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ACETYLATED FLAKEBOARD RESISTANCE TO *SCHIZOPHYLLUM COMMUNE* FUNGUS ATTACK

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Flakeboards made from three-, four-, and six-year sengon woods (*Paraserianthes falcataria*) were used for testing the resistance to fungal attack. Dried flakes were immersed in acetic anhydride and subsequently heated at temperature of 120°C for 24 hours, the weight percent gain was 23%. In addition, control flakes were prepared without any treatment to serve as control. Phenol formaldehyde was used as adhesive, the amount was 10% based on oven dried flakes weight, and flakeboard density was 500 kg/m^3. The flakeboards were innoculated with *Schizophyllum commune* fungus for two months [1] and subsequently tested to determine their weights, modulus of rupture, and modulus of elasticity losses. The weight loss was based on oven dried condition, but MOR and MOE were compared to equilibrium moisture content condition.

INTRODUCTION

Sengon wood (*Paraserianthes falcataria*) is a fast growth species which is planted broadly for industrial plantation forest in Indonesia. For construction timber purpose the cutting cycle is 8 - 15 years, and of course the thinning activities have to be done to get a good final timber quality.

To get better added value of trees harvested from thinning the wood can be utilized for particleboard. Martawijaya *et. al.* [5] mentioned that sengon has a low wood density (330 kg/m^3) so it is favourable for particleboard manufacturing. However, these thinning trees are very young, they have a lot of juvenile wood, and this wood belongs to moderate durability class, so it is therefore suggested that its durability should be improved.

Acetylation of sengon flakes gave lower moisture content and lower water absorption flakeboard, and also the chemical structure of acetylated flakes was changed [3]. The acetylated flakeboard is more hydrophob, and the flakeboard is expected to posses a more resistance properties to *Schizophyllum commune* fungus attack.

Some researchers stated that acetylated flakeboard is more resistant to fungal attack. Rowell *et al.* [8] mentioned that flakeboard made from acetylated flakes above about 16% acetyl weight gain showed little or no weight loss in *Gleophyllum trabeum, Tyromyces palustris, Trametes versicolor* fungi tests, these boards also showed little strenght loss during or after fungal attack. Nilsson *et al.* [6] found particleboard made from chips acetylated in a liquid phase procedure were the most resistant to attack by white, brown, and soft rot fungi. Furthermore, Immamura *et al.* [4] reported particleboards made from acetylated pine or birch chips using melamine-urea-formaldehyde resin were resistant to attack by brown and white rot fungi in pure single culture tests.

The purpose of this research is to study acetylated flakeboard resistance to *Schizophyllum commune* fungus attack, especially for sengon wood from three-, four-, and six-year tree ages. The responses were weight, modulus of rupture (MOR), and modulus of elasticity (MOE) losses which were caused by fungi attack.

METHODS

FLAKEBOARD SAMPLES

Wood species used was sengon (*Paraserianthes falcataria*) from plantation forest in Bogor (Indonesia). The trees were from the stand of three-, four-, and six-year old, and from each tree age two trees were taken. The average log diameters were 11 cm, 13 cm, and 16 cm consequently. The logs were sawn to planks, further cut to flakes with diskflaker.

The flakes were dried to be in the neighbourhood of 3% moisture content and the dried flakes were immersed in acetic anhydride, then subsequently heated at temperature of 120°C for 24 hours. On the other hand, flakes sample were also prepared without any treatment, from the wood of each the three tree ages.

Phenol formaldehyde was used as adhesive with 10% resin level, and flakeboard density was 500 kg/m^3. The size of board was $35 \times 35 \times 1$ cm and replication of each treatment was three flakeboards. To analyze the data, a factorial method in a randomized complete design 3×2 was used.

TESTING METHODS

Schizophyllum commune fungus was innoculated in the glass boxes until it grew adequately. Flakeboard samples of 2.5×5 cm for weight loss test and 5 cm by 20 cm for MOR and MOE tests were put in the glass boxes. After two months innoculation process (ASTM D 2017 - 63), the sample flakeboards were

tested to determine weight loss, MOR loss, and MOE loss. Those values were determined using the following formula:

$$A = \frac{Bw - Bt}{Bw} \times 100\%,$$

where as A = Weight, MOR, and MOE losses, Bw = Value without fungi innoculation, Bt = Value after innoculated by fungi.

The weight value based on oven dried value, but MOR and MOE based on equilibrium moisture content condition for uninnoculated fungi board and for innoculated fungi boards the boards were tested just after two months fungi innoculation process.

