

ABSTRAK

KARAKTERISASI *SYNGAS* HASIL GASIFIKASI PELET BAMBU BETUNG (*Dendrocalamus asper*) MENGGUNAKAN *DOWNDRAFT GASIFIER*

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Ketergantungan pada energi fosil mendorong eksplorasi sumber energi terbarukan, salah satunya melalui pemanfaatan biomassa bambu betung (*Dendrocalamus asper*) sebagai bahan baku gasifikasi. Penelitian ini bertujuan untuk menganalisis komposisi *syngas*, nilai *Lower Heating Value* (LHV), serta karakteristik proksimat pelet bambu betung dan produk samping (*ash*) hasil gasifikasi menggunakan *downdraft gasifier*. Proses gasifikasi dilakukan selama 60 menit menggunakan 20 kg pelet bambu betung pada reaktor *downdraft gasifier* berkapasitas 15 kWh, dan analisis *syngas* dilakukan secara *real-time* menggunakan *Portable Infrared Syngas Analyzer Gasboard G3100-P*. Hasil penelitian menunjukkan bahwa *syngas* yang dihasilkan mengandung rata-rata CO sebesar 13,62%, CO₂ 13,28%, CH₄ 2,55%, H₂ 8,65%, dan O₂ 1,64%, dengan nilai LHV rata-rata sebesar 887,57 kcal/m³. Analisis proksimat pelet bambu betung menunjukkan kadar air 7,10%, kadar abu 12,02%, kadar zat terbang 74,11%, dan karbon terikat 6,78%. Setelah gasifikasi, *ash* (*by-product*) memiliki kadar air 4,67%, kadar abu 73,09%, kadar zat terbang 17,61%, dan kadar karbon terikat 4,63%. Pelet bambu betung terbukti memenuhi syarat sebagai bahan baku *downdraft gasifier*, dengan kadar air di bawah 20% dan kadar zat terbang yang tinggi, sehingga berpotensi menjadi sumber energi terbarukan yang berkelanjutan.

Kata kunci: bambu betung, biomassa, *downdraft gasifier*, gasifikasi, *lower heating value*, pelet, *syngas*

ABSTRACT

CHARACTERIZATION OF SYNGAS PRODUCED VIA GASIFICATION OF BETUNG BAMBOO PELLETS (*Dendrocalamus asper*) USING A DOWNDRAFT GASIFIER

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*The global reliance on fossil fuels has driven the exploration of renewable energy sources, including the use of betung bamboo (*Dendrocalamus asper*) biomass as a feedstock for gasification. This study aims to analyze the syngas composition, lower heating value (LHV), and proximate characteristics of *D. asper* bamboo pellets, as well as the by-product (ash) resulting from their gasification in a downdraft gasifier. The gasification process was conducted for 60 minutes using 20 kg of *D. asper* bamboo pellets in a 15-kWh downdraft gasifier reactor, with real-time syngas analysis performed using a portable infrared syngas analyzer (Gasboard-3100P). The results demonstrated that the produced syngas contained average concentrations of 13.62% CO, 13.28% CO₂, 2.55% CH₄, 8.65% H₂, and 1.64% O₂, yielding an average LHV of 887.57 kcal/m³. Proximate analysis of the bamboo pellets revealed a moisture content of 7.10%, an ash content of 12.02%, a volatile matter content of 74.11%, and a fixed carbon content of 6.78%. Following gasification, the ash byproduct exhibited a moisture content of 4.67%, an ash content of 73.09%, a volatile matter content of 17.61%, and a fixed carbon content of 4.63%. These findings demonstrate that betung bamboo pellets meet the critical requirements for downdraft gasifier feedstock—specifically, a moisture content below 20% and high volatile matter—highlighting their potential as a sustainable, renewable energy source.*

Keywords: betung bamboo, biomass, downdraft gasifier, gasification, Lower Heating Value, pellets, syngas