

Characterization of Finishing with Acid Catalyst Lacquer and Nitrocellulose Lacquer on sesenduk (*Endospermum diadenum*) Wood

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Abstract

*The wood finishing process is the last treatment on artwork or a piece of wood to protect surface and to enhance the aesthetic value of the timber. In this study, sesenduk (*Endospermum diadenum*) was used to substitute the shortage of the commercial timber and as alternative material supply for furniture industry. The objective of this study was determined the performance of application acid catalyst lacquer (AC) and nitrocellulose lacquer (NC) as the finishing material for sesenduk wood. Other than that, to investigate the performance of finishing system using acid-catalyst lacquer (AC) and nitrocellulose lacquer (NC) as the finishing material for sesenduk wood. Cross cut test, pull off test, impact test, abrasion test and resistance to household test were carried out accordance to ISO 2409;2007, ISO 4624;2002 and ASTM D4060-07 respectively. Based on the observation, the result show the AC and NC were easily to apply and give the good performance on sesenduk of wood surface. The performance of two by two systems (2 sealer + 2 lacquer) gave a good quality finishing on the product and are the best system as compare to one by one system (1 sealer + 1 lacquer). Beside that, both of that lacquer, AC and NC easy to apply with spraying technique. Generally the application of AC and NC were suitable to use as finishing material for sesenduk wood.*

Key words: sesenduk, acid catalyst lacquer, nitrocellulose lacquer, finishing characteristic.

INTRODUCTION

Finishing for furniture was practiced since hundred years ago. Wood finishing also refers to the process of embellishing and or protecting the surface of furniture. Finishing process can gives layer transparent, semi-transparent and not transparent for customer to choice and also can protect the surface of wood from decay, chemical and physical defect and attack by insect or fungi. The main purpose of finishing furniture is to develop the beauty and natural of the wood surface. The finishing also can exposure their beautiful of furniture through emergence decorative and original ray of wood that suitable to cover wood defect like color not uniform and pore of wood. Finishing can give attractive and high value on the furniture. The mechanical properties are influence with the final finishing process where it includes flexibility, durability, cohesion, adhesion, strength, resistance to fungi and fire and color retention.

Lacquer is range of finishing material giving a resilient and smoothness of finish (Hatchard, 1995). Lacquer were resistant to water, heat, alcohol, acid and alkali. Beside that, lacquer is easily to produce because of it is based on synthetic material

use is manufacture process. Normally, lacquer usually will apply in thin layer because thick layer will cause cracking problem. Two types the lacquer were use in this study; that are AC and NC lacquers. The AC lacquer as know as a two-pack lacquer (Joyce, 1987). A two-packed alkyd-melamine based acid curing lacquer finish for wooden substrate. Therefore it was excellent chemical resistance to water, alcohol, food and beverage and household chemicals including wet and dry heat resistance and also resistance to abrasion. Other while, NC lacquers a material which has many uses both inside and outside the home. One of the main reasons NC lacquer became so popular because is very quick drying and cheaper. When used NC lacquer, it easy to apply, easy to repair, and blends well with the natural grain and coloring of different woods. It also as a good clarity, no problem with recoats ability and adhesion. This type of lacquer has moderate water resistance, but it's sensitive to heat and certain solvents and flammable properties. Some nitrocellulose finishes have poor adhesion to sealer and it is recommended that they are only applied to stained wood. This finishing was applied with two systems which were 1x1 system where apply with one sealer and one lacquer and 2x2 system for apply two sealer and two lacquer on the sample of wood. This study is to characterize of finishing with AC and NC based on sesenduk (*Endospermum daidenum*). Beside that, this study also determined the effect of the system which influences the surface finishing performance based on that wood species.