RESULTS AND DISCUSSIONS

The average values of weight, MOR, and MOE losses of *S. commune* fungus innoculated flakeboards are shown in Table 1. Refering to the table, tree age and acetylation of flakes affected weight, MOR, and MOE losses. The older tree age showed lower weights, MOR, and MOE losses, because the older tree had more mature wood and the extractive matter was gradually deposited in

Table 1

Weight, modulus of rupture (MOR) and modulus of elasticity (MOE) losses of fungi innoculated flakeboard

Ubytki masy i spadek modułu na zerwanie (MOR) oraz modułu elastyczności (MOE) płyt wiórowych poddanych na działanie grzybów

Flakeboard properties Właściwości płyt	Tree age Wiek drzewa	Control board Płyta kontrolna	Acetylated board Płyta acetylowana	*F* Test *A* *B* *AB* Test *F* *A* *B* *AB*
Weight loss (%) Ubytki masy (%)	3	5.84	1.38	* ** NS
	4	6.55	1.32	
	6	5.11	1.12	
MOR loss (%) Spadek MOR (%)	3	57.68	51.21	* ** NS
	4	55.01	50.82	
	6	53.06	28.46	
MOE loss Spadek MOE	3	65.54	42.70	* ** NS
	4	60.95	41.70	
	6	54.63	22.29	

Legends:
A = Tree age factor, *B* = Acetylation factor
AB = Interaction factor between *A* and *B*,
* = Significant difference, 95% confidence level
** = Highly significant difference, 99% cofidence level
NS = Not significant difference

Objaśnienia:
A = wskaźnik wieku drzew, *B* = wskaźnik acetylacji
AB = współzależność między *A* i *B*
* = różnica istotna, poziom ufności 95%
** = wysoki stopień istotności różnicy, poziom ufności 99%
NS = różnica nieistotna

the wood, so that wood became more resistance to fungi attack. The extractive content extracted in hot water for the 3, 4, and 6 years tree ages were 4.0, 4.6, and 5.9 percents respectively and extracted in alcohol-benzene were 10.7, 11.8, and 12.9 percents respectively.

For the acetylation factor, acetylated flakeboard was more resistance to *S. commune* fungus attack. Hadi [2] indicated acetylated flakeboard had a better hydrophobility which was indicated by lower moisture content and water absorption and this condition does not support for fungi life because fungi need a humid condition.

The average weight loss of acetylated flakeboard was 1.3%, this value can be neglected regarding to Kolle Flask test standard. Furthermore, the weight percent gain (WPG) of the flakes was 23%, this WPG was enough to increase flakeboard resistance to fungi attack regarding to Rowell [7] who mentioned that 20% WPG was enough to prevent brown-rot fungi attack.

CONCLUSIONS

From discussions above, we concluded that:

1. Tree age and acetylation of flakes affected weight, MOR, and MOE losses. The older tree age and acetylation of flakes gave a better flakeboard resistance to *S. commune* fungus attack.

2. The weight loss of acetylated flakeboard could be neglected regarding to Kolle Flask test standard; this condition was supported by the WPG of 23 percent.

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ODPORNOŚĆ ACETYLOWANYCH PŁYT WIÓROWYCH NA DZIAŁANIE GRZYBA *SCHIZOPHYLLUM COMMUNE*

Streszczenie

Płyty wiórowe wykonane z trzy-, cztero- i pięcioletniego drewna sengowego (*Paraserianthes falcataria*) poddano laboratoryjnemu testowi mykologicznemu. Wysuszone wióry moczono w bezwodniku kwasu octowego i suszono w temperaturze 120°C przez 24 godz. Wzrost masy drewna w tych warunkach wyniósł 23%. Płyty kontrolne wykonano z wiórów drewna naturalnego. Do zaklejania płyt użyto kleju fenolowo-formaldehydowego w ilości 10% w stosunku do suchej masy wiórów. Otrzymane płyty poddano działaniu grzyba *Schizophyllum commune* w okresie dwóch miesięcy (wg ASTM D 2017-63), po czym określono zmiany masy próbek, modułu na zerwanie (MOR) i modułu elastyczności (MOE). Ubytki masy odnoszono do materiału zupełnie suchego, a moduł na zerwanie i moduł elastyczności do warunków równowagi higroskopijnej. Z badań wynika, że płyty otrzymane z drewna drzew trzyletnich, poddanego acetylowaniu, pod wpływem testowego grzyba wykazują ubytki masy i obniżenie modułu na zerwanie i obniżenie modułu elastyczności. Acetylowane drewno z drzew starszych pozwala na otrzymanie płyt wiórowych o większej odporności na działanie grzyba *Schizophyllum commune*.

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