Analisis pengaruh perlakuan fermentasi air dan alkalisasi pada tandan kosong kelapa sawit sebagai bahan baku komposit plastik kayu ramah lingkungan = Analysis of the effect of water fermentation treatment and alkalization treatments on empty oil palm bunches as raw material for Eco-Friendly wood plastic composite

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Abstrak

Permintaan plastik domestik di Indonesia terus meningkat, sementara limbah organik seperti Tandan Kosong Kelapa Sawit (TKKS) menawarkan potensi sebagai bahan baku Wood Polymer Composite (WPC) berbasis polietilena daur ulang (Recycled Polyethylene, rPE). Penelitian ini mengkaji pengaruh perlakuan alkalisasi dan fermentasi terhadap sifat mekanis, kimia, morfologi, dan termal TKKS sebagai filler dalam WPC. Hasil menunjukkan bahwa alkalisasi efektif menghilangkan lignin dan hemiselulosa, menghasilkan struktur serat lebih kasar yang meningkatkan interaksi dengan matriks rPE, sehingga meningkatkan kekuatan tarik dan lentur. Fermentasi menggunakan bakteri G. sichuananse mempertahankan struktur selulosa yang lebih kristalin, meningkatkan fleksibilitas dan kompatibilitas serat dengan matriks polimer. Uji termal menunjukkan alkalisasi memberikan stabilitas termal tertinggi dengan onset degradasi pada 323,37°C, sedangkan fermentasi menghasilkan flexural strength dan ultimate tensile strength optimal pada kandungan serat 10–15%. Dengan performa mekanis dan termal yang baik, WPC berbasis TKKS dan rPE berpotensi sebagai material furnitur ramah lingkungan, memberikan solusi inovatif bagi pengelolaan limbah plastik dan organik di Indonesia.

.....The demand for domestic plastics in Indonesia continues to increase, while organic waste such as Empty Fruit Bunches (EFB) presents potential as a raw material for Wood Polymer Composite (WPC) based on recycled polyethylene (rPE). This study examines the effects of alkali treatment and fermentation on the mechanical, chemical, morphological, and thermal properties of EFB as a filler in WPC. The results demonstrate that alkali treatment effectively removes lignin and hemicellulose, producing coarser fiber structures that enhance interaction with the rPE matrix, thereby improving tensile and flexural strength. Fermentation using G. sichuananse bacteria preserves a more crystalline cellulose structure, improving the flexibility and compatibility of fibers with the polymer matrix. Thermal analysis shows that alkali treatment provides the highest thermal stability, with a primary degradation onset at 323.37°C, while fermentation achieves optimal flexural strength and ultimate tensile strength at 10–15% fiber content. With excellent mechanical and thermal performance, WPC based on EFB and rPE holds potential as an environmentally friendly furniture material, offering an innovative solution for managing plastic and organic waste in Indonesia.