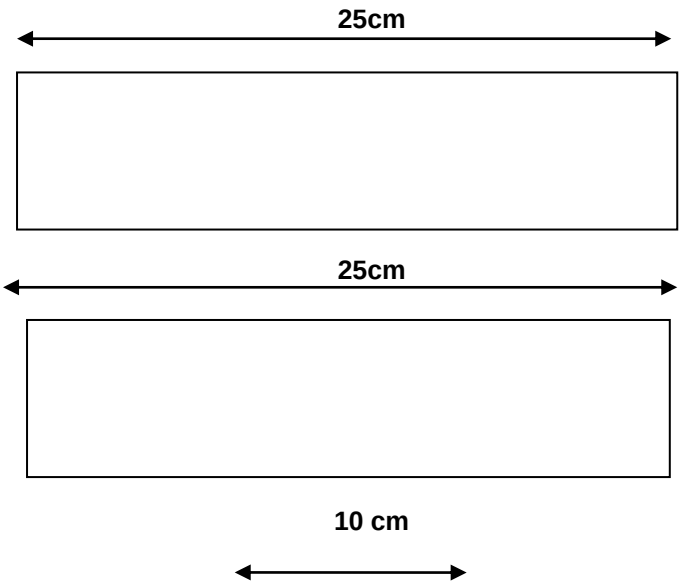


Fig. 1 Two specimen and lap joint

Table 2 *Summery of test*

Testing	Machine Used	Adhesive	No of Specimen Tested	Standard Used
Tensile	UTM	Adhesive 1-2-3-4-5	10x5=50	ASTM D638
Compressive	UTM	Adhesive 1-2-3-4-5	10x5=50	ASTM D639
Shear	UTM	Adhesive 1-2-3-4-5	10x5=50	ASTM D640
Bending	bending machine	Adhesive 1-2-3-4-5	10x5=50	ASTM D642

Test Program

Tensile, compression, shear and bending tests were carried out on lap joint made by various bamboo specimen.[4] Prior to each test, preloading and calibration were conducted. Loading rate was controlled according to the increasing speed of the force, and all electric digital data were collected using a data logger, controlled by a PC computer. Full range of test loading was recorded for each specimen.

Tensile and compressive tests are carried out on bamboo species respectively.

The experiments were performed on universal testing machine under axial loading. Tensile Test are carried out to test the strength of the adhesive on 10 specimens for each adhesive. The same load are applied to each specimen.

Fig. 2 Universal testing Machine

Similarly the Compression test on the 20 specimen is carried out with the same load on the same machine. It was observed that the compressive test Of each specimen of different adhesive is greater than the tensile test.

Shear test is also carried out on the same machine .the specimen are fixed in the upper and lower jaws and a shear load applies on the specimen and the test is carried out.

For carried out the bending Strength, Bending machine are used. A specimen is placed on the table in a horizontal direction a vertical load is applied on the lap joint of the specimen. The strength of the different adhesives specimens is tested and readings were recorded.

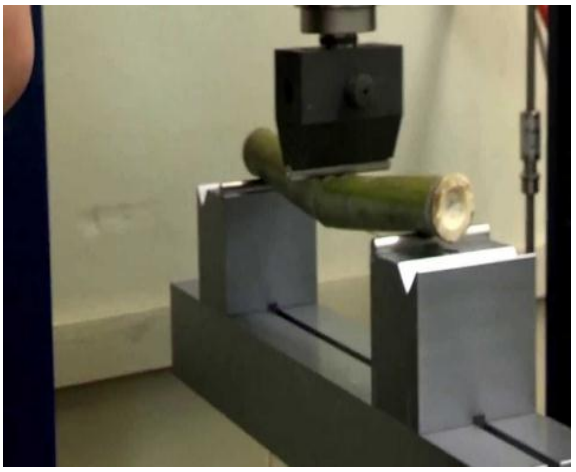


Fig.3 Bending Machine

OBSERVATIONS

The readings are taken on the timber on UTM Machine.

Tensile Test

Specimen	*Fevical SR 998*	*Dendrite Supreme*	*Fevical Heatx(Heat Proof)*	*Araldite*	*Asian Paints (Loctite touch)*
1	10.9	14.3	11.2	18.4	18.4
2	11.2	13.7	11.2	18.3	18.3
3	12	14.8	12.9	17.9	17.9
4	11	15.8	12.3	16.8	17.8
5	13.2	14.7	13.2	18.2	18.2
6	12.1	15.6	14.8	18.9	18.9
7	12.4	17.2	12.4	17.3	18.2
8	12.4	16.3	11.6	17.8	18.7
9	11.4	14	12.3	18.3	18.3
10	10	13.6	12.7	18.4	18.4

Compressive Test

Specimen	Fevical SR 998	Dendrite Supreme	Fevical Heatx(Heat Proof)	Araldite	Asian Paints (Loctite touch)
1	16.9	20.2	16.9	24.5	27.2
2	17.3	21	17.3	25.8	25.8
3	16.2	22.3	16.2	24.7	26.8
4	15	20.3	19.3	26.8	26.8
5	16.2	22.4	20.2	27.6	27.6
6	16.7	23.3	20.8	24.5	24.5
7	15.2	20.5	18.4	24.8	28.7
8	15.4	20.6	18.6	27.5	27.5
9	16.1	21.5	19.6	25.2	25.2
10	16.3	22.3	19.3	26.7	26.7

