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RESEARCH PAPER

Preservation of bamboos using pressurized bamboo treatment unit

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ABSTRACT

Bamboo is a woody, valuable, strong and exceptionally fast growing grass. Bamboos are mostly used for structural purposes in rural and tribal housing. But the presence of large amount of starch makes bamboo highly susceptible to attack by staining fungi and powder-post beetles. It deteriorates in a couple of years, putting heavy pressure on the resource, owing to increased demands for frequent replacements. This adversely affects the supplies of bamboo, even in bamboo rich regions. Preservation can extend the life of bamboo and can maintain its quality and hence, make it suitable for the use as construction material. Different preservation methods are used for this purpose. In present study, pressure treatment was developed for treating bamboo by using copper chrome boron, cashew nut shell liquid and cow urine. By using developed treatment unit bamboos can be treated within 2 hours. Tensile strength for Mes above soil was found to be 30.16 N/mm², 29.40 N/mm² and 26.94 N/mm² for CCA, CCB and untreated, respectively and compressive strength was found to be 13.06 N/mm², 12.58 N/mm² and 10.38 N/mm² for CCA, CCB and untreated, respectively after 90 days of environmental exposure. The tensile and compressive strength of chemically treated bamboos was found to be better than untreated bamboos.

KEY WORDS : Bamboo efficiency, Perservation of bamboos, Pressurized bamboo treatment unit, Strength of bamboo

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INTRODUCTION

Bamboo is one of nature most valuable gifts to mankind. Its remarkable growth rate and versatile properties have made it one of the most tough after materials. Bamboo is used for housing construction, mats, ladders, floating fenders, furniture, handicraft articles, baskets, etc. Its versatile nature and innumerable uses have earned bamboo the name 'green gold of the forest'. Since bamboo is less expensive than construction materials like steel, cement and even wood, it is considered to be 'poor man's timber'. A major drawback with bamboo is that it is not durable against wood degrading organisms. Bamboos are under natural conditions gradually decay if they are used as structural components they need to be replaced after a period of time. Preservation of bamboo extends their life, reduces costs in the long run and improves safety of the structures they are used to form (Bali, 2003). Low life of bamboo and its susceptibility to various attacking agents is the main cause for its fewer accepts as construction material but preservation can extends the life of bamboo and can maintain its quality and hence, make it suitable for the use as construction material.

EXPERIMENTAL PROCEDURE

Two varieties of bamboo *viz.*, *Dendrocalamus stocksii* (Mes) and *Dendrocalamus strictus* (Manvel) were

Table A : Specification of developed bamboo treatment unit

Sr. No.	Particulars	Specifications
1.	M.S. tank with stand	60 lt
2.	Thickness of tank sheet	1 mm
3.	Paddle pump with pressure gauge	0-14 kg/cm^2
4.	Control valve assembly	12.5 mm Φ
5.	Bamboo holder with rubber casing and clamps assembly	100 mm Φ
6.	Fluid inlet	12.5 mm Φ
7.	Air inlet	12.5 mm Φ
8.	Fluid outlet	25 mm Φ

used for the study. Bamboos were treated by using copper chrome boron and copper chrome arsenic. Mechanical properties of bamboos were determined by using Universal Testing Machine.

Specifications of bamboo treatment unit :

The manually operated bamboo treatment unit was useful to treat whole bamboos of different diameters. It is compact and portable device. It could be assembled and dissembled easily. The safe bearing pressure of joints of M.S. tank was upto 140 N/mm^2. The specifications of the unit are shown below in Table A.

EXPERIMENTAL FINDINGS AND ANALYSIS

The findings of the present study as well as relevant discussion have been presented in Table 1 and Fig. 1 to 8 :

Mechanical properties :

Treated and untreated bamboo strips after exposure to environmental conditions during rainy season were used for testing their mechanical properties on universal testing machine. They were tested for tensile and compressive strength. The two different chemicals *viz.*, copper chrome arsenic and copper chrome boron were used to treat two bamboo varieties Mess and Manvel.

