

Resistance of Mangium-Medium Density Fiberboard to Subterranean Termite

by

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Abstract

This study deals with the effect of resin content and board thickness on the resistance of Medium Density Fiberboard (MDF) made from Acacia mangium to subterranean termite. For that purposes, the dry process of MDF with a targeted density of 0.7 g/cm³ was manufactured by using 8% and 12% of UF. The hand formed mats of 30x30x0.25 cm and 30x30x0.5 cm were pre-pressed and subsequently hot-pressed at 140°C for 10 minutes, and the pressure applied was 30 kg/cm². The boards were tested to subterranean termite (*Coptotermes curvignathus* Holmgren) in laboratory according to Indonesian standard SNI 01.7207–2006 during four weeks. The results are as follow: (1) the weight loss of 0.25 cm board-thickness was higher than that of 0.50 cm board-thickness; (2) the weight loss of mangium-MDF was higher than that of solid wood; and (3) there was no significant different of weight loss between 8% and 12% UF used.

Key words: Acacia mangium, Medium Density Fiberboard, Urea Formaldehyde, subterranean termite

Introduction

Log production activity in Indonesia is carried out by Stated Owned Enterprises in conjunction with the private sector using a Forest Concessionaire System, under direct control of the Ministry of Forestry. In the early 1970 to 2000, the dominant wood supply came from natural forest which were high quality trees with large diameter logs, sound, cylindrical, and straight. The logs are primarily to support plywood industries and sawmills. However, after 2000 the trend of wood supply from natural forest decreased and on the contrary the wood supply from plantation forest increased. The Indonesian logs production, in between 2000-2006, reached 9.0 to 24.2 million m³ and about 60% come from plantation forest (Indonesian Ministry of Forestry, 2007). About four million hectares of fast growing species has been developed with cutting cycle of 10-15 years, e.g. mangium (*Acacia mangium*), teak (*Tectona grandis*), mahogany (*Swietenia macrophylla*), pine (*Pinus merkusii*), sengon (*Paraserianthes falcataria*), sonokeling (*Dalbergia latifolia*) and sungkai (*Peronema canescens*) (Rohadi, 2010). Changing in wood supply from natural forest to plantation forest affect the wood characteristics, i.e., from large diameter logs to small diameter logs; from well known wood species to lesser used species; and from superior logs quality to inferior quality.

Medium Density Fiberboard (MDF) is the bio-composites products which have more possibilities to use the small diameter and inferior logs. In addition, according to the previous study concerning market assessment, MDF are the potential for future market growth for bio-composites

products. Therefore, the investigation of the properties of this new characteristics wood and find out the possibilities utilization are needed. In addition, the durability of MDF made from fast growing species must be recognized. It can be suggested that the durability of bio-composite products is similar to its solid wood, for this reason the resistance of bio-composite product especially MDF made from fast growing species to subterranean termite should be recognized.

The purpose of this work is to evaluate the durability made from acacia mangium to subterranean termite attack in laboratory test.

Materials and methods

Materials

The small diameter logs from plantation forest, i.e. Mangium (*Acacia mangium*) was used as raw material of MDF. Urea Formaldehyde was used as a binder.

Methods

The dry processed of MDFs with a targeted density of 0.7 g/cm³ were manufactured by using 8% and 12% of UF. The hand formed mats of 30x30x0.25 cm and 30x30x0.50 cm were pre-pressed and subsequently hot-pressed at 140°C for 10 minutes, and the pressure applied was 30 kg/cm².

Subterranean termite test

Wood sample was put in and touched to a jam pot containing 200 g of sand (7% moisture content under water holding capacity) and 200 healthy and active worker of subterranean termites (*Coptotermes curvignathus* Holmgren). The jam pots were put in the dark room for four weeks, and every week the bottles were weight and if moisture content of the sand reduced 2% or more, water was added to reach moisture content standard. At the end of the test, MDF weight loss was determined regarding to SNI 01.7207–2006 (Indonesian National Standard, 2006), and feeding rate was also calculated.

Results and discussion

Weight Loss

Weight loss (%) of MDF at different resin content and board thickness is shown in Figure 1. Weight loss of 2.5 mm board thickness with 8% and 12% UF was 26.6% and 28.5%, respectively. Meanwhile, the weight loss of 5.0 mm board thickness was 12.6% and 12.5%, respectively. The addition of 8% to 12% UF did not affect the resistance of MDF to subterranean termite. Based on statistical analysis, there was no significant differences between 8% and 12% UF used.