MATERIALS AND METHODS

The panel used in this study is *sesenduk* rough sawn-timber or planks. The sawn timber was obtained from University Technology MARA forest reserved. Two types of lacquer were selected including acid catalyst (AC) lacquer and nitrocellulose (NC) lacquer. The number of samples have been prepared was 50 pieces. The wood surface was sanded with sandpaper grit number of 100,180 and 240 of sandpaper grit. AC lacquer and NC lacquer were applied with spraying technique in this finishing process. The sample size for the impact test and adhesion test (Cross cut test and Pull off test) was 300mm × 100mm × 12mm and the sample size for abrasions test the sample size was 100mm × 100mm × 5mm. the sample size for resistance to household liquid, chemical and solvent the sample size was 300mm × 100mm × 5mm. According to each standard where impact test follow BS 3962: Part 6:1980, adhesion test (Cross cut test) follow the ISO 2409:2007, adhesion test (Pull off test) follow the ISO 4624:2002,abrasion test follow the ASTN D 4060-07:2007 and ASTM D 1308-79:1979 for the resistance household test. The equipments been used were meter adhesion tester for adhesion test, Elco meter for (pull off test) and Taber Type Abrasion Tester for abrasion test.

RESULTS AND DISCUSSIONS

Table 1 shows the result between coating and system with impact test, adhesion test (cross cut test and pull off test) and abrasion test. Generally, the resistance

household test is proved to protect the surface coating on sesenduk wood since no damage observed. The resistance household test is measured using acetic acid (3%), ethyl alcohol (50% volume), cold and hot distilled water, cooking oil, ketchup, source and tea.

Table 1: AC and NC Properties on Sesenduk Wood

Coating	System	Impact test (Rating)	Adhesion test (Cross cut test) (Rating)	Adhesion Test (Pull off test)(%)		Abrasion test (weight loss in gram)
				Wood	Coating	
AC	1x1	2.5	1	3.5	96.5	0.011
	2x2	2.1	2	1.2	98.8	0.013
NC	1x1	3	1	10.4	89.6	0.014
	2x2	2	2	0.7	99.3	0.021

Note 1x1: 1sealer x1 lacquer, 2x2: 2 sealer x 2 lacquer, AC: Acid catalyst, NC: Nitrocellulose

Table 2 shows the ANOVA for the impact test, cross cut and pulls off test for adhesion test and the abrasion test. From that table, the interactions of coating with adhesion test (pull off test) is not significant but for the other test; impact test, adhesion test (cross cut test) and abrasion test significant different were observed. On the other hand, the interactions between system with impact test and adhesion test (cross cut test) are highly significant but for the adhesion test (pull off test) and abrasion test are not significant. Besides that, interactions between coating and system are not significant with abrasion test and both of adhesion tests cross cut test and pull off test but are highly significant with the impact test.

Table 2: Summary of the ANOVA for impact test, adhesion test (crosscut test and pull-off test) and abrasion test

Source of Variance	DF	Mean square			
		Impact Test (Rating)	Adhesion Test (Cross Cut Test) (Rating)	Adhesion Test (Pull off test) (% of wood flakes)	Abrasion test (weight loss in gram)
Coating	1	4.235*	6.211*	0.392 n.s	7.291*
System	1	51.882**	36.634**	0.00 n.s	4.152n.s
Coating & System	1	9.529**	1.141 n.s	2.65 n.s	1.089n.s

a,b Mean with the same letters in each row are not significant different at $P \leq 0.05$

* Significant ($P \leq 0.05$), ** Highly significant ($P \leq 0.01$), n.s Not significant ($P \leq 0.05$)

Referring to Figure 1, the adhesion test (cross-cut test) of AC and NC lacquer apply with 1x1 system shows good cross-cut performance. It based on first rating, that mean the small flakes of cross cut area not greater than 5% is affected. Meanwhile, for the AC and NC lacquer apply with 2x2 system show poor performance because the coating has flaked along the edges with greater than 5% but not greater than 15% is affected of cross-cut area. The higher of rating of cross cut test means that the more coating flaked were affected. The result for adhesion test (pull off test)

indicated that the 1x1 finishing system for NC was the high percentage of wood flakes. It means the 1x1 system for NC lacquer was poor in performance as compare to 1x1 finishing system for AC. A 1x1 system easily failed in the adhesion of wood flaked. The good finishing performance was been shown by NC lacquer which applied 2x2 system.

