KONAKA
KONFERENSI AKADEMIK

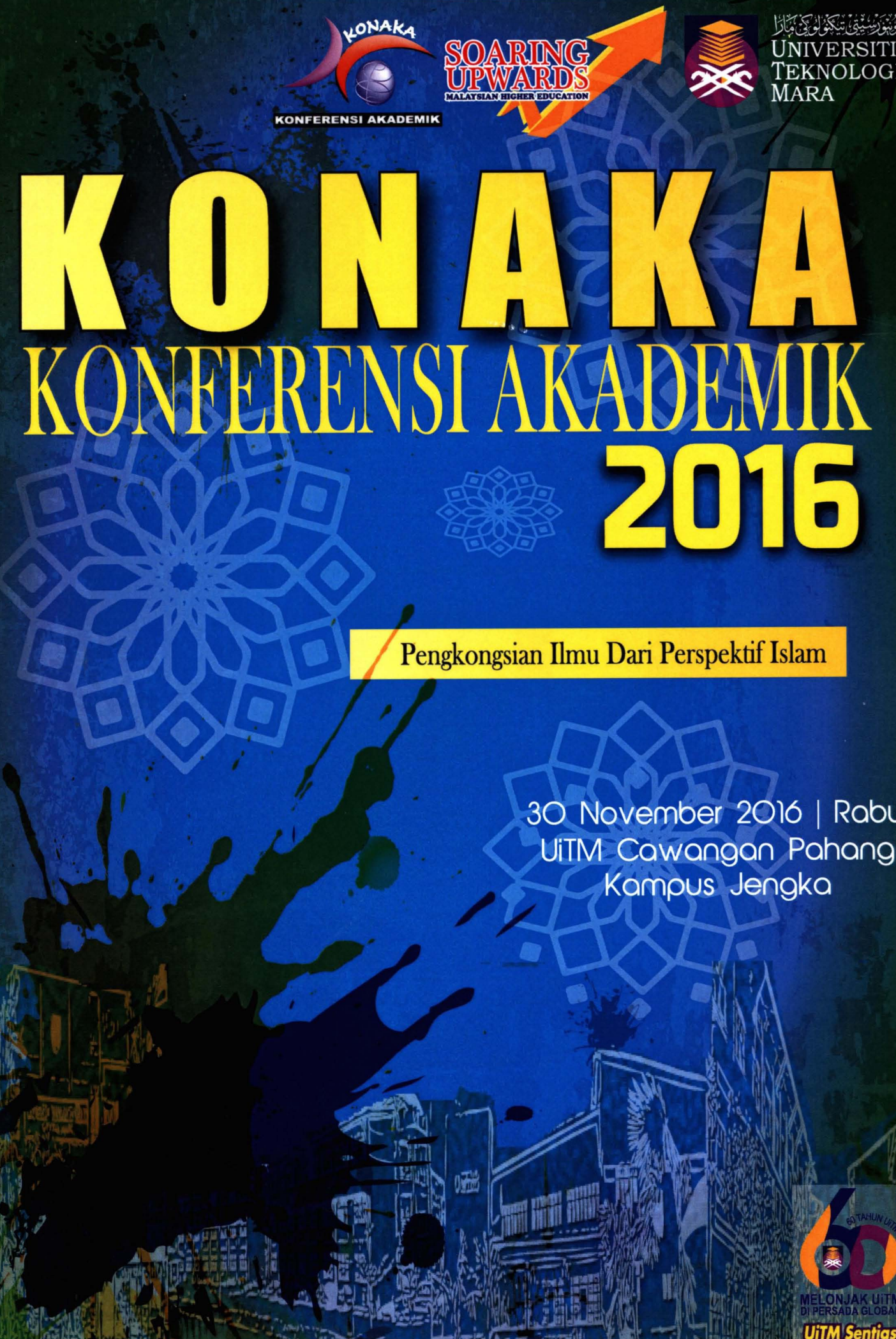
SOARING UPWARDS
MALAYSIAN HIGHER EDUCATION

UNIVERSITI TEKNOLOGI MARA

KONAKA
KONFERENSI AKADEMIK 2016

Pengkongsian Ilmu Dari Perspektif Islam

30 November 2016 | Rabu
UiTM Cawangan Pahang
Kampus Jengka



60 TAHUN UiTM
MELONJAK UiTM DI PERSADA GLOBAL
UiTM Sentiasa

Finishing Properties of Acid Catalyst (AC) Lacquer on Oil Palm Lumber (OPL)

