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Synergistic effects of catalytic co-pyrolysis *Chlorella vulgaris* and polyethylene mixtures using artificial neuron network: Thermodynamic and empirical kinetic analyses

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ABSTRACT

The catalytic pyrolysis of *Chlorella vulgaris*, high-density polyethylene (Pure HDPE) and, their binary mixtures were conducted to analyse the kinetic and thermodynamic performances from 10 to 100 K/min. The kinetic parameters were computed by substituting the experimental and ANN predicted data into these iso-conversional equations and plotting linear plots. Among all the iso-conversional models, Flynn-Wall-Ozawa (FWO) model gave the best prediction for kinetic parameters with the lowest deviation error (2.28–12.76%). The bifunctional HZSM-5/LS catalysts were found out to be the best catalysts among HZSM-5 zeolite, natural limestone (LS), and bifunctional HZSM-5/LS catalyst in co-pyrolysis of binary mixture of *Chlorella vulgaris* and HDPE, in which the E_a of the whole system was reduced from range 144.93–225.84 kJ/mol (without catalysts) to 75.37–76.90 kJ/mol. With the aid of artificial neuron network and genetic algorithm, an empirical model with a mean absolute percentage error (MAPE) of 51.59% was developed for tri-solid state degradation system. The developed empirical model is comparable to the thermogravimetry analysis (TGA) experimental values alongside the other empirical model proposed in literature

1. Introduction

Energy plays an irreplaceable role in human's daily lives for centuries and also being regarded as the main principal factor for a country's socio-economic development. According to the International Energy Agency (IEA), the total world's energy from non-renewable fossil

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