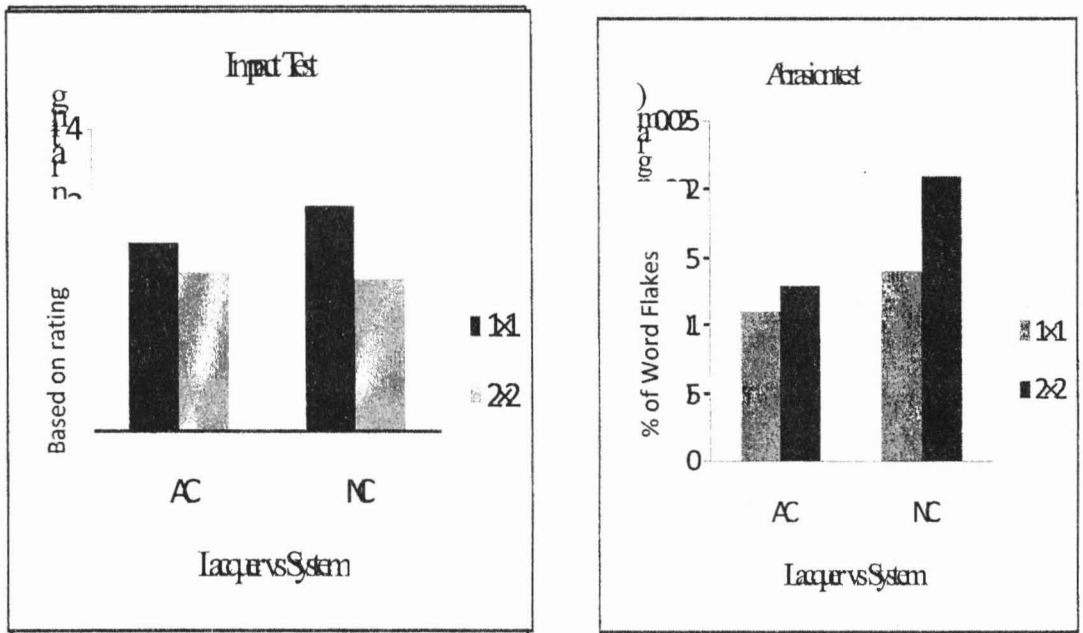


Figure 1: Adhesion test (Cross cut test and pull off test) at the difference types of lacquer and system

Figure 2 indicates the performance of 2x2 finishing system which is two sealers and two lacquers when applied on sesenduk wood surfaces have gave the lowest rating on both AC and NC lacquers. A 2x2 system shows poor performance compared with 1x1 system. It could be due to the high surface tension occurs during coated the samples. Therefore more cracking has been observed on the wood surfaces. Figure 3 shows the abrasion test at different type of lacquers and finishing system. The highest weight loss of the abrasion test was in NC lacquer applied with 2x2 system. In this situation, the NC lacquer was easily to loss and give poor abrasion properties to the sesenduk wood. The comparison between both AC and NC lacquers show that the AC lacquer has a good finishing performance compared to NC lacquer. The results revealed that the AC lacquer apply with 1x1 system has lower weight loss compared to with AC lacquer apply with 2x2 system.