Mazlin Kusin[1]*, Norhafizah Rosman[2], Said Ahmad[3], Nuramiratul Hakimah Badrul Nidzam[4]

[1-4]Study Centre of Wood Industries, Faculty of Applied Sciences Universiti Teknologi MARA Pahang, Kampus Jengka, 26400 Bandar Tun Razak Jengka, Pahang, Malaysia
mazlin@pahang.uitm.edu.my, hafizah@ pahang.uitm.edu.my, said pahang.uitm.edu.my,
*Corresponding Author

Abstract: Oil palm is the largest and most important plantation crop in Malaysia. Oil Palm Lumber (OPL) is seen as a strategic alternative wood material in Malaysia. The material is low in quality and various techniques have been used to improve its quality. The application finishes to protect the surface and enhance the aesthetic qualities of the timbers. Finishing also helps to enhance the attractiveness of the surface texture, dimensional stability and durability. This study was carried out to compare the finishing properties of acid catalyst lacquer on OPL. It also determine the suitability of techniques or system which applied on OPL. Three types of finishing testing was used to determine the properties of lacquer which is house hold test, heat resistance test and pencil hardness test. Based on results from different coating material used in this study, the surface finished with acid catalyst shows good performance on household test and heat resistance.

Keywords: Acid Catalyst Lacquer, Finishing Properties, Oil Palm Lumber (OPL)

1. Introduction

The oil palm tree *(Elaeis guineensis)* is indegineous to the tropical forests in West Africa. The oil palm tree was introduced to the Bogor Botanical Garden of Indonesia in 1848 before it was planted in Malaysia as an ornamental plant in 1871 (Basiron et al., 2000). The oil palm tree is categorized as a non-wood tree (Bee et al., 2014). Oil palm is a monocotyledon species. The anatomical structure of oil palm consists of parenchyma cells and vascular bundles, in contrast to hardwoods and softwoods for which the cells consist of mostly fibers, tracheids, vessel parenchyma, and ray parenchyma cells (Sulaiman et al., 2012). The chemical composition of oil palm trunk differs from hardwood and softwood species with change in cellulose, hemicellulose, and lignin content (Akmar & Kennedy, 2001). Oil palm trunk (OPT) contained various sizes of vascular bundles. There are many uses of potential value-added products made from oil palm trunk such as particleboard, laminated board, plywood, fiberboard, and furniture. The enhanced features and good looks impregnated OPT has found use in residential furniture and high-grade materials.

The oil palm tree has become one of the most valuable commercial cash crops in Malaysia. In 2015, the total oil palm planted area was 5.64 million hectares. With such a large area of plantation, the amount of planting of oil palm is creating a significant biomass that can be converted into a value-added product. There are many uses of potential value-added products made from oil palm trunk such as particleboard, laminated board, plywood, fibreboard and furniture (Gurmit et al. 1999). Oil Palm Lumber (OPL) is seen as a strategic alternative wood material in Malaysia. The material is low in quality and various techniques have been used to improve its quality.

This study was carried out to compare the finishing properties of acid catalyst lacquer on OPL as alternative species for furniture production by considering its physical, machining and finishing characteristics and making appropriate recommendation to the forest industry on effective use of the oil palm trunk for sustainable forest management. Wood finishing is refers to the process of embellishing or protecting the surface of a wooden material. The main functions of any finish are to seal the surface of the wood against moisture, to make cleaning