Tensile strength during storage :

The dumbbell shaped bamboo sample having length 220 mm, width 30 mm and thickness 6 mm were used to determine tensile strength by using universal testing machine. The speed of machine was 10 mm/min. The results showed that tensile strength goes on decreasing during the storage period. The untreated bamboo had less tensile strength as compare to treated bamboo (Chen *et al.*, 1985).

Compressive strength :

The rectangular shaped bamboo sample having length 100 mm and thickness 10 mm used to determine compression

Table 1 : Strength of bamboo under test

Sr. No.	Type	Days	Tensile strength (N/mm^2)						Compressive strength (N/mm^2)					
			Mess			Manvel			Mess			Manvel		
			CCA	CCB	Untreated	CCA	CCB	Untreated	CCA	CCB	Untreated	CCA	CCB	Untreated
1.	Above soil	0	33.41	33.28	33.07	28.11	27.92	25.64	15.32	15.08	15.07	11.22	11.15	11.11
		30	32.40	31.7	30.29	27.15	26.41	24.51	15.12	14.57	13.29	10.20	9.54	9.12
		60	30.55	29.59	27.70	25.75	24.16	22.08	14.29	13.83	12.70	8.8	8.34	7.51
		90	28.51	27.8	25.26	24.16	23.08	20.32	13.06	12.58	10.38	7.65	7.02	6.31
2.	Below soil	0	33.41	33.28	33.07	28.11	27.92	25.64	15.32	15.08	15.07	11.22	11.15	11.11
		30	33.18	32.51	31.55	25.64	24.12	21.42	13.82	12.92	12.15	9.09	8.80	7.68
		60	31.74	30.99	29.21	23.12	22.19	18.24	12.12	11.14	9.99	7.25	6.80	5.78
		90	30.16	29.40	26.94	21.17	20.12	16.53	10.95	10.68	7.44	5.41	4.84	3.92

by using universal testing machine. The speed of machine was 10 mm/min. The results showed that compressive strength goes on decreasing during the storage period (Mathew and Nair, 1998 and Rao, 2001). The untreated bamboo has less compressive strength as compare to treated bamboo.

The Table 1 reveals the strength of bamboo under test.

Conclusion :

- Bamboo can be treated within 2 hrs using developed bamboo treatment plant.
- After 90 days of environmental exposure tensile strength for manvel under soil and above soil was found to be 21.17 N/mm², 20.12 N/mm², 16.53 N/mm² and 24.16 N/mm², 23.08 N/mm² and 20.32 N/mm² for CCA,

