

Optimization studies of microwave-induced co-pyrolysis of empty fruit bunches/waste truck tire using response surface methodology

ABSTRACT

The central composite design of RSM was utilised for the optimization of experimental conditions of microwave-assisted co-pyrolysis of empty fruit bunch (EFB) and waste truck-tire (TT) to maximise the co-pyrolysis oil and energy yield. The predicted maximum co-pyrolysis oil of 40.0 wt% and energy yield of 59.0% were obtained at the optimum conditions of 505 °C pyrolysis temperature, 65.0% of EFB ratio and 60.0 g of activated carbon loading. The reaction temperature and TT ratio in EFB feedstock were identified as the most significant variables that affect the oil and energy yield. A design of experiment was performed to determine the quality of liquid oil. The result indicates the co-pyrolysis oil (PO65) properties were significantly improved after adding TT to EFB biomass. Olefin-rich pyrolytic oil (39.0%) with high selectivity of D-limonene was produced (28.6%). While, the oxygenates and polyaromatics hydrocarbon were reduced to 9.9% and 7.4%, respectively. The energy recovery analysis shows that the optimised co-pyrolysis oil (PO65) was 20.0% higher as compared to the TT alone. In view of the improved yield and quality of co-pyrolysis oil (PO65), this work shows that co-pyrolysis of EFB/TT presents a viable method to produce diesel-like fuel using the microwave-assisted heating method.