easier and to provide the surface colour and texture desired for the end use. For wood used internally there are many options including oils, waxes, clear varnishes, lacquer, shellac, sealer, decorative translucent stains and opaque paints and stains. External finishing systems are generally required to contribute to the long-term durability of the wood and be resistant to UV light, water and temperature variation. Finishing also can protect surface of product from being exposed to air, inorganic liquid and corrosive chemicals (Ahmad, 1998). Translucent and opaque stains and paint finishes which are specially formulated for external use are the preferred choice. Clear finishes such as varnish should not be used externally since they weather badly and need considerable and frequent maintenance to keep their appearance and protective qualities. Finishing can affect the colour of the wood. Some wood species have special finishing requirements or are particularly suitable to receive paint or stain finishes (Lefteri, 2003). The objectives of this study was to determine the suitability of AC lacquer to be applied on oil palm lumber and to compare the effect of different finishing system layer using AC lacquer on OPL surface.

2. Material and Methods

The OPL sample that use in this study was obtained from Felda Ulu Jempol, Jengka, Pahang. The sample was cut into 10 feet by using chainsaw and brought back to UiTM, Pahang. OPL was put in freezer and the temperature OPL in freezer must reach until -18°C. After that OPL was soaking with ethanol for 24 hours and then OPL place it in kiln dry. The OPL has been dried around 2 to 3 days to reache constant reading of 13% of MC. One type of wood finished was select that is acid catalyst lacquer. The finishing material used was and paper to smooth the surface and the materials that need for spray were AC hardener, AC lacquer and AC sealer and AC reducer to spray on sample. The OPL samples were cut into size 200mm x 100mm x 20mm and applied two system of finishing, System A and System B. In System A, the OPL sample was used 5 sealers and 4 lacquers and System B was use 4 sealers and 2 lacquers.

A total of three tests was conducted in this study, household testing, heat resistance testing and pencil hardness testing. In this study, a total of 30 samples of OPL were fabricated and five samples were tested for each system. After cut sample into the size the sample was be sanded using sand paper. The sandpaper types of silicon carbide was used and for first sanding, samples must using the sand paper 80, 100, 240 grit and followed by 320 grit sand paper. This system was use 50:20:5 ratios. For AC sealer and AC lacquer the ratio are 50 and for reducer the ratio use 20 and for hardener use 5 ratios. After mixed measured the viscosity, the viscosity for all lacquer must 12 to 16 seconds. After that, the sample was being dried before the process of sanding and sealing process. The process was repeated again refer to the system used before applied the top coat.

This test was being carried out based on American Standard Test Method (ASTM standard) British Standard (BS) for heat resistance. The household test for measure the resistance of surface of sample if exposed to the chemicals and stains at a particular time. For liquid resistance to household test was using oil from, sauce and soap and dropped to sample and left the sample around 24 hours and wiped the liquid on samples. Household was carried out according ASTM D1308 (ASTM, 2009). Heat resistance also known as cigarettes test. The sample was test with heat resistance testing to determine the resistance of AC lacquer in OPL to the cigarette burn. It was conducted according to BS EN 14323:2004 standards (BS EN, 2004). For scratch test was using wooden pencil from H grades until B grades. The test started with the lead against the film at 45° angle and pushed forward. The process was repeated using down hardness scale pencil until no cut preparation through the film was detected. Observe and record the result with using ASTM D 3633 standards (ASTM, 2011).

3. Results and Discussion

In this study a total 30 samples of OPL samples were tested. In each System A total of 15 samples were tested and 5 samples for each testing. The tests that carried out were household test, pencil hardness test and heat resistance test. For household test three types of liquids have been used were sauce, oil and vinegar. For heat resistance testing the material used is cigarette and pencil hardness test using pencil to view the level of scratch. Table 1 shows the summary result of finishing properties of OPL.