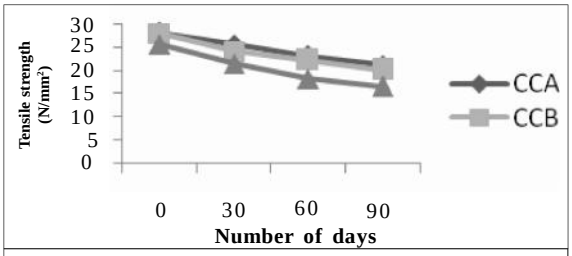

Fig. 1 : Tensile strength (N/mm²) for Manvel under soil

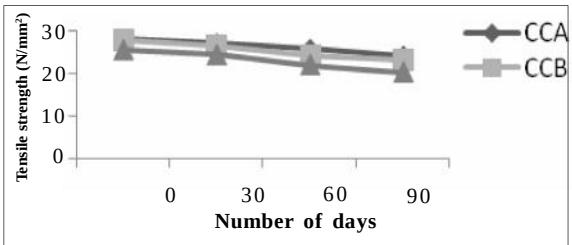

Fig. 2 : Tensile strength (N/mm²) for Manvel above soil

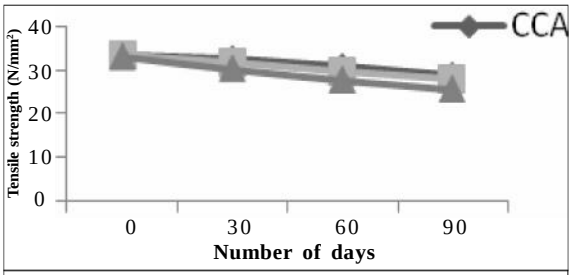

Fig. 3 : Tensile strength (N/mm²) for Mes under soil

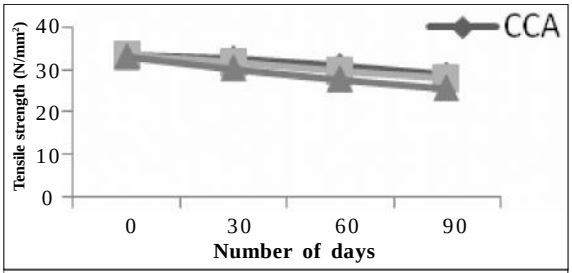

Fig. 4 : Tensile strength (N/mm²) for Mes above soil

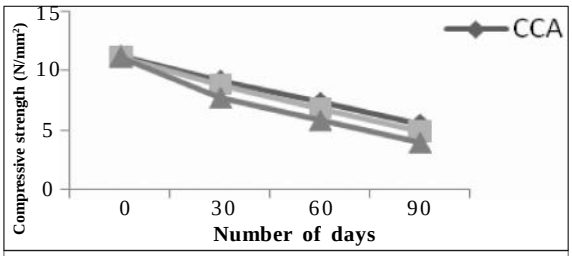

Fig. 5 : Compressive strength (N/mm²) for Manvel under soil

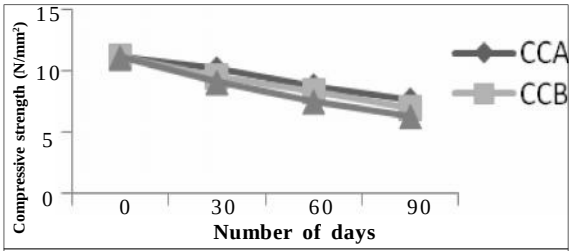

Fig. 6 : Compressive strength (N/mm²) for Manvel above soil

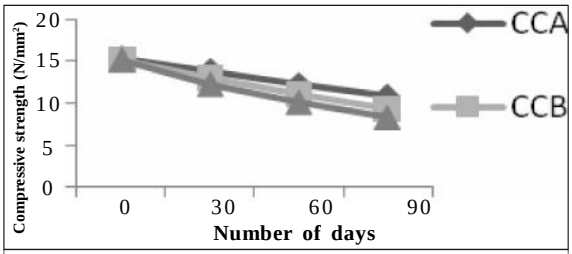

Fig. 7 : Compressive strength (N/mm²) for Mes under soil

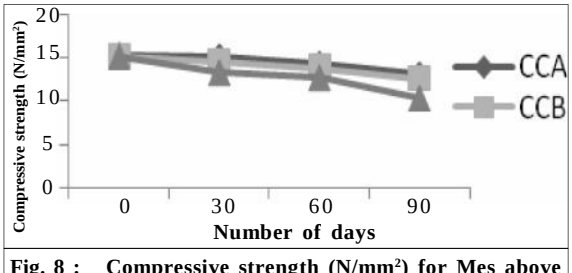

Fig. 8 : Compressive strength (N/mm²) for Mes above soil

CCB and untreated, respectively.

- Tensile strength for mes under soil and above soil was found to be 28.51 N/mm², 27.84 N/mm² and 23.46 N/mm² and 30.16 N/mm², 29.40 N/mm² and 26.94 N/mm² for CCA, CCB and untreated, respectively after 90 days of environmental exposure.
- After 90 days of environmental exposure compressive strength for manvel under soil and above soil was found to be 5.41 N/mm², 4.84 N/mm² and 3.92 N/mm² and 0.65 N/mm², 7.02 N/mm² and 6.31 N/mm² for CCA, CCB and untreated, respectively.
- Compressive strength for Mes under soil and above soil was found to be 10.73 N/mm², 9.24 N/mm² and 7.44 N/mm² and 13.06 N/mm², 12.58 N/mm² and 10.38 N/mm²for CCA, CCB and untreated, respectively after 90 days of environmental exposure.

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