

## Finishing Properties of Polyurethane and Acid Catalyst Coating on Bamboo Strip Board

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### ABSTRACT

*Finishing process is the last of a sequence of manufacturing actions. The application of finishes is to protect the surface and also enhance the aesthetic value of bamboo strips board. Finishing also helps to enhance the attractiveness of the surface texture, dimensional stability and durability. In this study, bamboo strips board was used as a panel commercial. It used to substitute the shortage of the other plywood but no information about the finishing on bamboo strips board. This study carried out the suitability of three types of finishing material such as polyurethane and acid catalyst lacquer. From this study, polyurethane lacquer shows good a resistance against gloss and hardness but slightly poor for the impact, crosscut and household. Acid catalyst lacquer shows a good performance on the impact, crosscut and household but slightly poor for hardness and gloss. It is very suitable to make kitchen cabinet and dining table.*

**Keywords:** *Finishing, lacquer, polyurethane, acid catalyst and nitrocellulose*

### Introduction

Bamboo strip board (BSB) is produced from woven mats of bamboo that are soaked in adhesive resin and then pressed together in a hot press. It is the first of the wide range of different panel boards presently available that use bamboo as a raw material. Bamboo strip board is the simplest to produce, involve only bamboo raw materials and have a great potential income (FAO, 1997)

Bamboo strip board (BSB) is as panel of high strength, stiffness and rigidity. They are also known as bamboo mat board and bamboo plywood (Zoolagud, 2011). Bamboo strip board is very durable, attractive and also highly resistant to fungus and insect attack.

Wood finish is the final surface treatment to protect bamboo and enhance its appearance. Finishes may also protect against abrasion or indentation and prevent changes in color due to light or atmospheric pollutants. However the most important function is to impede the exchange of moisture with the atmosphere, thus helping to avoid the consequences of dimensional change (Hoadley, 2000).

In order to obtain a perfect finishing, a proper finishing systems need to be applied, which will include the application of finishing material. Acid catalyst (AC) is added to the film-forming components just prior to use. Acid is used as a catalyst or initiator to start the polymerization process. Co-polymerization with an alkyd resin can be done to confer a more durable lacquer (Thomas, 1985). Polyurethane (PU) consists of an isocyanate component and other component with two or more hydroxyl group. Thomas (1985) states that, these lacquers show good adhesion, toughness, flexibility, resistant to scratching, heat and solvents.

### Methodology

Bamboo (*Bambusa heterostachya*) was split to get bamboo strips. All the strips were sliced into thin slivers manually. Slivers were woven into mats. Mats were soaked in Phenol Formaldehyde (PF) for 5 minutes. After dipping, the mats were filtered for about 30 minutes to allow excess PF to drain away. Mats were pressed together under high temperature about 145°C and pressure 16kg/cm<sup>2</sup> for 6 minutes for 3 mats. Boards were

trimmed to get required size. All the bamboo strip boards were put in a conditioning room (25°C) for 7 days. Then, they were sanded using sand paper grit number 120, 180, 240 and 320. Spraying technique was applied in the finishing process. The formulation of Acid Catalyst (AC) and Polyurethane (PU) were set. The mixing ratio for AC clear lacquer was set to 100% lacquer/sealer, 10% hardener and 40% thinner whereas AC sealers clear also set to 100% lacquer/sealer, 10% hardener and 40% thinner. The mixing ratio for PU was set to 100% lacquer/sealer, 100% hardener and 100% thinner. Meanwhile PU sealer clear was set to 100% lacquer/sealer 50% hardener and 50% thinner. After all bamboo strip boards were coated with AC and PU, and they were tested on adhesion (cross cut) test, impact test, gloss test, abrasion test, household test and pencil hardness test. India Standard IS: 3944 for board making standard, BS 3962: part 1: 1980 and ASTM D3363-05 for bamboo strip specification were applied. While for the finishing tests standard, ISO 2409: 2007 for adhesion test, BS 3962: Part 6: 1980 for impact test, BS 3962: Part 1:1990 for gloss test, D 4060-07 for abrasion test, ASTM D 1308-79 for household test and ASTM D 3363-05 for pencil hardness test were applied.