Table 1. Summary result of finishing properties of OPL

System	Household Test			Pencil Hardness Test (B)	Heat Resistance Test
	sauce	oil	vinegar		
A	1.67	2.33	3	8	3
	2.83	2.50	3	8	3
	2.83	2.5	3	8	3
	2.5	2.67	3	6	3
	1.17	2.67	3	6	3
B	2.00	3.00	3	8	3
	2.17	3.00	3	9	3
	2.33	2.5	3	8	3
	2.33	2.33	3	7	3
	2.5	2.33	3	8	3

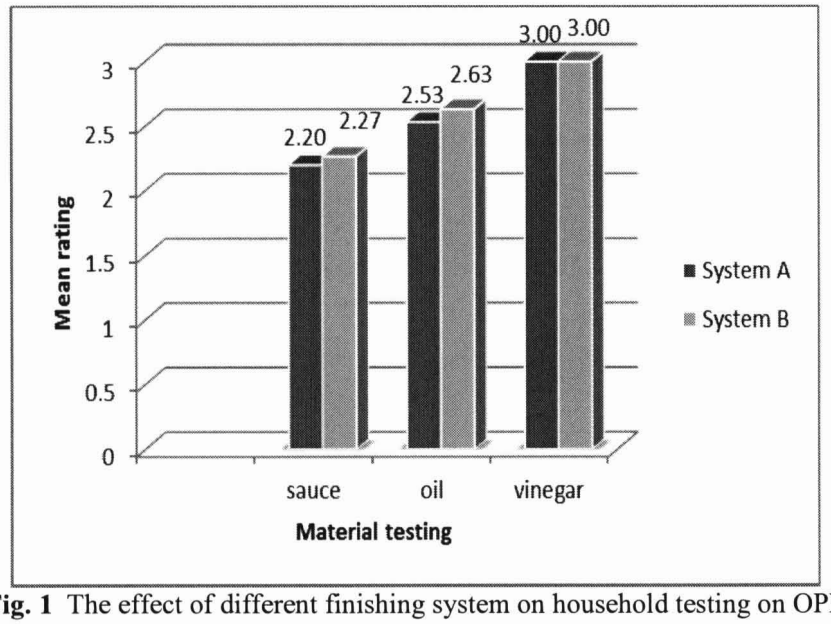


Fig. 1 The effect of different finishing system on household testing on OPL

Fig. 1 shows the effect of different finishing system on household test by using sauce, oil and vinegar. Based on result System A and System B shows the sauce is lower which it is from alkaline grouping. From alkaline group for scale pH is 10-8, the neutral scale pH is 7 and for acid scale pH is 6-0. The results were rated on no change, discoloration/ medium penetrate into wood grain and material penetrate into wood grain. The results of sauce shows 2.20 for

System A and 2.27 for System B and it is give medium penetrate into wood grain effect and for System A the result shows oil is 2.53 and System B is 2.63 it show the oil from neutral grouping give the effect same with sauce but for vinegar from acid grouping the results both system is 3.00 and it is give the material penetrate into wood grain effect. The sauce, oil and vinegar give different effect on household test and the vinegar gives highly effect on OPL. This is because vinegar is a liquid and it was absorbed into wood.

Therefore System A which is has 5 sealers and 4 lacquers gives the better results in household test. This is because the layers of System A are thicker than System B and it was prevent the household material penetrating into wood and give effect on wood. The function of sealer is to smooth the surface by filling up the pores on the wood surfaces. When the sealer applied on sample, it will harden the wood grain. But it depends on the thickness of sealant. The more sealer layer applied, the smoother the surface of wood will become (Shuhaili, 2013).

According to Hanis (2015) kelempayan species with 6 layers of sealer give better result compared with 4 layers of sealer, for result OPL it show 5 layers of sealer more better compared with 4 sealer. Its mean, more sealer layer applied it give low effect. In household testing, OPL and solid wood shows the different result. For OPL the sauce and vinegar give effect on surface and penetrate into wood surface this is because every oil palm wood contains plenty of wood fibers and it will float at wood surface compared with solid wood it just gives effect on surface wood (Sulaiman et al., 2012).

