The Effects of Tree Portion on Extractive Content of Kelempayan *(Neomalarckia cadamba sp.)* wood

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ABSTRACT

The extractives provide a major contribution to the many properties of wood. Data on the extractive content of wood material is generally preferred and required for various processes and applications in the wood industry. The main objective of the study was to determine the extractive content of Kelempayan with the diameter of its breast height ranging between 35cm to 41cm. Samples were taken from each high level, namely, bottom, middle and top from three trees. The highest value of cold water was observed in the middle portion followed by the top and the bottom while the greatest value of hot water was observed in the bottom portion followed by the top and the middle. The alkali soluble content also showed a similar trend. For alcohol toluene, the highest value was observed in the bottom portion followed by the top and the middle portion.

Keywords: *Extractive, Kelempayan, Cold and Hot Water, Alcohol Toluene, Alkali*

Introduction

Neomalarckia cadamba which is locally known as 'Kelempayan' comes under the family of *Rubiaceae.* It is a fast-growing tree species with a tall and straight bole. The timber is soft and light creamy yellowish colour of wood and classified under Light Hardwood in Malaysia. This type of wood is regarded as non-durable and also susceptible to wood rotting, fungi and blue stain. The tree has potential to be utilized for sawn timber, veneer, chips, pulp and composites (Ismail et. al., 1995). As it is a fast-growing species, it could become an alternative raw material to support the wood industry. Wood often contains measurable quantities of extractives and infiltrates including terpenes, resins, polyphenols such as tannins, sugars, and oils as well as inorganic compounds such as silicates, carbonates, and phosphates. The amount of extractives in wood varies from less than 3 to over 30 percent of the ovendry weight (Bowyer et al., 2007). Panshin and Zeeuw (1970) stated that the extractives provide a major contribution to many properties of wood. The odors and colors typical of most woods derive from extractives. Fungal and insect resistance of wood are closely linked to the presence of specific forms of toxic. In addition, their presence in wood is directly related to permeability and physical properties such as specific gravity, hardness, and compressive strength. Taylor et al. (2002) stated that extractives can be removed with neutral, organic solvents or water. The objective of this study is to determine extractive content of kelempayan tree with the diameter of breast height (DBH) ranging between 35 cm to 41 cm.

Materials and Methods

The samples were harvested and received from the forest reserve at Uitm Pahang. Wood samples for chemical analysis were grounded to pass a 40 mesh sieve and were retained on a 60 mesh sieve. The samples were then air dried for at least one day before chemical analysis so that the reaction of the wood with the reagents used in the chemical analysis was complete. The sawdust used in this study was taken from three Kelempayan trees with a diameter breast height (DBH) ranging between 35cm to 41cm and divided into three equal portions namely the bottom, the middle and the top. The sampling and preparation of sawdust for this analysis were carried out according to the standard Technical Association of the Pulp and Paper Industry USA (TAPPI). The chemical analysis was carried out according to the following standard procedures. The Kelempayan wood was analyzed for cold water and hot water, 1% natrium hydroxide soluble and alcohol toluene soluble, respectively (T 207 os-75, T 202 os-75, T 207 os-75)

Results and Discussions

Table 1 shows the average value for cold and hot water solubles, NaOH solubles and Alcohol Toluene solubles according to portion. The highest value for cold water was observed in the middle portion (6.46%) and the lowest value in the bottom portion (5.94%). Kelampayan had higher percentage of hot water in the bottom portion (8.82%) followed by top (6.85%) and middle portion (6.26%). Alkali solubles of kelempayan ranged from 17.33 to 19.20%. Bottom portion had higher alkali solubles (19.20%) compared to the middle (17.33%) and top portion (17.57%). The greatest alcohol toluene solubles was observed in the bottom portion (2.69%) while the the lowest was middle portion (2.24%).

Table 1: Cold and hot water solubles, NaOH solubles and Alcohol Toluene solubles of Kelempayan wood according to tree portion

Portion	CW (%)	HW (%)	NaOH (%)	AT (%)
Bottom	5.94	8.82	19.20	2.69
Middle	6.46	6.26	17.33	2.24
Top	5.95	6.85	17.57	2.26

Table 2 shows the analysis of variance (ANOVA) on the cold and hot water solubles, NaOH solubles and alcohol toluene solubles of kelempayan wood. It shows that the value of cold water solubles, hot water solubles and alcohol toluene solubles of kelempayan wood according to portion were not statistically different. However, the portion was observed to have significant effects on the value of NaOH solubles.

Table 2: Summary of ANOVA on the cold and hot water solubles, NaOH solubles and Alcohol Toluene solubles of Kelempayan wood influenced by portion.