## Results and Discussion

Table 1: Summary for Impact test, Hardness test, Cross cut test and Abrasion test.

Source	Mean Square			
	Impact test (Rating)	Hardness test (Rating)	Cross cut test (Rating)	Abrasion test (%)
Coating	1.800*	7.200**	24.200**	18.818 <sup>n.s</sup>

Not significant ( n.s ) ( $P > 0.05$ )

\*\* Highly significant ( $P < 0.01$ )

\*Significant ( $P < 0.05$ )

### Impact test

Table 2: Mean value of AC and PU for impact test

Source (Coating)	Mean (Rating)
AC	4.4
PU	3.8

Table 1 shows there are a significant difference between AC and PU on impact test about 1.800. The property revealed that AC and PU resulted different rating on impact test. From table 2, the impact test (mean) on AC is higher than PU about 4.4 and 3.8 respectively. The bamboo strip boards coated with AC give better performance. It means that AC is more durable compare to PU. According to previous study, AV has high performance in impact test resistance long life flexibility (Anon, 2011).

### Hardness test

Table 3: Mean value of AC and PU for hardness test.

Source (Coating)	Mean (Percentage flaked)
AC	15.00
PU	13.80

The property revealed that the two different of coating resulted the different rating on hardness test. From Table 3, it revealed that, different coating type has highly significant about 7.200 that affected on hardness test. The mean percentage flaked for PU is lower means 13.80 than AC means 15.00. AC is the best lacquer and more durable when applied on bamboo strips board. According to Thomas (1985), he stated that, Acid Catalyst lacquers show good adhesion, toughness, flexibility, resistance to scratching, heat and solvents.

## Cross-cut test

Table 4: Mean value of AC and PU for cross-cut test

Source (Coating)	Mean (Rating)
AC	1.6
PU	3.8

Table 4 shows there is a high significance between AC and PU while testing on cross-cut about. It indicates that the different coating type affects the mean value of the adhesion test (crosscut test). It means that, Acid Catalyst is more suitable to be used for bamboo strips board. It is also more durable than PU. Previous study shows, Polyurethane coating is more abrasion resistance with long life flexibility, impact resistance, stain resistance, scratch resistance properties. Polyurethane is suitable in protective and decorative application (Anon, 2011).

## Abrasion test

Table 5: Mean value of AC and PU for abrasion test

Source (Coating)	Mean (Weight loss in %)
AC	1.7
PU	1.0

Based on table 1, it shows that there is no significant difference between AC and PU with mean 18.818. The coated bamboo mat boards were determined on their percentage of weight loss. From Table 5 Acid Catalyst has high performance in abrasion test compare to Polyurethane because the weight loss for Acid Catalyst is higher than Polyurethane (PU) after 300 cycles operations. Previous study shows, Polyurethane coating is more abrasion resistance with long life flexibility compared to AC (Anon, 2011).

## Household test

Table 6: The results of Resistance to Household Test (Liquid)

No of sample	Oil	Ketchup	Sauce	Salt	Detergent
Coating (AC)					
1	-	-	-	-	Changes in gloss
2	-	-	-	-	Changes in gloss
3	-	-	-	-	Changes in gloss
Coating (PU)					
1	Changes in gloss	-	-	-	Changes in gloss
2	Changes in gloss	-	-	-	Changes in gloss
3	Changes in gloss	-	-	-	Changes in gloss

Based on table 6, AC and PU lacquer are did not affect the coating surface when applied ketchup, sauce and salt. However AC changed in gloss when dropped detergent and the Polyurethane changed when drop oil and

detergent. In this test, AC lacquer showed a high quality coating. It is very suitable for making kitchen cabinet and dining table. Polyurethane are good resistant to Acids, Alkalis, Salt spray, solvents, lubricants and weathering properties like saline and marine atmosphere. Polyurethane is used in making furniture such as bar tops, and kitchen tops. They are very resistant to all types of chemical, reagents, water and alcohol that are applied into them. (Thomas, 1985).

## Conclusion

Based on the result from this study, it can be concluded that Polyurethane (PU) lacquer is a good resistance against hardness but slightly poor for impact, crosscut and household. AC lacquer is a good performance on impact, crosscut and household but slightly poor for hardness.

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