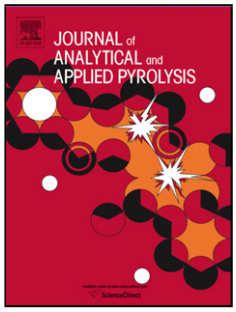

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Catalytic effects of magnesium on the characteristics of fast pyrolysis products - bio-oil, bio-char, and non-condensed pyrolytic gas fractions

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Abstract

Fast pyrolysis of yellow poplar impregnated with different concentrations of $MgCl_2$ was carried out at 450, 500, and 550°C to investigate the effects of magnesium on the characteristics of the pyrolytic products. Analysis of the physicochemical properties of bio-oil, bio-char, and non-condensed pyrolytic compounds was carried out accordingly. The results indicate that the yield of char as well as some physicochemical properties of the bio-oil was influenced by the magnesium concentration. The water content increased due to a dehydration reaction induced by magnesium. Additionally, the viscosity significantly increased from 45 cSt to 216 cSt as the magnesium content increased. Magnesium promoted a repolymerization reaction leading to increases of the average molecular weight and solid content of the bio-oil from 950 Da to 1,670 Da and 0.37 wt% to 0.73 wt%, respectively. Also, the amounts of levoglucosan and other small molecules detected by gas chromatography-mass spectroscopy analysis decreased as large fractions such as oligomers or char fines were formed. Meanwhile, the yield and elemental composition of the bio-oil barely changed. Following the pyrolysis, most of the inorganic metals remained in the bio-char. Furthermore, the various forms of aromatic hydrocarbons obtained from the non-condensed pyrolytic gas fractions were identified and quantified in this study.

Keywords: **fast pyrolysis, bio-oil, magnesium, recombination, inorganic distribution, aromatic hydrocarbons**