ABSTRAK

PEMANFAATAN LIMBAH PLASTIK JENIS PP DAN TEMPURUNG KELAPA MELALUI PROSES PIROLISIS SEBAGAI ENERGI ALTERNATIF

(Raden Muhammad Dika Adriansyah, 57 Halaman, 08 Tabel, 08 Gambar)

Meningkatnya jumlah limbah plastik Polypropylene (PP) dan tempurung kelapa menjadi permasalahan lingkungan yang perlu mendapatkan penanganan yang tepat. Salah satu upaya yang dapat dilakukan adalah mengolah kedua limbah tersebut menjadi bahan bakar alternatif melalui proses pirolisis. Penelitian ini bertujuan untuk menganalisis pengaruh variasi rasio campuran tempurung kelapa dan plastik PP terhadap yield serta karakteristik bio-oil yang dihasilkan. Proses pirolisis dilakukan pada suhu 350°C selama 120 menit dengan menggunakan katalis bentonit sebesar 10%. Variasi rasio bahan baku yang digunakan yaitu 5:1, 4:2, 3:3, 2:4, dan 1:5 (tempurung kelapa:plastik PP). Bio-oil yang dihasilkan kemudian diuji karakteristiknya meliputi densitas, viskositas, titik nyala, dan nilai kalor.

Hasil penelitian menunjukkan bahwa variasi rasio bahan baku berpengaruh terhadap yield dan karakteristik bio-oil. Yield bio-oil tertinggi diperoleh pada rasio 3:3 sebesar 14,86%, sedangkan yield terendah diperoleh pada rasio 4:2 sebesar 7,00%. Nilai densitas bio-oil berada pada kisaran 0,7578–0,7973 g/mL, viskositas 33,0–38,0 cP, titik nyala 33,0–38,0°C, dan nilai kalor 7683,49–8481,54 kal/g. Peningkatan proporsi plastik PP dalam campuran cenderung meningkatkan nilai kalor bio-oil, namun menurunkan viskositas dan titik nyala. Berdasarkan hasil penelitian, rasio 3:3 merupakan komposisi terbaik dalam menghasilkan bio-oil berdasarkan nilai yield, sedangkan rasio 1:5 (tempurung kelapa:plastik PP) menghasilkan bio-oil dengan nilai kalor tertinggi. Hasil penelitian ini menunjukkan bahwa pirolisis campuran tempurung kelapa dan plastik PP menggunakan katalis bentonit berpotensi menjadi alternatif pengolahan limbah sekaligus menghasilkan bahan bakar cair yang memiliki potensi untuk dikembangkan sebagai sumber energi alternatif.

Kata kunci: pirolisis, bio-oil, plastik Polypropylene (PP), tempurung kelapa, bentonit, yield, karakteristik bio-oil.

ABSTRACT

Utilization of Polypropylene (PP) Plastic Waste and Coconut Shells Through the Pyrolysis Process as an Alternative Energy Source

(Raden Muhammad Dika Adriansyah, 57 Pages, 08 Tables, 08 Figures)

The increasing amount of Polypropylene (PP) plastic waste and coconut shell waste has become an environmental issue that requires proper management. One potential solution is to convert these wastes into alternative fuels through the pyrolysis process. This study aims to analyze the effect of varying the mixing ratio of coconut shell and Polypropylene (PP) plastic on the bio-oil yield and its characteristics. The pyrolysis process was carried out at a temperature of 350°C for 120 minutes using 10% bentonite catalyst. The feedstock mixing ratios used were 5:1, 4:2, 3:3, 2:4, and 1:5 (coconut shell:PP plastic). The resulting bio-oil was then characterized by measuring its density, viscosity, flash point, and calorific value.

The results showed that the variation in feedstock ratio significantly affected both the bio-oil yield and its characteristics. The highest bio-oil yield was obtained at the 3:3 ratio, reaching 14.86%, while the lowest yield was recorded at the 4:2 ratio, with 7.00%. The density of the produced bio-oil ranged from 0.7578 to 0.7973 g/mL, the viscosity ranged from 33.0 to 38.0 cP, the flash point ranged from 33.0 to 38.0°C, and the calorific value ranged from 7,683.49 to 8,481.54 cal/g. Increasing the proportion of PP plastic in the feedstock tended to increase the calorific value of the bio-oil while decreasing its viscosity and flash point. Based on the experimental results, the 3:3 feedstock ratio produced the highest bio-oil yield, whereas the 1:5 ratio (coconut shell:PP plastic) produced bio-oil with the highest calorific value. These findings indicate that the pyrolysis of coconut shell and PP plastic using bentonite catalyst has considerable potential as an alternative method for waste management while producing liquid fuel with promising prospects as an alternative energy source.

Keywords: pyrolysis, bio-oil, Polypropylene (PP) plastic, coconut shell, bentonite, bio-oil yield, bio-oil characteristics.