

Iradiasi electron beam dalam pembuatan compatibilizer daur ulang polietilen untuk komposit kayu limbah kelapa sawit = Electron beam irradiation in the development of recycled polyethylene compatibilizer for wood plastic composites from oil palm empty fruit bunch

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Abstrak

Penggunaan plastik sehari-hari meningkatkan sampah plastik sulit terurai, sementara limbah tandan kosong kelapa sawit (TKKS) dari industri minyak kelapa sawit juga menjadi masalah lingkungan signifikan.

Penelitian ini mengkaji pengaruh iradiasi electron beam terhadap sifat kimia dan fisik recycled polyethylene (rPE) serta kompatibilitasnya dengan TKKS dalam komposit Wood Plastic Composite (WPC). Iradiasi electron beam digunakan untuk memodifikasi rPE agar lebih kompatibel dengan TKKS. RPE diiradiasi dengan dosis 0, 100, 200, dan 300 kGy, kemudian dikarakterisasi menggunakan Melt Flow Index (MFI) dan pengukuran sudut kontak. Hasil menunjukkan dosis iradiasi mempengaruhi viskositas dan sifat permukaan rPE. Pada dosis 100 kGy, terjadi peningkatan hubung silang yang menurunkan MFI, sementara pada 300 kGy, chain scission dominan meningkatkan MFI. Pengukuran sudut kontak menunjukkan peningkatan sifat hidrofilik hingga dosis 200 kGy, namun sedikit meningkat pada 300 kGy. Uji mekanik menggunakan Universal Testing Machine (UTM) menunjukkan WPC dengan iradiasi 100 kGy memiliki tensile strength dan elongation at break lebih tinggi dibandingkan tanpa iradiasi. Analisis Scanning Electron Microscopy (SEM) menunjukkan peningkatan adhesi antara serat TKKS dan matriks rPE pada sampel dengan iradiasi 100 kGy, menghasilkan struktur yang lebih homogen dan kuat. Penelitian ini menunjukkan iradiasi electron beam pada dosis optimal dapat meningkatkan sifat mekanik dan kompatibilitas WPC, menjadikannya alternatif potensial untuk mengatasi masalah lingkungan.

.....The use of plastic in daily life has led to an increase in non-degradable plastic waste, while empty fruit bunch (EFB) waste from the palm oil industry also poses a significant environmental problem. This study examines the effects of electron beam irradiation on the chemical and physical properties of recycled polyethylene (rPE) and its compatibility with EFB in the formation of Wood Plastic Composite (WPC). Electron beam irradiation is used to modify rPE to improve compatibility between hydrophobic rPE and hydrophilic EFB. In this study, rPE was irradiated at doses of 0, 100, 200, and 300 kGy, followed by characterization using Melt Flow Index (MFI) and contact angle measurements. Results showed that irradiation doses affect the viscosity and surface properties of rPE. At a dose of 100 kGy, increased hubung silang reduced MFI, while at 300 kGy, chain scission was dominant, significantly increasing MFI. Contact angle measurements indicated increased hydrophilicity up to a dose of 200 kGy, with a slight increase at 300 kGy. Mechanical testing using a Universal Testing Machine (UTM) showed that WPC irradiated at 100 kGy had higher tensile strength and elongation at break compared to non-irradiated samples. Scanning Electron Microscopy (SEM) analysis revealed improved adhesion between EFB fibers and the rPE matrix in samples irradiated at 100 kGy, resulting in a more homogeneous and robust structure. This study demonstrates that optimal electron beam irradiation doses can enhance the mechanical properties and compatibility of WPC, making it a potential alternative for addressing environmental issues.