

Characterization of bio-oil from palm kernel shell pyrolysis

Abstract

Pyrolysis of palm kernel shell in a fixed-bed reactor was studied in this paper. The objectives were to investigate the effect of pyrolysis temperature and particle size on the products yield and to characterize the bio-oil product. In order to get the optimum pyrolysis parameters on bio-oil yield, temperatures of 350, 400, 450, 500 and 550 °C and particle sizes of 212-300 µm, 300-600 µm, 600µm-1.18 mm and 1.18-2.36 mm under a heating rate of 50 °C min⁻¹ were investigated. The maximum bio-oil yield was 38.40% at 450 °C with a heating rate of 50 °C min⁻¹ and a nitrogen sweep gas flow rate of 50 ml min⁻¹. The bio-oil products were analysed by Fourier transform infra-red spectroscopy (FTIR) and gas chromatography-mass spectroscopy (GCMS). The FTIR analysis showed that the bio-oil was dominated by oxygenated species. The phenol, phenol, 2-methoxy- and furfural that were identified by GCMS analysis are highly suitable for extraction from the bio-oil as value-added chemicals. The highly oxygenated oils need to be upgraded in order to be used in other applications such as transportation fuels.

Keywords

Bio-oil; Biomass; Char; Palm kernel shell; Pyrolysis; Renewable energy