Fig.2 shows the effect of heat resistance on OPL. The purpose of this testing is to determine which system of finishing can give the best result on surface sample. According to Fig. 2, System A and System B has same value of mean, the value of mean for both system is 3.00. The higher value of means is obtained the high effect when the cigarettes put on the surface of sample. Its shows that for System A which has 5 sealer and 4 lacquer and System B which has 4 sealer and 2 lacquer has no different results and the rating show it give high effect of burn on surface lacquer. The AC sealer already has properties of heat resistant (Dresdner, 1999). Based on heat resistance on test sample for System A, only sample 1 shows the result of burnt on all area replicate and the others are have certain area of replicate give discolor to yellowish. Probably, during the finishing process, maybe the human lack of knowledge about the right skill to spraying. Surface of OPL also will affect the result of cigarette test. According to Hanis (2015), the mean result for kelempayan species showed the result for 6 layers of sealer is 1.8 but for 4 layers of sealers is 1.6. This is shows that the 6 layers of sealer on kelempayan give more resistance to heat compare to 4 layers of sealers on kelempayan. Meanwhile, for OPL the mean results for both system of layers finishing is 3.00 and the result give a burnt effect on surface of OPL compared with kelempayan gives the result stain easily removed and just give small effect of burnt. That means kelempayan species better to use in finishing process.

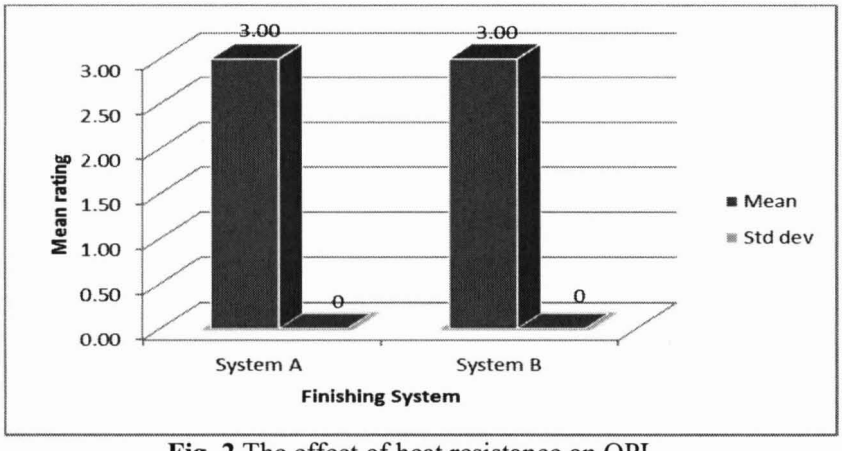


Fig. 2 The effect of heat resistance on OPL

Table 2 shows that there are no significant different on the pencil hardness when using different system of finishing (System A and System B) on a surface of OPL. This is because the surface of OPL not smooth and both system it still give effect on surface OPL and it give no different result. Compared with kelempayan species the result shows pencil hardness test on kelempayan is highly significant. This is because the different layers applied on kelempayan give different result on pencil hardness testing (Hanis, 2015).

Table 2. F-Value For Pencil Hardness on OPL Surface

S_{ov}	df	Pencil hardness	Sig.
Finishing system	1	1.882^{ns}	0.207

Note: $p > 0.05$: not significant (*ns*)

Fig. 3 shows the interaction between finishing system and pencil hardness. The test will be evaluated by the scratching with grade pencil on the surface of the OPL

