

ABSTRAK

ANALISIS PENGARUH LAJU ALIR UDARA TERHADAP KINERJA KOMPOR GASIFIKASI BIOMASSA MENGGUNAKAN BAHAN BAKAR BIOPELET SEKAM PADI DAN SERBUK KAYU

(Maulidya Zahra Tunisa, 2024, Skripsi, 99 Halaman, 21 Tabel, 30 Gambar, 4 Lampiran)

Indonesia memiliki potensi besar dalam pemanfaatan biomassa sebagai sumber energi terbarukan, terutama untuk kebutuhan rumah tangga. Kompor gasifikasi biomassa dapat membantu kebutuhan rumah tangga lebih efisien dan ramah lingkungan. Penelitian ini menganalisis pengaruh variasi laju alir udara terhadap kinerja kompor gasifikasi biomassa berbahan bakar biopellet campuran sekam padi dan serbuk kayu. Metode eksperimen dilakukan dengan variasi laju alir udara 3 m/s, 4 m/s, 5 m/s, 6 m/s, dan 7 m/s, menggunakan metode *Water Boiling Test* (WBT) untuk mengukur parameter seperti temperatur nyala api, *boiling time*, lama nyala api, emisi CO dan CO₂, efisiensi termal, *Specific Fuel Consumption* (SFC), serta daya *output/power* pada kompor gasifikasi biomassa. Hasil penelitian menunjukkan bahwa laju alir udara 6 m/s menghasilkan kinerja optimal dengan temperatur nyala api tertinggi (786°C), *boiling time* tercepat (9,1 menit), efisiensi termal maksimal (61,80%), dan emisi CO terendah (20 ppm). Efisiensi pembakaran mencapai 94,38%, dengan konsumsi bahan bakar spesifik terendah (0,53 kg/jam). Sementara itu, laju alir udara 3 m/s menghasilkan nyala api terlalu lama (65,08 menit) tetapi dengan efisiensi termal lebih rendah (44,04%). Kesimpulan penelitian ini menegaskan pentingnya pengaturan laju alir udara untuk mencapai pembakaran biomassa yang efisien dan ramah lingkungan. Penelitian ini memberikan kontribusi signifikan bagi pengembangan teknologi energi terbarukan, khususnya kompor biomassa, serta manfaat praktis bagi masyarakat dan akademisi.

Kata kunci: Kompor gasifikasi biomassa, biopellet, laju alir udara, efisiensi termal, emisi CO.

ABSTRACT

ANALYSIS OF THE EFFECT OF AIR FLOW RATE ON THE PERFORMANCE OF BIOMASS GASIFICATION STOVE USING RICE HUSK AND SAWDUST BIOPELLETS FUEL

(Maulidya Zahra Tunisa, 2024, Thesis, 99 Pages, 21 Tables, 30 Figures, 4 Appendices)

Indonesia has great potential in utilizing biomass as a renewable energy source, especially for household needs. Biomass gasification stoves can help household needs more efficiently and environmentally friendly. This study analyzes the effect of air flow rate variations on the performance of biomass gasification stoves fueled by biopellets mixed with rice husks and sawdust. The experimental method was carried out with variations in air flow rates of 3 m/s, 4 m/s, 5 m/s, 6 m/s, and 7 m/s, using the Water Boiling Test (WBT) method to measure parameters such as flame temperature, boiling time, flame duration, CO and CO₂ emissions, thermal efficiency, Specific Fuel Consumption (SFC), and output power/power in biomass gasification stoves. The results showed that an air flow rate of 6 m/s produced optimal performance with the highest flame temperature (786°C), fastest boiling time (9.1 minutes), maximum thermal efficiency (61.80%), and lowest CO₂ emissions (20 ppm). Combustion efficiency reached 94.38%, with the lowest specific fuel consumption (0.53 kg/h). Meanwhile, an air flow rate of 3 m/s produced the longest flame (65.08 min) but with lower thermal efficiency (44.04%). The conclusion of this research confirms the importance of air flow rate regulation to achieve efficient and environmentally friendly biomass combustion. This research makes a significant contribution to the development of renewable energy technology, especially biomass stoves, as well as practical benefits for the community and academia.

Keywords : Biomass gasification stove, biopellets, air flow rate, thermal efficiency, CO emissions.