UTILIZATION OF BIOPELLETS FROM YOUNG COCONUT PEELS FOR TOP-LIT UPDRAFT (TLUD) STOVE: QUALITY ANALYSIS, EMISSION FACTORS, AND COMBUSTION PERFORMANCE

UNDERGRADUATE THESIS

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By:
MUHAMMAD ATSIIL DHAIFULLAH
2210943036

Supervisor:
Dr. Ir. FADJAR GOEMBIRA, S.T., M.Sc.
ISRA' SURYATI, S.T., M.Si.

UNDERGRADUATE PROGRAM
DEPARTMENT OF ENVIRONMENTAL ENGINEERING
FACULTY OF ENGINEERING - UNIVERSITAS ANDALAS
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ABSTRACT

The increasing demand for renewable energy encouraged the utilization of biomass as an alternative energy source. Young coconut peels had potential to be converted into biopellets for household-scale energy applications. This research aimed to analyze the quality of young coconut peel biopellets based on SNI 8675:2018 and to evaluate the emission factors of $PM_{2.5}$, CO, and CO_2, as well as the combustion performance, in Top-Lit Updraft (TLUD) stove based on SNI 7926:2013. The research methodology involved producing biopellets from young coconut peels, followed by proximate analysis, density measurement, net calorific value determination, and sulfur content analysis. Combustion experiments were conducted using TLUD stove to measure emission factors and combustion performance parameters. The results showed that young coconut peels biopellets had density of 0.76 ± 0.11 g/cm³, ash content of 4.94 ± 0.04%, moisture content of 8.88 ± 0.33%, volatile matter of 68.23 ± 1.23%, fixed carbon of 17.95 ± 1.51%, net calorific value of 16.51 ± 0.57 MJ/kg, and sulfur content of 0.12 ± 0.02%. These properties met the reference values of SNI 8675:2018, except for sulfur content. Combustion tests produced $PM_{2.5}$ emission factors of 224.63 ± 12.26 mg/kg, CO emission factors of 4.40 ± 1.55 g/kg, and CO_2 emission factors of 268.31 ± 18.59 g/kg, with $PM_{2.5}$ and CO below the limits specified in SNI 7926:2013. The TLUD stove achieved a specific fuel consumption of 0.74 ± 0.04 kg/hour, combustion efficiency of 96.25 ± 0.12%, and thermal efficiency of 25.28 ± 1.58%, all of which complied with the standard.

Keywords: *Biopellets, combustion performance, emission factor, TLUD stove young coconut peels*