UNIVERSITI PUTRA MALAYSIA

EFFECT OF OIL HEAT TREATMENT ON PROPERTIES OF 'BULUH SEMANTAN' (*Gigantochloa scortechinii* Gamble)

RAFIDAH BT MD SALIM

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EFFECT OF OIL HEAT TREATMENT ON PROPERTIES OF 'BULUH SEMANTAN' (*Gigantochloa scortechinii* Gamble)

By

RAFIDAH BT MD SALIM

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

October 2007

Specially dedicated to……..

My mother

MERIAM BINTI OMAR

My father

MD SALIM BIN AHMAD

My husband

MOHAMED AZHARI MOHAMED NEZURI

And my daughter

ALIA MAISARAH MOHAMED AZHARI

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

EFFECT OF OIL HEAT TREATMENT ON PROPERTIES OF 'BULUH SEMANTAN' (*Gigantochloa scortechinii* Gamble)

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October 2007

Chairman : Associate Professor Zaidon Ashaari, PhD

Faculty : Forestry

Bamboo is regarded as eco-friendly plant which grows and matures quickly. It has a potential to be used as an alternative raw material to wood. Like wood, bamboo is susceptible to fungal and insect attacks. Heat treatment is one of the potential treatments to enhance the durability of bamboo. In this study, bamboo splits *(Gigantochloa scortechinii*) were heat-treated in crude palm oil at temperatures ranged from 140 to 220° C for 30 and 60 mins. The objectives were to determine the effect on resistance to fungal and termite attacks, and to assess any significant changes on physical, mechanical and chemical properties of the treated bamboo. The optimum treatment schedule of treating bamboo was also evaluated.

The resistance of heat-treated bamboo against white rot fungus (*Pycnoporous sanguineus* (Pers. Ex Fr.) Murr) and termite (*Coptotermes curvignathus* Holmgren*)* was evaluated based on weight loss of sample after exposure to the fungus and termite for 12 weeks and 4 weeks, respectively.

For fungal test, the resistance significantly increased when the temperature and time of treatment increase. Heat treatment at 220°C/60 min offers the best protection followed by heat treatment at 180°C/60 min. A similar trend was also noted for the resistance against subterranean termites. In ground contact test, the most effective treatment condition was at 220°C/60 min while the least effective treatment condition was at 140°C/60 min.

With regard to physical properties; equilibrium moisture content, density and volumetric shrinkage of heat-treated bamboo decreased as the treatment temperature and time increase. Majority of the mechanical properties of bamboo were significantly reduced by the treatments. A significant reduction in values of fibre stress at proportional limit (FSPL), modulus of elasticity (MOE) and shear parallel to grain were recorded when the bamboo were treated at temperature higher than 180°C, but for modulus of rupture (MOR), the value was only decreased when it was heated at 220°C/60 min. Compression parallel to grain was not affected by the treatments.

Holocellulose content of heat-treated bamboo did not differ to each other when it was heated at 180°C however, the content reduced significantly when treated at 220°C/60 min**.** Hemicellulose content of bamboo was not affected by the treatments. Cellulose content in bamboo was only reduced when it was treated at temperature higher than 180°C. At 140°C to 180°C, the lignin content in the treated bamboo decreased, but the chemical content value increased when the bamboo was heated at 220°C. Starch content in

the bamboo was found to be inversely proportional to treatment temperatures. At 180°C, duration of treatment did not significantly affect the starch content.

As a whole, the optimum treatment condition in protecting bamboo against *P. sanguineus* and *C. curvignathus* was 180°C/30 min. The mechanical reductions of bamboo found at this condition do not, in general, represent a serious detriment to use.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KESAN RAWATAN MINYAK PANAS KE ATAS SIFAT-SIFAT 'BULUH SEMANTAN' (*Gigantochloa scortechinii* Gamble)