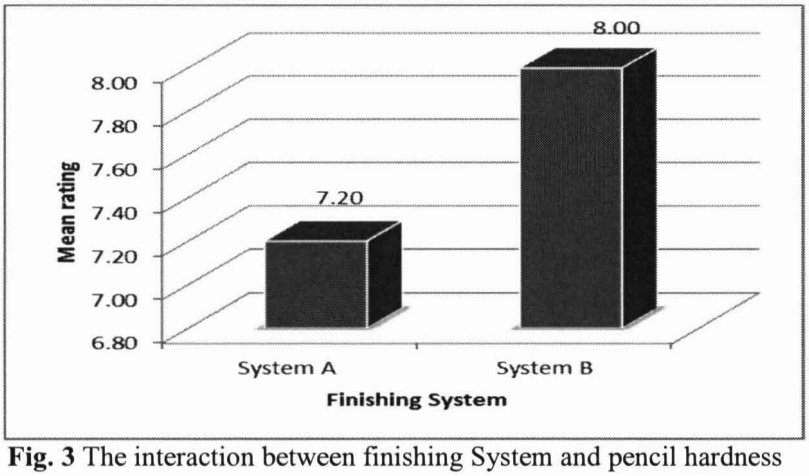


Fig. 3 The interaction between finishing System and pencil hardness

System A shows lower mean value compared to System B. It was showed even in mean value have different but in ANOVA it still show that pencil hardness not significant different between finishing system (System A and System B). The mean value result test pencil hardness for System A was 7.20 and System B was 8.00 that mean System A more better. This is because the layers System A thicker and can give more resistance to scratch. AC lacquer withstands the scratch, heat, water and alcohol (Thomas, 1985). In System A, the ranking of pencil hardness test on sample was scratched at grade 8B but for System B started scratch at grade 9B. According to Hanis (2015), for kelempayan species the result of pencil hardness testing showed for 6 layers sealer the mean value is 2.2 and for 4 layers sealer is 4.2. Wood kelempayan started scratch at 2H compared with OPL it started scratch at grade 9B. This result shows the OPL more softly and easy to scratch compared with wood kelempayan more resistance to scratch.

4. Conclusion

The finishing is very important to give the surface good aesthetic value for the product. There were 2 system used for application finishes which is system A was using 5 layers of sealers and 4 layers of lacquers while system B was using 4 layers of sealers and 2 lacquers

process. The material coating used is AC lacquer. There are no significant different between system A and system B. However, system A give best result in household test. This is because System A gives more thicker of layers coating further its could enhance the resistance of finishes. In conclusion, based on system A and system B the results from household test, resistance test and pencil hardness test showed there is no different testing in surface OPL so the industry can applied system B because it is more economical cost in long term compared to system A. Even though, for system A can be more expensive in cost because need more layer sealer and lacquer.

5. References

Akmar, P. F., & Kennedy, J. F. (2001). "The potential of oil and sago palm trunk wastes as carbohydrate resources," *Wood Sci. Technol.* 35:467473.

ASTM D1308. (2009). Standard Test Methods for Household Chemical Resistance Test, ASTM International, Pennsylvania.

ASTM D3633. (2011). Standard Test Method for Film Hardness by Pencil Test, ASTM International, Pennsylvania.

Basiron, Y., Jalani, B. S., & Chan, K. W. (2000). Advances in Oil Palm Research, Malaysian Palm Oil Board, Bangi. pp. 1-782.

Bee, S., Hamid, A., & Chowdhury, Z. Z. (2014). Catalytic Extraction of Microcrystalline Cellulose (MCC) from Elaeis guineensis using Central Composite Design (CDD), *BioResources*, 9(4):7403-7426.

BS EN 14323. (2004). Resistance to Cigarrate Burn. *Wood-based panels-Melamine faced boards for interior uses-Test methods*,11.

Gurmit, S., Lim, K. H., Teo, L., & David, L. K. (1999). "Oil palm and the environment, a Malaysian perspective," Malaysian Oil Palm Growers' Council.

Hanis, A. I. (2015). Finishing Properties of a Coffee Table from Kelempayan (*Neolamarckia cadamba*). Unpublished Project Thesis. (Bachelor of Science (Hons.) Furniture Technology). Thesis. Universiti Teknologi MARA, Malaysia. Pp.30-36.

Lefferi, C. (2003). Materials for Inspirational Design Wood: Classification of wood. Switzerland : Rotovision SA.

Shuhaili, J. (2013). The Effect of Sealant as a Finishing on a Wood Panel (Plywood). Unpublished Project Thesis. (Bachelor of Science (Hons.) Furniture Technology). Thesis. Universiti Teknologi MARA, Malaysia. Pp.46-47.

Sulaiman, O., Nurjannah S., Noor Afeefah, N., Rokiah, H., Mazlan,I., & Masatoshi S. (2012). The Potential of Oil Palm Trunk Biomass as an Alternative Source for Compressed Wood. *BioResources*, 7(2).pp 2688-2706.

Thomas, M. (1985). *Azadirachta excelsa* (Jack) Jacbos PROSEA Plant Resources of S.E.A.