

ABSTRAK

Peningkatan konsumsi energi dan dampak bahan bakar fosil mendorong pengembangan energi terbarukan berbasis pemanfaatan limbah pertanian melimpah di Indonesia. Penelitian ini bertujuan untuk menganalisis karakteristik pembakaran biopellet berbahan baku campuran bongkol jagung dan batok kelapa dengan penambahan zeolit alam. Metode penelitian yang digunakan adalah eksperimen di laboratorium dengan variasi komposisi zeolit alam sebesar 15 g dan 20 g, serta variasi metode karbonisasi berupa torefaksi pada suhu 200°C dan pirolisis pada suhu 450°C. Biopellet dicetak dengan diameter 10 mm dan panjang 25 mm menggunakan tepung tapioka sebagai bahan perekat. Parameter yang dianalisis meliputi kadar air, nilai kalor, dan laju pembakaran. Hasil penelitian menunjukkan bahwa sampel CT1 (torefaksi dengan penambahan zeolit 15 g) menghasilkan kadar air terendah sebesar 10% dengan nilai kalor sebesar 2907,57 kal/g. Sementara itu, sampel CP1 (pirolisis dengan penambahan zeolit 15 g) menghasilkan nilai kalor tertinggi sebesar 4047,80 kal/g. Pada pengujian laju pembakaran, sampel CP1 menunjukkan laju pembakaran tercepat sebesar 0,06 g/detik dengan waktu pembakaran 1,03 menit. Peningkatan komposisi zeolit cenderung menurunkan nilai kalor biopellet, namun penambahan zeolit alam serta variasi metode karbonisasi terbukti berpengaruh terhadap kinerja pembakaran biopellet. Penelitian ini menyimpulkan bahwa kombinasi bongkol jagung dan batok kelapa dengan penambahan zeolit alam serta perlakuan pirolisis mampu menghasilkan biopellet dengan karakteristik pembakaran yang baik, sehingga berpotensi dikembangkan sebagai sumber energi terbarukan yang ramah lingkungan sekaligus mendukung pengurangan limbah pertanian.

Kata kunci: Biopellet, Bongkol Jagung, Batok Kelapa, Zeolit Alam, Nilai Kalor, Laju Pembakaran

ABSTRACT

The increasing energy consumption and the environmental impacts of fossil fuels have driven the development of renewable energy based on the utilization of abundant agricultural waste in Indonesia. This study aims to analyze the combustion characteristics of bio-pellets made from a mixture of corn cobs and coconut shells with the addition of natural zeolite. The research method employed was a laboratory experiment with variations in natural zeolite composition of 15 g and 20 g, as well as variations in carbonization methods, namely torrefaction at 200°C and pyrolysis at 450°C. The bio-pellets were molded with a diameter of 10 mm and a length of 25 mm using tapioca starch as a binder. The parameters analyzed included moisture content, calorific value, and combustion rate. The results showed that sample CT1 (torrefaction with the addition of 15 g of zeolite) produced the lowest moisture content of 10% with a calorific value of 2907.57 cal/g. Meanwhile, sample CP1 (pyrolysis with the addition of 15 g of zeolite) produced the highest calorific value of 4047.80 cal/g. In the combustion rate test, sample CP1 exhibited the fastest combustion rate of 0.06 g/s with a burning time of 1.03 minutes. An increase in zeolite composition tended to reduce the calorific value of the bio-pellets; however, the addition of natural zeolite and variations in carbonization methods were proven to affect the combustion performance of the bio-pellets. This study concludes that the combination of corn cobs and coconut shells with the addition of natural zeolite and pyrolysis treatment can produce bio-pellets with good combustion characteristics, making them potential candidates for development as environmentally friendly renewable energy sources while also supporting the reduction of agricultural waste.

Keywords: *Bio-pellets, Corn Cobs, Coconut Shells, Natural Zeolite, Calorific Value, Combustion Rate*