SOV	Properties			
Portion	CW	HW	NaOH	AT
	4.50ns	3.79ns	45.26*	1.71ns

Note: *shows F value significance at P value <0.05, ns shows F value not significance at P value <0.05

Cold and hot water solubles

Jamaludin (2006) pointed out that cold and hot water solubles are important in the evaluation of water soluble extracts such as tannin, starch, sugar, pectin and phenolic compounds within any lignocellulosic material. The highest cold water soluble was observed in the middle portion (6.46%) and the lowest in the bottom portion (5.94%). Meanwhile, the highest hot water soluble was observed in the bottom portion (8.82%) and the lowest in the middle portion (6.26%). The values of hot water solubles were higher than cold water solubles. The hydrolysis and corresponding increase in solubility of wood substance during the boiling with water can result in the difference of solubility (Nazri, 2009).

The result of this study indicated that cold and hot water solubles of kelempayan were not significantly affected by tree portion as shown in Table 2 and Table 3. This study also showed that cold and hot water solubles had insignificant positive ($r = 0.09$, $p < 0.05$) and negative ($r = -0.55$, $p < 0.05$) correlations with portion respectively as shown in Table 4. Nazri et al., (2009) in his study pointed out that generally, the portion with lower cold and hot water solubles contain higher lignin and holocellulose content while the portion with higher values of hot and cold water solubles contained more active cells.

Alkali soluble

The alkali soluble of Kelempayan wood in Table 1 ranges from 17.33% to 19.20%. The highest and lowest alkali solubles were observed at the bottom portion and the middle portion. The results indicated that the alkali soluble tends to show a higher value in the bottom portion of the tree. The summary of ANOVA (Table 2) showed that the alkali solubles was shown to be significantly with the portion. The correlation analysis of the effects of the portion on the alkali solubles (Table 4) further indicates that alkali solubles were significantly correlated ($r = -0.78$, $p < 0.05$) with the portion. Jamaludin (2006) in his study found that the high alkali solubles were associated with the high degradation of cellulose and low polyphenol content. For pulping, this property will results in lower yield, but it could give benefits with its high holocellulose content.

Alcohol Toluene soluble

Kelempayan wood had a higher percentage of alcohol toluene soluble in the bottom portion as show in Table 1. Higher percentage of extractive in the bottom portion made it stiffer and more resistant. Alcohol toluene solubles was insignificantly affected by the portion (Table 2 and Table 3). This study indicates that the tree portion was negatively correlated ($r = -0.51$, $p < 0.05$) with the alcohol toluene solubles.

Table 3: Cold and hot water solubles, NaOH solubles and Alcohol Toluene solubles of Kelempayan wood influenced by portion

Portion	Properties			
	CW	HW	NaOH	AT
Bottom	5.94b	8.82a	19.20a	2.69a
Middle	6.79a	6.26ab	17.33b	2.24a
Top	6.05ab	6.85b	17.57b	2.26a

Note: Values with the same alphabetical superscript in each column indicates groups that are not statically different according according to Duncan's multiple range tests at $P < 0.05$

Table 4: Correlation coefficients of cold and hot water solubles, NaOH solubles and Alcohol Toluene solubles with portion

SOV	CW	HW	NaOH	AT
Portion	0.09ns	-0.55ns	-0.78*	-0.51

Note: * shows value significance at $P < 0.05$

Conclusions

The extractive contents of Kelempayan wood was analyzed for cold and hot water solubles, alkali solubles and alcohol toluene soluble. The cold and hot water solubles were not significantly affected by the tree portion. The alkali solubles were observed to be significantly correlated with the portion. In this study the alcohol toluene solubles were insignificantly affected by the portion and had shown to be negatively correlated with the tree portion.

References

Bowyer, J. L., Shmulsky, R., Haygreen, J. G. (2007). *Forest Products and Wood Science. An Introduction.* USA: Blackwell Publishing.

Ismail, J., Jusoh, M. Z., & Mohd. H. Sabri. (1995). Anatomical Variation in Planted Kelempayan (Neolamarckia Cadamba, Rubiaceae). *IAWA Journal, Vol. 16(3). 1995*: 277-287.

Jamaluddin, K. (2006). *Properties of Particleboard and Thermoplastic Board from Buluh Semantan (Gigantochloa Scortechinii)*. Shah Alam: University Publication Centre (UPENA).

Nazri, W.M., Jamaludin, K., Rudaini, M.N., Rahim, S., Nor Yuziah, M.Y. (2009). Effects of Chemicals Components on Properties of Oriented Strand Board From Leucaena Leucocephala Wood. *Journal of Tropical Forest Science 21: 353-360.*

Panshin, A. J. & De Zeeuw, C., (1970). *Textbook of Wood Technology Volume 1*. McGraw Book Co. Ltd., New York.

Taylor, A.M., Gartner, B.L., Morrell, J.J. (2002). Heartwood Formation and Natural Durability. *Wood and Fiber Science 34*: 587-611