

INTISARI

Pada studi ini dilakukan produksi papan partikel dari bahan limbah bambu petung dengan perekat berbasis kitosan. Partikel limbah bambu merupakan salah satu limbah organik yang sering digunakan karena keberadaannya yang melimpah dan sifatnya yang lebih terbarukan. Perekat berbasis kitosan dikembangkan sebagai perekat alternatif, yang merupakan biopolimer lebih terbarukan dan lebih ramah lingkungan. Penambahan glukosa ke dalam perekat kitosan diharapkan dapat meningkatkan sifat perekat dan papan partikel lebih resistensi terhadap air. Penelitian ini menggunakan rancangan acak lengkap dengan faktor komposisi perekat kitosan-glukosa (10:0); (9:1); (8:2); dan (7:3). Metode pengempaan papan partikel dilakukan pada suhu 200°C selama 12 menit. Papan partikel terbaik dihasilkan dengan komposisi perekat 10:0 yang memiliki nilai kerapatan 0,736 g/cm³, kadar air 10,696%, pengembangan tebal 77,21%, penyerapan air 150,67%, modulus patah 6,13 MPa, dan modulus elastisitas 1,58 GPa. Penambahan glukosa ke dalam perekat kitosan tidak meningkatkan sifat fisika dan mekanika papan partikel. Analisis FTIR papan partikel menunjukkan terjadinya reaksi Maillard antara partikel bambu dan kitosan. Analisis keberlanjutan dari produksi bersih papan partikel ini juga telah dilakukan berdasarkan aspek lingkungan dan ekonomi. Analisis aspek lingkungan menunjukkan bahwa pemanfaatan limbah bambu dapat mereduksi emisi gas rumah kaca sebesar 2.058,24 ton CO₂eq serta emisi karbondioksida yang dihasilkan dari produksi papan partikel berdasarkan satuan berat papan partikel adalah 0,025 kg CO₂eq/kg. Analisis aspek ekonomi menunjukkan bahwa usaha papan partikel dinilai layak dan menguntungkan, dengan rincian: *Benefit Cost Ratio* sebesar 1,08; *Net Present Value* sebesar Rp 10.122.188.074; *Rate of Investment* sebesar 71,14%; *Payback Period* selama 1,5 tahun; *Internal Rate of Return* sebesar 33,57%; *Break Even Point* Rp 107.885 dan 169.919 produk/tahun; serta *Life Cycle Cost* senilai Rp 201.874.462.006.

Kata kunci: limbah bambu, glukosa, limbah, biokomposit, *life cycle cost*, emisi gas rumah kaca.

ABSTRACT

In this study, the production of particleboard from petung bamboo waste material has been carried out using a chitosan-based adhesive. Bamboo waste particles are one of the organic wastes that are often used because of their abundance and renewable properties. Chitosan-based adhesive was developed as an alternative adhesive, which is a more renewable and environmentally friendly biopolymer. The addition of glucose to chitosan adhesive is expected to increase the adhesive properties and make the particleboard more water-resistant. This study used a completely randomized design with the composition factor of chitosan-glucose adhesive was (10:0); (9:1); (8:2); and (7:3). The hot pressing method was carried out at a temperature of 200°C for 12 minutes. The best particleboard is produced with an adhesive composition of 10:0 which has a density value of 0.736 g/cm³, water content of 10.696%, thickness expansion of 77.21%, water absorption of 150.67%, modulus of rupture of 6.13 MPa, and modulus elasticity of 1. 58 GPa. The addition of glucose did not increase the particleboard's mechanical and physical properties. From FTIR analysis of the particleboard showed that the Maillard reaction occurred between bamboo particles and chitosan. Analysis of the sustainability of the clean production of particleboard has also been carried out on environmental and economic aspects. Analysis of environmental aspects shows that the use of bamboo waste can reduce greenhouse gas emissions by 2,058.24 tons CO₂eq and carbon dioxide emissions resulting from particle board production based on the unit weight of particle board are 0.025 kg CO₂eq/kg. Analysis of economic aspects shows that the particle board business is considered feasible and profitable, with details: Benefit Cost Ratio of 1,08; Net Present Value worth Rp 10.122.188.074; Rate of Investment of 71,14%; Payback Period is 1,5 year; Break Even Point worth Rp 107.885 and 169.919 sheets/year ; Internal Rate of Return of 33,57%; and the Life Cycle Cost value obtained is Rp 201.874.462.006.

Keywords: bamboo waste, chitosan, glucose, waste, biocomposite, life cycle cost, greenhouse gas emissions.