Oleh

RAFIDAH BT MD SALIM

Oktober 2007

Pengerusi : Profesor Madya Zaidon Ashaari, PhD

Faculty : Perhutanan

Buluh dianggap sebagai tumbuhan mesra alam yang cepat tumbuh dan matang. Ia berpotensi digunakan sebagai tumbuhan pengganti kayu. Seperti kayu, buluh juga mudah diserang oleh kulat dan serangga. Rawatan minyak panas merupakan salah satu kaedah yang berpotensi untuk meningkatkan ketahanan buluh. Dalam kajian ini, belahan buluh semantan (*Gigantochloa scortechinii*) dipanaskan di dalam minyak kelapa sawit mentah pada suhu 140 hingga 220°C selama 30 dan 60 min. Tujuan kajian ini adalah untuk mengenalpasti kesan ketahanan terhadap serangan kulat dan anai-anai, juga untuk menaksir sebarang perubahan yang nyata ke atas sifat-sifat fizikal, mekanikal dan kimia buluh yang sudah dirawat. Jadual rawatan buluh yang terbaik juga dinilai.

Ketahanan buluh yang dirawat terhadap kulat pereput (*Pycnoporous sanguineus* (Pers. Ex Fr.) Murr) dan anai-anai (*Coptotermes curvignathus* Holmgren*)* dinilai berdasarkan kehilangan berat sampel selepas didedahkan

kepada kulat dan anai-anai masing-masing selama 12 dan 4 minggu. Untuk ujian anai-anai, ketahanan meningkat dengan nyata apabila suhu dan masa rawatan meningkat. Rawatan pada 220°C/60 min menunjukkan perlindungan terbaik diikuti rawatan pada 180°C/60 min. Ketahanan buluh terhadap anai-anai juga merekod arah yang sama. Dalam ujian bersentuhan tanah, rawatan yang sangat berkesan adalah pada 220°C/60 min manakala rawatan yang paling kurang berkesan adalah pada 140°C/60 min.

Melalui pemerhatian pada sifat-sifat fizikal, kandungan lembapan seimbang, ketumpatan dan pengecutan isipadu buluh yang telah dirawat berkurang dengan pertambahan suhu dan masa rawatan. Majoriti sifat-sifat mekanikal buluh berkurang selepas rawatan. Tegangan dalam had kekadaran (FSPL), modulus keanjalan (MOE) dan kekuatan ricih selari ira berkurang pada buluh yang dirawat melebihi suhu 180°C manakala modulus kepecahan (MOR) berkurang pada 220°C/60 min. Suhu rawatan yang tinggi tidak memberi kesan pada mampatan selari ira.

Kandungan holoselulosa buluh yang dirawat pada kondisi 180°C/60 min tidak menunjukkan perbezaan bagaimanapun berkurang pada kondisi 220°C/60 min. Kandungan hemiselulosa pula tidak menunjukkan sebarang perbezaan selepas rawatan. Kandungan selulosa buluh hanya berkurang pada suhu melebihi 180°C. Pada suhu 140°C hingga 180°C, kandungan lignin buluh yang dirawat berkurang tetapi nilai kandungan kimia ini meningkat apabila suhu rawatan buluh mencapai 220°C. Kandungan kanji didapati berkadar

songsang pada suhu rawatan. Pada suhu 180°C, tempoh rawatan tidak memberi kesan yang nyata ke atas kandungan kanji.

Pada keseluruhan, keputusan dari dapatan kajian mendapati rawatan buluh pada 180°C/30 min merupakan kondisi rawatan yang optima untuk ketahanan buluh terhadap *Pycnoporous sanguineus* and *Coptotermes curvignathus.* Pengurangan sifat mekanikal buluh pada kondisi ini secara umumnya tidak menunjukkan kerosakan yang serius pada buluh yang dirawat untuk digunakan.

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Last but not least, appreciation to my parent in law for their constant prayers for my success.

I certify that an Examination Committee has met on 5th October 2007 to conduct the final examination of Rafidah binti Md Salim on her Master of Science thesis entitled "Effect of Oil Heat Treatment on Properties of 'Buluh semantan' (*Gigantochloa scortechinii* Gamble)" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the degree of Master of Science.

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Date: 17 December 2007

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Date: 22 January 2008

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

RAFIDAH BT MD SALIM

Date: 16 December 2007

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