

ABSTRAK

Penelitian ini menganalisis pengaruh variasi ukuran partikel dan gaya tekan terhadap kualitas biopelet berbahan dasar kayu cemara laut (*Casuarina equisetifolia*). Biopelet, sebagai bahan bakar biomassa, mendukung target *Net Zero Emission* (NZE) 2060. Ukuran partikel 20, 40, dan 60 *mesh* serta gaya tekan 2, 3, dan 4 ton diuji menggunakan proses densifikasi dan pengeringan pada 150°C selama 30 menit, dengan perekat tapioka 10%. Pengujian meliputi kadar air, densitas, dan nilai kalor berdasarkan SNI, dianalisis menggunakan ANOVA dua arah. Hasil menunjukkan ukuran partikel 60 *mesh* dengan gaya tekan 4 ton menghasilkan biopelet terbaik (densitas 1,191 g/cm³, kadar air 5,27%, dan nilai kalor 4.302,67 cal/g). Sebaliknya, ukuran partikel 20 *mesh* memberikan performa lebih rendah (densitas 0,947 g/cm³, kadar air 9,49%). Kombinasi ukuran partikel kecil dan gaya tekan tinggi memberikan kualitas optimal. Penelitian ini berkontribusi pada pengembangan energi terbarukan berbasis biomassa yang efisien dan berkelanjutan.

Kata kunci: Biopelet, kayu cemara laut, densitas, kadar air, nilai kalor, energi terbarukan, *Net Zero Emission*.

ABSTRACT

*This study analyzes the effect of particle size variation and compression force on the quality of biopellets made from *Casuarina equisetifolia* wood. Biopellets, as a biomass-based fuel, support the Net Zero Emission (NZE) 2060 target. Particle sizes of 20, 40, and 60 mesh and compression forces of 2, 3, and 4 tons were tested using densification and drying processes at 150°C for 30 minutes, with 10% tapioca adhesive. The quality tests, including moisture content, density, and calorific value, were conducted based on SNI standards and analyzed using two-way ANOVA. Results showed that a 60-mesh particle size with a 4-ton compression force produced the best biopellet quality (density of 1.191 g/cm³, moisture content of 5.27%, and calorific value of 4,302.67 cal/g). Conversely, a 20-mesh particle size resulted in lower performance (density of 0.947 g/cm³, moisture content of 9.49%). The combination of smaller particle sizes and higher compression forces provided optimal quality. This study contributes to the development of efficient and sustainable biomass-based renewable energy.*

*Keywords: Biopellets, *Casuarina equisetifolia*, density, moisture content, calorific value, renewable energy, Net Zero Emission.*