

ABSTRAK

UJI KINERJA KOMPOR BIOMASSA SKALA RUMAH TANGGA MENGUNAKAN EMPAT JENIS BAHAN BAKAR

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Seiring dengan kebijakan pemerintah dalam mengurangi subsidi Liquefied Petroleum Gas (LPG), pengembangan dan pemanfaatan kompor berbahan bakar biomassa menjadi salah satu alternatif sumber energi rumah tangga yang perlu diperhatikan. Kompor biomassa memiliki potensi untuk mengurangi ketergantungan terhadap bahan bakar fosil sekaligus memanfaatkan sumber daya biomassa yang tersedia secara lokal. Namun, kinerja kompor biomassa sangat dipengaruhi oleh desain kompor serta karakteristik bahan bakar biomassa yang digunakan. Perbedaan desain kompor dapat memengaruhi proses pembakaran, distribusi panas, efisiensi termal, dan konsumsi bahan bakar. Selain itu, setiap jenis biomassa memiliki sifat fisik dan kimia yang berbeda, seperti kadar air, nilai kalor, densitas, dan kandungan abu, yang turut menentukan kualitas pembakaran dan performa kompor. Oleh karena itu, diperlukan pengujian kinerja kompor biomassa dengan berbagai jenis bahan bakar untuk memperoleh desain dan bahan bakar yang memberikan kinerja terbaik.

Penelitian ini bertujuan untuk menguji kinerja kompor biomassa skala rumah tangga menggunakan empat jenis bahan bakar, yaitu arang, biopellet, limbah kayu, dan sabut kelapa muda pada dua tipe kompor biomassa. Penelitian menggunakan Rancangan Acak Lengkap (RAL) faktorial dengan dua faktor, yaitu jenis kompor dan jenis bahan bakar, masing-masing diulang sebanyak tiga kali. Pengujian dilakukan menggunakan metode Water Boiling Test (WBT) dengan parameter

karakteristik bahan bakar, konsumsi bahan bakar, efisiensi termal, daya kompor, dan suhu pembakaran.

Hasil penelitian menunjukkan bahwa jenis bahan bakar berpengaruh nyata terhadap karakteristik bahan bakar dan kinerja kompor biomassa. Arang memiliki kadar air terendah (1,89%), nilai kalor tertinggi (27,48 MJ/kg), dan nilai fixed carbon tertinggi (69,11%). Sabut kelapa muda memiliki kadar abu dan volatile matter tertinggi, masing-masing sebesar 2,79% dan 84,06%. Hasil pengujian menunjukkan bahwa bahan bakar arang menghasilkan performa pembakaran yang lebih baik dibandingkan bahan bakar lainnya. Jenis bahan bakar menjadi faktor utama yang memengaruhi efisiensi dan daya kompor biomassa skala rumah tangga.

Kata kunci: Biomassa, Kompor Biomassa, Biopellet, Arang, Efisiensi Termal, Water Boiling Test

ABSTRACT

PERFORMANCE TESTING OF HOUSEHOLD-SCALE BIOMASS STOVES USING FOUR TYPES OF FUEL

By

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In line with the government's policy to reduce Liquefied Petroleum Gas (LPG) subsidies, the development and utilization of biomass-fueled stoves have become a promising alternative household energy source. Biomass stoves have the potential to reduce dependence on fossil fuels while utilizing locally available biomass resources. However, the performance of biomass stoves is highly influenced by stove design and the characteristics of the biomass fuel used. Differences in stove design can affect the combustion process, heat distribution, thermal efficiency, and fuel consumption. In addition, each type of biomass possesses distinct physical and chemical properties, such as moisture content, ash content, volatile matter, fixed carbon, and calorific value, which significantly influence combustion quality and stove performance. Therefore, performance testing is necessary to determine the effects of stove type and fuel type on the performance of household-scale biomass stoves.

This study aimed to evaluate the performance of two types of household-scale biomass stoves using four different fuels: charcoal, wood pellets, wood waste, and young coconut husk. The experiment employed a factorial Completely

Randomized Design (CRD) with two factors, namely stove type and fuel type, each replicated three times. Performance testing was conducted using the Water Boiling Test (WBT) method. The observed parameters included fuel characteristics, fuel consumption, thermal efficiency, stove power output, and combustion temperature.

The results showed that fuel type significantly affected both fuel characteristics and biomass stove performance. Charcoal exhibited the lowest moisture content (1.89%), the highest calorific value (27.48 MJ/kg), and the highest fixed carbon content (69.11%). Meanwhile, young coconut husk had the highest ash content and volatile matter, at 2.79% and 84.06%, respectively. Based on the WBT results, charcoal demonstrated superior combustion performance compared with the other fuels, as indicated by higher thermal efficiency and stove power output. Therefore, fuel type was identified as the primary factor influencing the performance of household-scale biomass stoves, with charcoal being the most effective fuel for enhancing stove performance.

Key words: biomass, biomass stove, charcoal, wood pellets, thermal efficiency, Water Boiling Test.