

ABSTRAK

PENGARUH VARIASI PERSEN KATALIS ZEOLIT PADA PROSES PIROLISIS PLASTIK *POLYETHYLENE TEREPHTHALATE* (PET) TERHADAP *YIELD* DAN KARAKTERISTIK BAHAN BAKAR CAIR

(Vira Enjela Putri, 2026, 57 Halaman, 14 Tabel, 16 Gambar, 3 Lampiran)

Peningkatan konsumsi plastik, khususnya *Polyethylene Terephthalate* (PET), menyebabkan akumulasi limbah yang sulit terurai dan berpotensi mencemari lingkungan. Salah satu alternatif pemanfaatan limbah PET adalah melalui proses pirolisis untuk menghasilkan bahan bakar cair (BBC). Penelitian ini bertujuan menganalisis pengaruh variasi persen katalis zeolit terhadap *yield*, karakteristik, dan komposisi senyawa bahan bakar cair hasil pirolisis plastik PET. Penelitian dilakukan menggunakan 2.000 gram plastik PET pada temperatur operasi 350°C dengan variasi katalis zeolit sebesar 0%, 5%, 10%, 15%, dan 20% dari massa bahan baku. Karakteristik bahan bakar cair yang dikarakterisasi melalui pengujian densitas, viskositas, titik nyala, nilai kalor, serta analisis komposisi senyawa menggunakan *Gas Chromatography–Mass Spectrometry* (GC-MS). Hasil penelitian menunjukkan bahwa penambahan katalis zeolit berpengaruh terhadap *yield* dan karakteristik bahan bakar cair. *Yield* tertinggi diperoleh pada penggunaan katalis 15% sebesar 1,028%, dengan densitas 0,810 g/mL, viskositas 1,01287 cP, titik nyala 39°C, dan nilai kalor 7.627,9084 cal/g. Hasil analisis GC-MS menunjukkan bahwa bahan bakar cair didominasi oleh senyawa hidrokarbon aromatik, terutama benzena, toluena, xilena, serta beberapa senyawa hidrokarbon pada rentang C₅–C₂₀ yang merupakan fraksi penyusun bahan bakar cair. Berdasarkan karakteristik fisik dan komposisi senyawanya, produk hasil pirolisis PET berpotensi dimanfaatkan sebagai bahan bakar alternatif yang memiliki karakteristik mendekati fraksi kerosin.

Kata kunci: limbah plastik PET, pirolisis, katalis zeolit, bahan bakar cair, GC-MS.

ABSTRACT

THE EFFECT OF VARYING ZEOLITE CATALYST PERCENTAGES ON THE PYROLYSIS OF POLYETHYLENE TEREPHTHALATE (PET) PLASTIC ON LIQUID FUEL YIELD AND CHARACTERISTICS

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The increasing consumption of plastics, particularly Polyethylene Terephthalate (PET), has resulted in the accumulation of non-biodegradable waste that poses serious environmental concerns. One promising approach to utilizing PET waste is through the pyrolysis process to produce liquid fuel. This study aimed to investigate the effect of zeolite catalyst loading on the yield, fuel characteristics, and chemical composition of liquid fuel produced from PET pyrolysis. The experiments were conducted using 2,000 g of PET plastic at an operating temperature of 350°C with zeolite catalyst loadings of 0%, 5%, 10%, 15%, and 20% based on the feedstock mass. The produced liquid fuel was characterized in terms of density, viscosity, flash point, calorific value, and chemical composition using Gas Chromatography–Mass Spectrometry (GC-MS). The results showed that the addition of zeolite catalyst significantly affected both the yield and the fuel characteristics. The highest yield of 1.028% was obtained at a catalyst loading of 15%, producing a density of 0.810 g/mL, a viscosity of 1.01287 cP, a flash point of 39°C, and a calorific value of 7,627.9084 cal/g. GC-MS analysis revealed that the liquid fuel was predominantly composed of aromatic hydrocarbons, mainly benzene, toluene, xylene, and several hydrocarbon compounds within the C₅–C₂₀ carbon range, which are commonly found in liquid fuels. Based on its physicochemical properties and chemical composition, the liquid fuel produced from PET pyrolysis has the potential to be utilized as an alternative fuel with characteristics comparable to kerosene.

Keywords: PET plastic waste, pyrolysis, zeolite catalyst, liquid fuel, GC-MS.