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Selective Production of Phenols from Lignin via Microwave Pyrolysis Using Different Carbonaceous Susceptors

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Abstract

With an objective to improve the yield and selectivity of phenols in pyrolysis bio-oil from lignin, this study investigates the effects of mass ratio of lignin-to-susceptor and different types of susceptors (activated carbons of different particle sizes, charcoal and graphite) in microwave pyrolysis. Pyrolysis was carried out in a batch microwave reactor, and the temperature profiles at different operating conditions were captured. Increasing the mass of susceptor with respect to lignin enhanced the bio-oil yield, and maximum yield of 66 wt.% with >90% selectivity to phenols was obtained with 10 g lignin:90 g activated carbon. Moisture present in the susceptor is shown to control the pyrolysis severity and lead to better phenol yields. This was verified by the high yield of hydrogen gas formed due to the steam-assisted cracking of lignin. With highly porous activated carbon, 80% selectivity of phenol was obtained, albeit with a low yield of bio-oil.

Keywords: Microwave; Pyrolysis; Lignin; Simple Phenols; Activated carbon; Susceptor; Bio-oil

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