

Catalytic pyrolysis of low density polyethylene and polypropylene wastes to fuel oils by N-clay

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Abstract. Dealing effectively with plastic wastes has been a major global challenge. Different methods have been previously employed to proffer solution to plastic wastes problem however, all showed their energetic, economic and environmental implications. In this research, catalytic pyrolysis of low density polyethylene and polypropylene wastes was carried out to proffer solution to the problem. The plastic materials were collected and appropriately prepared after which ultimate and proximate analysis was carried out on them. The clay was collected from Naka, Gwer West Local Government Area of Benue State, Nigeria, thereafter, referred to as N-clay and was appropriately prepared, then analyzed by a BET analyzer for the following properties: the surface area, which was found to be 85.418 m²/g, pore size 2.100 nm and pore volume of 0.042 cc/g. Also, the XRF determination of the chemical composition of the N-clay was done and the SiO₂/Al₂O₃ ratio was found to be 70.81/29.19. The N-clay and the plastics were then pyrolyzed in a chemical vapor deposition (CVD) reactor in the ratio 1:3 respectively, at 500 °C with residence time of 30 min using nitrogen as purge gas. The polypropylene yielded 70.34 % liquid oil, 6.43 % char and 23.23 % gas. The liquid was analyzed for functional groups, using Raman spectrometer. Physicochemical analysis was also done on the oil and it was determined that the oil had properties consistent with commercial-grade gasoline. The low density polyethylene yielded wax, instead of liquid, char and gas. Finally, it was concluded that the N-clay was suitable as catalyst for the pyrolysis of plastics and the fuel oil obtained from polypropylene pyrolysis is comparable to gasoline fuel.

Keywords: N-clay; polyethylene; polypropylene; plastic-wastes; characterization; fuel oils pyrolysis.

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