

## ABSTRAK

### PENGARUH VARIASI TEMPERATUR TERHADAP KONVERSI CAMPURAN PLASTIK LDPE - PP MENJADI BAHAN BAKAR CAIR MELALUI METODE PIROLISIS MENGUNAKAN KATALIS ZEOLIT

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(M. Yogi Pirnanda, 2026: 50 Halaman, 15 Tabel, 12 Gambar, 3 Lampiran)

Peningkatan jumlah limbah plastik, khususnya *Low Density Polyethylene* (LDPE) dan *Polypropylene* (PP), menjadi permasalahan lingkungan yang memerlukan teknologi pengolahan yang mampu mengurangi pencemaran sekaligus menghasilkan produk bernilai tambah. Salah satu teknologi yang dapat diterapkan adalah pirolisis katalitik menggunakan katalis zeolit alam teraktivasi. Penelitian ini bertujuan untuk mengetahui pengaruh variasi temperatur terhadap *yield* dan karakteristik bahan bakar cair hasil konversi campuran plastik LDPE dan PP melalui metode *Catalytic Thermal Cracking* menggunakan katalis zeolit. Penelitian dilakukan secara eksperimental menggunakan campuran plastik LDPE dan PP dengan perbandingan 30:70, massa umpan 2.000 gram, katalis zeolit alam teraktivasi sebanyak 5% dari massa umpan, waktu operasi 180 menit, serta variasi temperatur 350°C, 375°C, 400°C, 425°C, dan 450°C. Produk cair yang dihasilkan dianalisis berdasarkan *yield*, densitas, viskositas, titik nyala, nilai kalor (*High Heating Value*), serta komposisi senyawa hidrokarbon menggunakan GC-MS. Hasil penelitian menunjukkan bahwa peningkatan temperatur berpengaruh terhadap kuantitas dan kualitas bahan bakar cair yang dihasilkan. *Yield* meningkat dari 14,50% pada temperatur 350°C menjadi 24,50% pada temperatur 450°C. Densitas menurun dari 0,7824 g/mL menjadi 0,7600 g/mL, viskositas menurun dari 4,4353 cSt menjadi 3,8159 cSt, sedangkan nilai kalor meningkat dari 47,42 MJ/kg menjadi 47,68 MJ/kg. Nilai titik nyala mengalami penurunan dari 38°C menjadi 32°C. Hasil analisis GC-MS menunjukkan bahwa produk cair didominasi oleh fraksi hidrokarbon C<sub>10</sub>–C<sub>16</sub> sebesar 39,41% dan C<sub>5</sub>–C<sub>12</sub> sebesar 34,68%, sehingga memiliki kecenderungan berada pada rentang bahan bakar *kerosene* dan *gasoline*. Berdasarkan hasil tersebut, temperatur 450°C merupakan kondisi operasi optimum karena menghasilkan *yield* tertinggi dan karakteristik bahan bakar cair terbaik pada penelitian ini.

**Kata kunci:** *Catalytic Thermal Cracking*, LDPE, PP, Zeolit alam teraktivasi, Variasi temperatur, Bahan Bakar Cair, GC-MS

## **ABSTRACT**

### ***THE EFFECT OF TEMPERATURE VARIATION ON THE CONVERSION OF LDPE–PP PLASTIC MIXTURES INTO LIQUID FUEL BY PYROLYSIS USING A ZEOLITE CATALYST***

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***(M. Yogi Pirnanda, 2026: 50 Pages, 15 Tables, 12 Figures, 3 Appendices)***

*The increasing amount of plastic waste, particularly Low Density Polyethylene (LDPE) and Polypropylene (PP), has become an environmental problem that requires processing technologies capable of reducing pollution while producing value-added products. One of the applicable technologies is catalytic pyrolysis using activated natural zeolite as a catalyst. This study aimed to determine the effect of temperature variation on the yield and characteristics of liquid fuel produced from the conversion of LDPE and PP plastic mixtures through the Catalytic Thermal Cracking method using a zeolite catalyst. The study was conducted experimentally using an LDPE and PP plastic mixture with a ratio of 30:70, a feed mass of 2,000 grams, activated natural zeolite catalyst at 5% of the feed mass, an operating time of 180 minutes, and temperature variations of 350°C, 375°C, 400°C, 425°C, and 450°C. The liquid products obtained were analyzed based on yield, density, viscosity, flash point, High Heating Value (HHV), and hydrocarbon composition using Gas Chromatography–Mass Spectrometry (GC-MS). The results showed that increasing the temperature significantly affected both the quantity and quality of the liquid fuel produced. The yield increased from 14.50% at 350°C to 24.50% at 450°C. The density decreased from 0.7824 g/mL to 0.7600 g/mL, while the viscosity decreased from 4.4353 cSt to 3.8159 cSt. Meanwhile, the High Heating Value increased from 47.42 MJ/kg to 47.68 MJ/kg. The flash point decreased from 38°C to 32°C. The GC-MS analysis revealed that the liquid product was dominated by C<sub>10</sub>–C<sub>16</sub> hydrocarbon fractions (39.41%) and C<sub>5</sub>–C<sub>12</sub> hydrocarbon fractions (34.68%), indicating that the product tended to fall within the kerosene and gasoline fuel ranges. Based on these findings, the operating temperature of 450°C was identified as the optimum condition, as it produced the highest yield and the best liquid fuel characteristics in this study.*

**Keywords:** *Catalytic Thermal Cracking, LDPE, PP, Activated Natural Zeolite, Temperature Variation, Liquid Fuel, GC-MS*