

ABSTRAK

GASIFIKASI PELET KAYU KARET (*Hevea brasiliensis*) SEBAGAI SUMBER ENERGI TERBARUKAN MENGGUNAKAN *DOWNDRAFT GASIFIER*

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Meningkatnya kebutuhan energi global, disertai dengan menurunnya cadangan bahan bakar fosil, mendorong pengembangan energi terbarukan berbasis biomassa. Kayu karet (*Hevea brasiliensis*) merupakan salah satu sumber biomassa potensial karena ketersediaannya yang melimpah dari kegiatan peremajaan kebun rakyat. Penelitian ini bertujuan untuk menganalisis karakteristik energi pelet kayu karet sebagai bahan bakar biomassa, menganalisis komposisi gas sintesis (*syngas*) dan nilai kalor rendah (*Lower Heating Value*), serta karakteristik *ash* (*by-product* gasifikasi) menggunakan *gasifier* tipe *downdraft*. Penelitian dilaksanakan di Laboratorium Teknologi Hasil Hutan, Fakultas Pertanian, Universitas Lampung dengan menggunakan 20 kg pelet kayu karet sebagai bahan baku. Prosedur gasifikasi berlangsung melalui empat tahapan utama, yaitu pengeringan, pirolisis, pembakaran, dan reduksi yang dilakukan di dalam sistem *gasifier* tipe *downdraft*. Analisis *syngas* dilakukan menggunakan *portable infrared syngas analyzer* (Gasboard G3100-P) untuk menentukan konsentrasi CO, CO₂, CH₄, H₂, dan O₂. Hasil penelitian menunjukkan bahwa rata-rata komposisi *syngas* yang dihasilkan adalah 17,98% CO, 8,58% CO₂, 1,57% CH₄, 10,04% H₂, dan 1,78% O₂. Nilai kalor rata-rata (LHV) sebesar 725,81 kcal/m³ dengan kisaran 690–775 kcal/m³. Hasil analisis proksimat menunjukkan kadar air 10,93%, zat terbang 74,37%, kadar abu 8,60%, dan karbon terikat 6,20% pada biomassa pelet, sedangkan pada *ash* (*by-product*) diperoleh kadar air 9,58%, zat terbang 14,42%, kadar abu 71,61%, dan karbon terikat 4,37%. Komposisi *syngas* yang dihasilkan berada dalam kisaran ideal untuk *gasifier* tipe *downdraft*, sehingga menunjukkan bahwa pelet kayu karet memiliki potensi yang tinggi sebagai bahan bakar energi terbarukan berbasis biomassa.

Kata kunci: biomassa, gasifikasi, kayu karet, *syngas*, *downdraft gasifier*.

ABSTRACT

GASIFICATION OF RUBBER WOOD PELLETS (*Hevea brasiliensis*) AS A RENEWABLE ENERGY SOURCE USING DOWNDRAFT GASIFIER

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*The increasing global energy demand, coupled with declining fossil fuel reserves, is driving the development of biomass-based renewable energy. Rubber wood (*Hevea brasiliensis*) is a potential biomass source due to its abundant availability from the rejuvenation of community gardens. This study aims to analyze the energy characteristics of rubber wood pellets as biomass fuel, analyze the composition of synthesis gas (syngas) and lower heating value (LHV), and the characteristics of ash (residue from the gasification process) using a downdraft gasifier. The study was conducted at the Forest Products Technology Laboratory, Faculty of Agriculture, University of Lampung, using 20 kg of rubberwood pellets as the raw material. The gasification procedure progresses through four fundamental stages, including drying, pyrolysis, combustion, and reduction, which are conducted within a downdraft gasifier system. Syngas analysis was performed using a portable infrared syngas analyzer (Gasboard G3100-P) to determine the concentrations of CO, CO₂, CH₄, H₂, and O₂. The results showed that the average composition of the syngas produced was 17.98% CO, 8.58% CO₂, 1.57% CH₄, 10.04% H₂, and 1.78% O₂. The average calorific value (LHV) was 725.81 kcal/m³ with a range of 690–775 kcal/m³. The proximate analysis results showed a moisture content of 10.93%, volatile matter 74.37%, ash content 8.60%, and fixed carbon of 6.20% in the pellet biomass, while the ash (by-product) had a moisture content of 9.58%, volatile matter 14.42%, ash content 71.61%, and fixed carbon 4.37%. The composition of the syngas produced was within the ideal range for a downdraft, indicating that rubberwood pellets have high potential as a biomass-based renewable energy fuel.*

Keywords: biomass, gasification, rubber wood, syngas, downdraft gasifier.