Shear Test

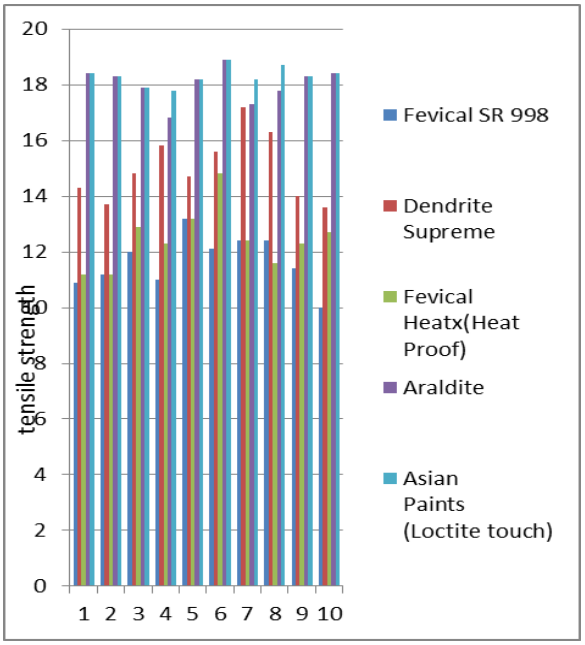
Specimen	Fevical SR 998	Dendrite Supreme	Fevical Heatx(Heat Proof)	Araldite	Asian Paints (Loctite touch)
1	7.9	9,2	8.2	12	15.7
2	8.5	9.4	8.5	15	16.2
3	8	10	8	14.8	15.6
4	7.7	10.1	8.9	15.8	15.8
5	8	9.8	8	13.7	14.3
6	8.4	8.5	8.4	15.8	15.8
7	8.9	8.3	8.9	14.7	15.9
8	7.9	9.2	9.7	16.9	16.9
9	6	8.3	9.2	17.5	17.5
10	6	8.1	9.4	15.6	16.7

Bending Test

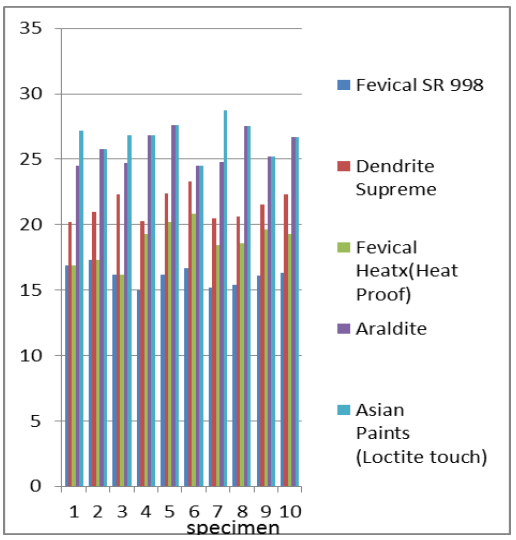
Specimen	Fevical SR 998	Dendrite Supreme	Fevical Heatx(Heat Proof)	Araldite	Asian Paints (Loctite touch)
1	12	10.4	13.5	14.9.	14.9.
2	11	13.5	12.3	15.6	15.6
3	12.3	13.8	12.3	14.9	14.9
4	12.5	14.5	12.5	13.8	13.8
5	11.6	14.2	13.7	16.9	16.9
6	11.7	15	12.6	16.8	16.8
7	12	15.2	12.8	17.2	17.2
8	10.6	13.4	13.2	15.9	15.9
9	10.5	12.5	13.1	17.7	17.7
10	12.6	15	12.5	18.2	18.2

RESULT

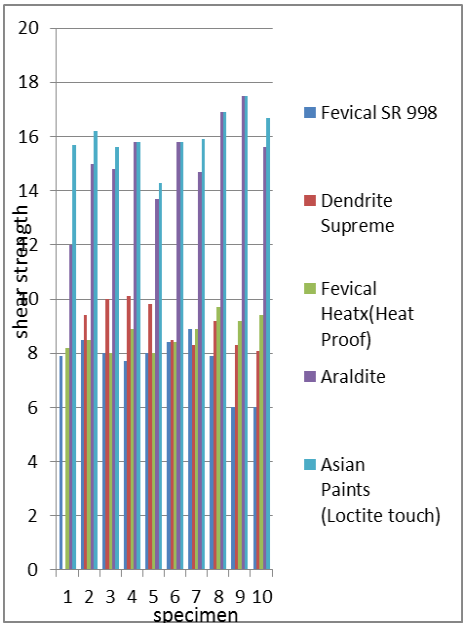
The followings were the reading of different adhesives on the different bamboo species. Table gives the comparison of different adhesive.



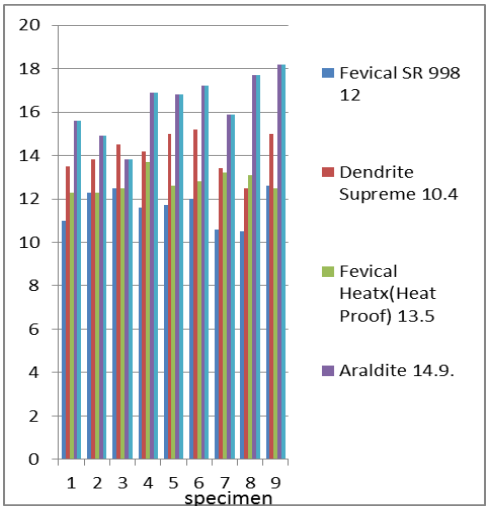
Tensile Test



Compressive Test



Shear Test



Bending Test

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.

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.

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