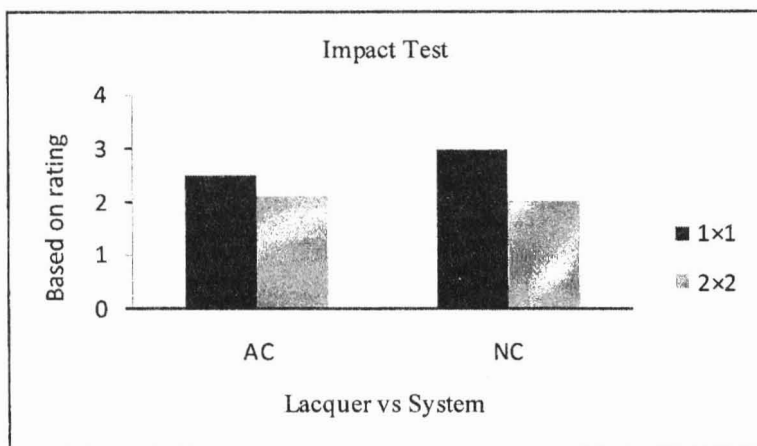


Figure 2: Impact test at difference types of lacquer and system

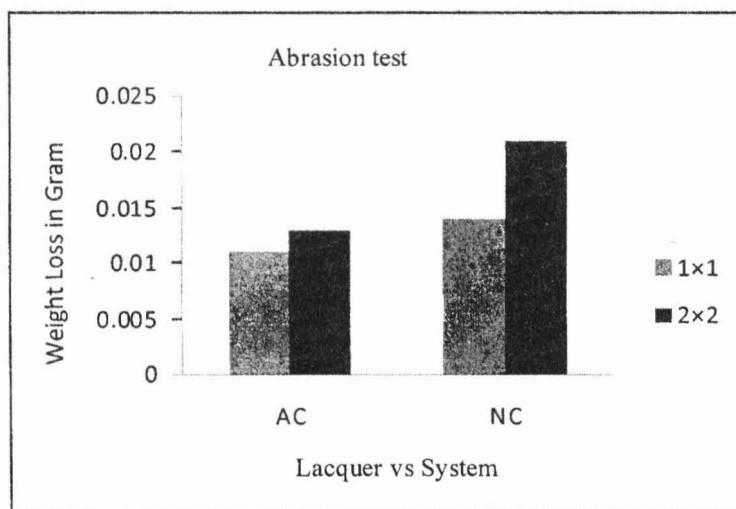


Figure 3: Abrasion test at difference types of lacquer and system

CONCLUSIONS

Application of good coating type and suitable system would promote to the great finishing performance. This study revealed that AC lacquer gave the good resistance for the impact test, adhesion test (pull off test) and abrasion test but slightly poor for the adhesion test (cross cut test). While the NC lacquer determined has a good finishing performance for impact test. The adhesion test (cross cut test) is showed the good performance for the both types of lacquer, AC and NC lacquers. In this study two finishing systems were 1x1 system (1 sealer + 1 lacquer) and 2x2 system (2 sealer+2 lacquers) have been applied. The finishing system of 2x2 applied suitable adhesion in pulls off test performance for sesenduk wood. Besides that, the

1x1 finishing system indicated that the slightly resistance to test impact test, abrasion test and adhesion test (cross cut test). As a conclusion the comparisons of finishing properties at different coating types and finishing systems gave significantly effect to the subjects.

References

- Anon. (1980) BS 3962: Part 6: *Standard Methods of Test for Finished to wooden Furniture. Assessment of Resistant to Mechanical Damage.*
- American Society of Testing Materials (ASTM). (1916). Standard test methods for formulated product and applied coating. Annual Book of ASTM Standards Des. D 1308-79. Race St. Philadelphia.PA.
- American Society of Testing Materials (ASTM). (2007). Standard test methods for abrasion resistance of organic coating by the taber abraser. Annual Book of ASTM Standards Des. D 4060-07. United States. PA.
- Bob Flexner. 1999. Understanding wood finishing (How to select and apply the right finish), The Reader's Digest Association, Inc. Pleasantville, New York/Montreal.
- Den Hatchard. 1995. *Wood Finishing-Step by Step Techniques.* TheCrowood Press.
- International Standard. 2007. Paint and varnish- cross cut test. ISO 2409:2007(E). Third edition. Switzerland.
- Ernest Joyce, (1987), *Encyclopedia of Furniture Making*, Sterling Publishing.
- Soevianegara, R.H.M.J.Lemmen. 1994. *Timber tree; Major Commercial Timber.* Bogor Indonesia.
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