

**PENGARUH UKURAN PARTIKEL DAN PENAMBAHAN SERBUK
TEMPURUNG KELAPA (*Cocos nucifera*) TERHADAP KUALITAS PELET
SERBUK KAYU *Eucalyptus pellita* F. Muell.**

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INTISARI

Kebutuhan energi terbarukan mendorong pemanfaatan biomassa sebagai bahan bakar alternatif yang ramah lingkungan. Pelet kayu merupakan biofuel berbentuk silinder hasil densifikasi serbuk kayu dengan atau tanpa bahan aditif, yang memiliki keunggulan berupa densitas energi tinggi, kemudahan penyimpanan, dan efisiensi transportasi dibandingkan biomassa mentah. Kayu *Eucalyptus pellita* F. Muell memiliki potensi sebagai bahan baku pelet kayu, tetapi nilai kalor alaminya (4.241 kal/g) belum memenuhi SNI 8021:2020 pelet kayu mutu I (≥ 4.300 kal/g). Penelitian ini bertujuan mengkaji pengaruh ukuran partikel dan penambahan tempurung kelapa terhadap kualitas pelet kayu *Eucalyptus pellita* F. Muell, serta menentukan kombinasi terbaik sesuai standar nasional dan internasional.

Penelitian ini menggunakan rancangan acak lengkap faktorial dengan dua faktor yaitu proporsi bahan baku kayu *Eucalyptus pellita* F. Muell terhadap serbuk tempurung kelapa (*Cocos nucifera*) (100:0; 85:15; 70:30; 55:45) dan ukuran partikel (20–40 mesh; 40–60 mesh; 60–80 mesh), dengan 3 ulangan pengujian. Pelet kayu dicetak dengan metode *single-peletizing* menggunakan kempa hidrolis dengan tekanan 150 kg/cm², kemudian diuji sifat fisika (berat jenis, kekuatan tekan radial) dan sifat proksimat (kadar air, kadar abu, kadar zat mudah menguap, kadar karbon terikat) serta nilai kalor. Analisis dilakukan menggunakan *ANOVA* dan uji HSD.

Hasil penelitian menunjukkan bahwa penambahan tempurung kelapa 45% dan ukuran partikel 60–80 mesh menghasilkan kadar air terendah (8,835%), nilai kalor tertinggi (4.491 kal/g), berat jenis 1,240 g/cm³, dan kadar abu 0,497%, memenuhi SNI 8021:2020 mutu II. Proporsi ini meningkatkan nilai kalor sebesar 5,6% dibanding kontrol (100% kayu *Eucalyptus pellita* F. Muell). Dengan demikian, kombinasi bahan baku dan ukuran partikel yang tepat mampu meningkatkan kualitas pelet kayu *Eucalyptus pellita* F. Muell sehingga layak sebagai sumber energi terbarukan.

Kata kunci: biomassa, pelet kayu, energi terbarukan, *Eucalyptus pellita* F. Muell, tempurung kelapa.

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INFLUENCE OF PARTICLE SIZE AND COCONUT SHELL (*Cocos nucifera*) ADDITION ON THE QUALITY OF *Eucalyptus Pellita* F. Muell BIOMASS PELLETS

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ABSTRACT

The transition towards renewable energy necessitates forces the development of environmentally high-quality biomass fuels to reduce fossil resources. Wood pellets, produced by densifying biomass particles into cylindrical forms, exhibit advantages such as high energy density, ease of handling, and low transportation costs. Although *Eucalyptus pellita* F. Muell is a fast-growing species with promising fuel characteristics, its inherent calorific value (4.241 cal/g) does not meet the Indonesian National Standard (SNI) Grade I requirement (≥ 4.300 cal/g). This study addresses this limitation by investigating the effects of particle size and coconut shell (*Cocos nucifera*) addition on *Eucalyptus pellita* F. Muell to improve the wood pellet quality.

A completely randomized 4×3 factorial design was applied in this research, comprising four feedstock ratios (100:0, 85:15, 70:30, 55:45 w/w of *Eucalyptus pellita* F. Muell to coconut shell) and three particle sizes (20–40 mesh, 40–60 mesh, 60–80 mesh), with three replications. Wood pellets were produced using a single-pelletizing hydraulic press by compressive power of 150 kg/cm², and evaluated for their bulk density, radial compressive strength, moisture content, ash content, volatile matter, fixed carbon, and calorific value. Statistical analysis was performed using ANOVA followed by HSD.

This research provides the optimal formulation of 45% coconut shell with 60–80 mesh particle size, achieved a moisture content of 8.835%, calorific value of 4,491 cal/g, bulk density of 1.240 g/cm³, and ash content of 0.497%, this result is already fulfilled SNI 8021:2020 Grade II specifications. This composition improved the calorific value by 5.6% over the control (100% *Eucalyptus pellita* F. Muell). The findings highlight that optimizing feedstock composition and particle size can significantly enhance *Eucalyptus pellita* F. Muell wood pellet quality, offering a competitive pathway for sustainable bioenergy production.

Keywords: biomass fuel; wood pellet quality; *Eucalyptus pellita* F. Muell; coconut shell; calorific value.

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