

SIFAT FISIKA, MEKANIKA, DAN PEREKATAN BAMBU PETUNG TERMODIFIKASI TERMAL

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INTISARI

Bambu petung (*Dendrocalamus asper*) merupakan bahan baku berlignoselulosa yang berpotensi sebagai bahan baku laminasi. Modifikasi termal merupakan salah satu metode yang sering digunakan untuk meningkatkan stabilitas dimensi kayu/bambu. Perbedaan karakteristik permukaan bagian dalam (dekat rongga) dan bagian luar (dekat kulit luar) bambu dapat mempengaruhi proses modifikasi termal yang berakibat pada perubahan sifat fisika, mekanika, dan perekatan bambu. Oleh karena itu, penelitian ini bertujuan untuk menganalisis pengaruh suhu modifikasi termal terhadap karakteristik bilah bambu petung serta pengaruhnya terhadap pola penyusunan bidang rekat bilah bambu terhadap sifat laminasi bambu petung.

Pada penelitian ini, bilah bambu petung dimodifikasi termal pada suhu 140 °C, 160 °C, dan 180 °C selama 3 jam. Pengujian sebelum dan sesudah modifikasi termal meliputi kadar air, kerapatan, kekasaran permukaan, sudut kontak, perubahan warna dan perubahan komponen kimia dengan *Fourier Transform Infrared Spectroscopy* (FTIR). Bilah-bilah tersebut kemudian direkatkan dengan fenol formaldehida (120 g/m²) dan disusun dengan pola : dalam-dalam (T1), dalam-luar (T2), dan luar-luar (T3). Pengempaan bambu laminasi dilakukan pada 135 °C selama 10 menit. Pengujian pada bambu laminasi terdiri dari kadar air, kerapatan, delaminasi, modulus elastis (MoE), modulus patah (MoR), keteguhan geser, dan persentase kerusakan bambu. Hasil pengujian bilah bambu dianalisis menggunakan analisis varian satu arah (ANOVA), sedangkan bambu laminasi menggunakan analisis varian dua arah. Kedua hasil analisis tersebut diuji lanjut menggunakan *Honestly Significant Different* (HSD).

Hasil penelitian menunjukkan bahwa peningkatan suhu modifikasi termal berpengaruh nyata terhadap penurunan kadar air bilah dan laminasi, kerapatan, dan kekasaran permukaan, peningkatan sudut kontak, serta warna bambu menjadi lebih gelap. Suhu modifikasi yang semakin tinggi juga berpengaruh nyata terhadap penurunan MoR dan keteguhan geser laminasi bambu petung. Sementara itu, pola penyusunan bidang rekat bilah bambu berpengaruh nyata terhadap keteguhan geser dan MoE. Di antara pola penyusunan tersebut, T2 secara umum menunjukkan nilai sifat mekanik yang baik. Oleh karena itu, sifat fisika, mekanika, dan perekatan terbaik pada penelitian ini diperoleh pada laminasi bambu petung termodifikasi termal pada suhu 140 °C dengan pola penyusunan T2.

Kata kunci: bambu petung, modifikasi termal, bambu laminasi, fenol formaldehida, sifat mekanika, sifat perekatan.

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PHYSICAL, MECHANICAL, AND BONDING PROPERTIES OF THERMALLY MODIFIED PETUNG BAMBOO

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ABSTRACT

Petung bamboo (*Dendrocalamus asper*) is a lignocellulosic material with potential for use in laminated products. Thermal modification is a commonly employed method for enhancing the dimensional stability of wood/bamboo. Differences in surface characteristics of the inner (near the hollow) and the outer side (near the outer skin) are hypothesized to influence the thermal modification process, thereby affecting the bamboo's physical, mechanical, and bonding properties. Therefore, this study aims to analyze the effect of thermal modification temperature on the characteristics of petung bamboo strips, as well as the influence of the strip bonding configuration on the properties of the resulting laminated petung bamboo.

In this study, petung bamboo strips were thermally modified at temperatures of 140 °C, 160 °C, and 180 °C for 3 hours. Tests conducted before and after thermal modification included moisture content, density, surface roughness, contact angle, color changes, and changes in chemical composition using Fourier Transform Infrared Spectroscopy (FTIR). The strips were then bonded with phenol-formaldehyde resin (120 g/m²) and arranged in the following configuration: inner-inner (T1), inner-outer (T2), and outer-outer (T3). The laminated bamboo was pressed at 135 °C for 10 minutes. Testing of the laminated bamboo included moisture content, density, delamination, elastic modulus (MoE), modulus of rupture (MoR), shear strength, and percentage of bamboo damage. The test results for the bamboo strips were analyzed using one-way analysis of variance (ANOVA), while those for the laminated bamboo were analyzed using two-way analysis of variance. Both sets of analysis results were further tested using the Honestly Significant Difference (HSD) test.

The research results indicate that increasing the thermal modification temperature significantly affects the reduction of moisture content (in both strips and laminates), density, and surface roughness, as well as an increase in contact angle and a darkening of the bamboo color. Higher modification temperatures also significantly reduce the MoR and shear strength of the petung bamboo laminates. Meanwhile, the configuration of the bamboo strips significantly influences shear strength and the MoE. Among the tested configurations, T2 generally exhibited favorable mechanical properties. Consequently, the optimal physical, mechanical, and bonding properties in this study were achieved with petung bamboo laminates thermally modified at 140 °C using the T2 bonding surface configuration.

Keywords: petung bamboo, thermal modification, laminated bamboo, phenol-formaldehyde, mechanical properties, adhesive properties.

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