

ABSTRAK

KARAKTERISASI DAN PEMURNIAN *SYNGAS* PADA GASIFIKASI *UPDRAFT* ARANG TEMPURUNG KELAPA MENGGUNAKAN *WET SCRUBBER* DENGAN VARIASI LAJU ALIR ABSORBEN NaOH

(Muhammad Al-Farid, 2026, 94 Halaman, 25 Tabel, 42 Gambar, 4 Lampiran)

Indonesia memiliki potensi besar sebagai penghasil biomassa yang dapat dimanfaatkan sebagai sumber energi alternatif di tengah meningkatnya kebutuhan energi dan ketergantungan terhadap bahan bakar fosil. Tempurung kelapa merupakan salah satu limbah biomassa melimpah dengan kandungan karbon tinggi yang berpotensi diolah menjadi bahan bakar alternatif melalui proses gasifikasi. Namun, *syngas* hasil gasifikasi masih mengandung gas pengotor seperti CO₂ dan H₂S yang dapat menurunkan kualitas dan nilai kalornya, sehingga diperlukan proses pemurnian menggunakan *wet scrubber* dengan absorben NaOH. Penelitian ini bertujuan untuk menganalisis pengaruh variasi laju alir absorben NaOH pada *wet scrubber* terhadap komposisi *syngas*, efektivitas penyerapan CO₂ dan H₂S, serta nilai kalor (*Lower Heating Value/LHV*) *syngas* hasil gasifikasi *updraft* berbahan baku arang tempurung kelapa. Penelitian dilakukan dengan memvariasikan laju alir absorben NaOH pada reaktor *wet scrubber*, kemudian dianalisis komposisi gas serta nilai kalornya. Hasil penelitian menunjukkan bahwa laju alir absorben 2 L/menit menghasilkan kadar gas mampu bakar tertinggi, yaitu CH₄ sebesar 4,12%, H₂ sebesar 15,6%, dan CO sebesar 24,4%, meningkat dari kondisi sebelum pemurnian masing-masing sebesar 3,19%, 12,8%, dan 21,2%. Efisiensi penyerapan gas pengotor tertinggi dicapai pada laju alir 2,5 L/menit, dengan efisiensi penyerapan CO₂ sebesar 45% dan H₂S sebesar 63%. Nilai LHV *syngas* tertinggi diperoleh sebesar 6,320 MJ/m³ pada laju alir absorben 2 L/menit, meningkat dari nilai sebelum pemurnian sebesar 5,214 MJ/m³. Secara keseluruhan, peningkatan laju alir absorben NaOH pada *wet scrubber* berpengaruh positif terhadap peningkatan kualitas *syngas* melalui reduksi gas pengotor dan peningkatan nilai kalor pada proses gasifikasi *updraft* arang tempurung kelapa.

Kata kunci : Gasifikasi *Updraft*, Arang Tempurung Kelapa, *Wet Scrubber*, NaOH, *Syngas*, LHV.

ABSTRACT

CHARACTERIZATION AND PURIFICATION OF SYNGAS FROM UPDRAFT GASIFICATION OF COCONUT SHELL CHARCOAL USING A WET SCRUBBER WITH VARIATION IN NaOH ABSORBENT FLOW RATE

(Muhammad Al-Farid, 2026, 94 Pages, 25 Tables, 42 Figures, 4 Appendices)

Indonesia has significant potential as a producer of biomass resources that can be utilized as alternative energy amid increasing energy demand and dependence on fossil fuels. Coconut shell is one of the abundant biomass wastes with high carbon content that has the potential to be developed into alternative fuel through gasification. However, syngas produced from gasification still contains impurity gases such as CO₂ and H₂S, which can reduce its quality and heating value, thus requiring a purification process using a wet scrubber with NaOH as the absorbent. This study aims to analyze the effect of NaOH absorbent flow rate variation in a wet scrubber on syngas composition, the effectiveness of CO₂ and H₂S absorption, and the calorific value (Lower Heating Value/LHV) of syngas produced from updraft gasification using coconut shell charcoal. The research was conducted by varying the NaOH absorbent flow rate in the wet scrubber reactor, followed by analysis of gas composition and calorific value. The results showed that an absorbent flow rate of 2 L/minute produced the highest combustible gas content, namely CH₄ of 4.12%, H₂ of 15.6%, and CO of 24.4%, increased from the pre-purification conditions of 3.19%, 12.8%, and 21.2%, respectively. The highest impurity gas absorption efficiency was achieved at a flow rate of 2.5 L/minute, with CO₂ absorption efficiency of 45% and H₂S of 63%. The highest syngas LHV was obtained at 6.320 MJ/m³ at an absorbent flow rate of 2 L/minute, increased from the pre-purification value of 5.214 MJ/m³. Overall, the increase in NaOH absorbent flow rate in the wet scrubber has a positive effect on improving syngas quality through the reduction of impurity gases and the increase of calorific value in the updraft gasification process of coconut shell charcoal.

Keywords: *Updraft Gasification, Coconut Shell Charcoal, Wet Scrubber, NaOH, Syngas, LHV.*