As shown in Figure 1, the weight loss of 2.5 mm board thickness was almost twice higher than that of 5.0 mm board thickness. In addition, this study revealed that the resistance of 5.0 mm board thickness was similar to solid wood, where the weight loss of mangium-solid wood was 12.3% (t=2.5 mm) and 9.6% (t=5.0 mm).

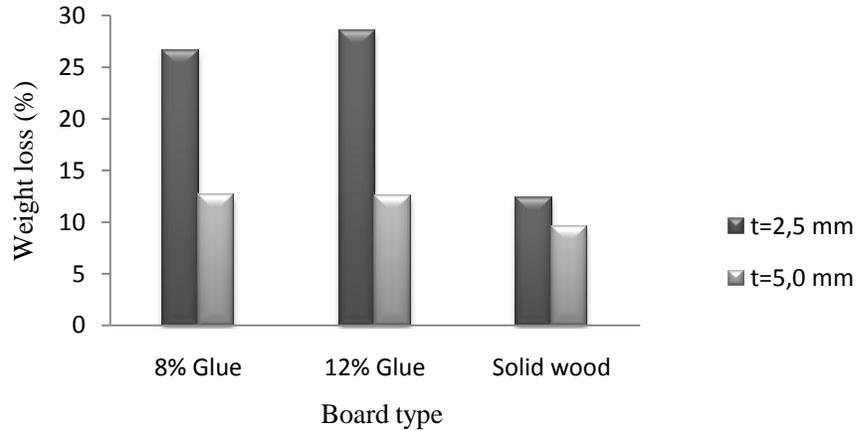


Figure 1. Weight Loss of Mangium-MDF

Feeding Rate

Feeding rate ($\mu\text{g/day/termite}$) of MDF at different resin content and board thickness is shown in Figure 2.

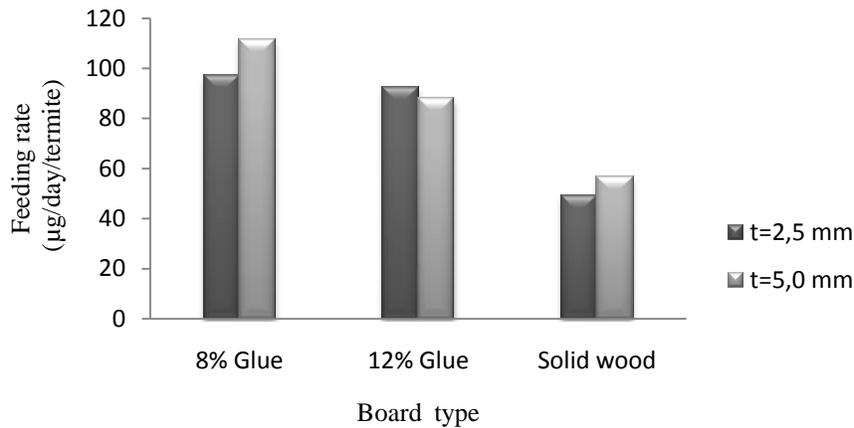


Figure 2. Feeding rate of Mangium-MDF

Feeding rate of 2.5 mm-board thickness with 8% UF was $97.1 \mu\text{g/day/termite}$, and almost similar to feeding rate of 5.0 mm-board thickness ($111.1 \mu\text{g/day/termite}$). The addition up to 12% UF did not affect the feeding rate of mangium-MDF. Solid wood of *Acacia mangium* had a lower feeding rate than MDF, and no significant differences between 2.5 mm and 5.0 mm board thickness. As resulted from previous research (Nurwati, 2005), that durability of *Acacia mangium* is belong to III – V grade, where the weight loss is in range of 4% - 8%. Subterranean termite utilizes wood as a shelter and food sources, mainly cellulosa (Bowyer *et al*, 2003). Fiber board from bio-based resources are degraded biologically because organism recognize the carbohydrate polymers in the cell wall.

Conclusion

1. The weight loss of 2.5 mm board-thickness was higher than that of 5.0 mm board-thickness.
2. The weight loss of mangium-MDF was higher than that of mangium-solid wood.
3. There was no significant difference of weight loss between 8% and 12% UF used.
4. Feeding rate of 2.5 mm-board thickness with 8% UF was almost similar to feeding rate of 5.0 mm-board thickness, and the addition up to 12% UF did not affect the feeding rate of mangium-MDF

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