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Analysis of Mechanical Properties of Bamboo using Different Adhesives

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Abstract:
In Maharashtra it is commonly named as "Velu". Dendrocalamus strictus, bambusa vulgaris schard are species of bamboo which has highest value of tensile and compression strength. As bamboo has the feature of growing fast with high yield, as well as high intensity, rigidity, thermal stability, and other strengths in physical performance. Mode of failure were identified at macroscopic level as suggested in ASTM standard and their mechanism were examined at microscopic level using SEM analysis of fractured surfaces under different type of tests. Bamboo is a versatile resource possessing high strength-to-weight ratio and cost ratio and offers considerable ease in working with simpler tools.The application of bamboo as a constructional material is largely based on established traditions and intuitions of forefathers throughout the tropical and sub-tropical regions. A need is now felt for design and construction code for bamboo to cater to a number of social and trade advantages, engineering recognition and the improved status.

Keywords: Bamboo, Adhesives, Mechanical properties, Physical properties.

I.INTRODUCTION

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 reinforced concrete structure for green building and low cost housing purpose.

The major application of bamboo is for construction and housing. It is estimated that one billion people live in bamboo houses. Bamboos are tied together to make grid reinforcement and placed in soft clay to solve deformation problems in embankments. In rural part of India mostly bamboo is use as reinforcement in mud walls as it has quit high strength. Today, bamboo is employed in building construction not only because of strength but other properties which makes it favorable for construction works such as; resistant to pest, sturdiness, flexibility and availability .Bamboo has been used in constructing; walls, support structures, piers, roof, floor and room dividers amongst other things. Bamboo has strong mechanics and good adaptability, it is easy to be processed which causes it to be used for wide range of architectural and industrial purposes. The comparative tensile strength of bamboo is about that of wood but has a compressive strength 10% higher than wood. Although, the tensile strength of steel is 2.5-3.0 times higher than bamboo and the specific gravity 6-8 times that of bamboo; but by counting their tensile strength/unit weight (bamboo vs. steel), the tensile strength of bamboo is 3-4 times that of steel.

II.OBJECTIVES OF THE STUD

- 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 CAD software
- Formation of model to test the bonding strength of adhesives

III. WORKING PRINCIPLE

Test carried upon bamboo

Tensile
Compression
Shearing
Bending
These are the three tests carried upon bamboo in order to compare with steel

Tensile strength calculation

Maximum tensile strength
$\sigma_{ult}=F_{ult}/A$
Where,
F_{ult}= maximum load, in N
A=area of cross-section of test specimen, in mm^2.

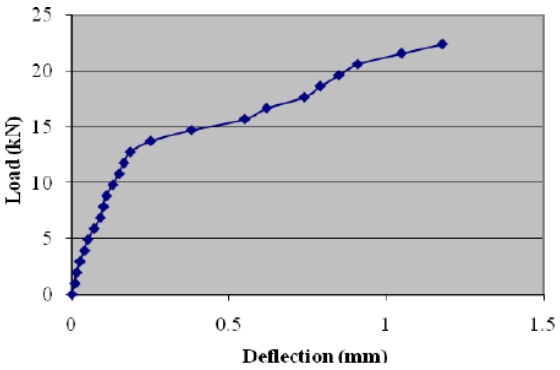

Figure.1. Deflection

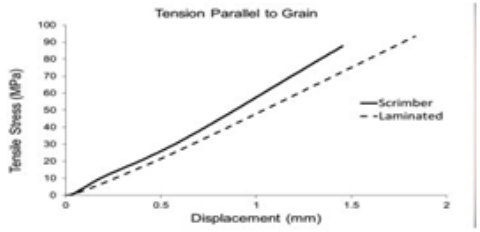

Figure.2. Displacement

Ultimate Shearing Strength

$\sigma_{ult} = F_{ult}/ (L*t)$
F_{ult} = maximum load, in N
t = mean of wall thickness at four points, in mm
L=mean of length of test specimen at four points where wall thickness is measured, in mm.

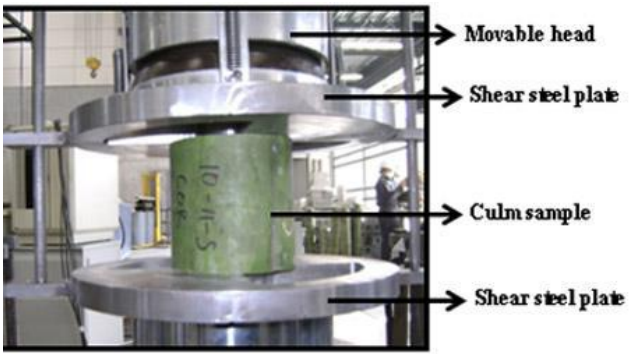

Figure.3. Ultimate Shearing Strength

Maximum Compressive strength

$\sigma_{ult} = F_{ult}/A$
F_{ult} =maximum load, in N
A=area of cross-section of test specimen
$A= \pi/4[D_2-(D-2t)_2]$
D= outer diameter, in mm
t = wall thickness, in mm

Figure.4. Maximum compressive strength

Bending Strength

σ_{ult} =[(1/6*I)(FL(D/2))]
I = moment of inertia, in mm4;
$I=\pi/64[D_4-(D-2t)_4]$
F = maximum load, in N;
L = effective span, in mm; and
D = outer diameter, in mm.

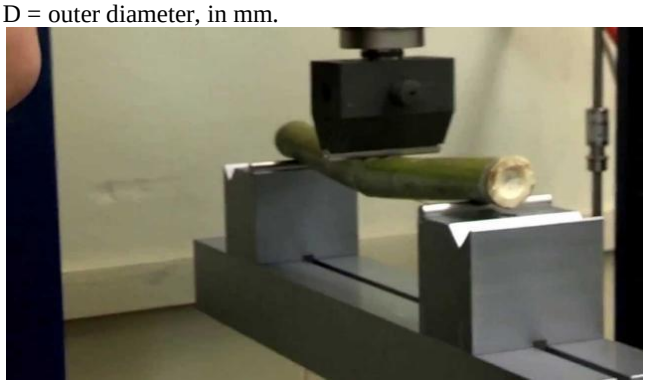

Figure.5. Bending Strength

IV. DISCUSSION

Table.1. Compressive Strength of Bamboo Along the selection

Compressive strength of bamboo along the section	Bottom	493	529
	Middle	536	607
	Top	627	692

	Section	2 years(kg cm^{-2})	4 years(kg cm^{-2})
Mean		552	609

V. CONCLUSION

Bamboo seems to be best choice of construction material of future. It is expected that application role of bamboo will be helpful for creation of environment beginning aesthetically appealing structures and products 7.The productivity can be increased by using this machine as the pedal operation is fast and operator fatigue and stress is less than conventional machine.

VI. REFERENCES

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