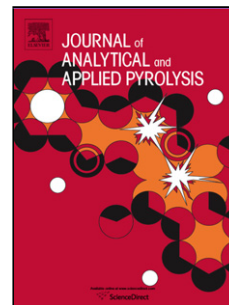


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Title: Catalytic effects of magnesium on the characteristics of fast pyrolysis products - bio-oil, bio-char, and non-condensed pyrolytic gas fractions

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

4
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9

10 **Abstract**

11 Fast pyrolysis of yellow poplar impregnated with different concentrations of MgCl₂ was
12 carried out at 450, 500, and 550°C to investigate the effects of magnesium on the
13 characteristics of the pyrolytic products. Analysis of the physicochemical properties of bio-oil,
14 bio-char, and non-condensed pyrolytic compounds was carried out accordingly. The results
15 indicate that the yield of char as well as some physicochemical properties of the bio-oil was
16 influenced by the magnesium concentration. The water content increased due to a
17 dehydration reaction induced by magnesium. Additionally, the viscosity significantly
18 increased from 45 cSt to 216 cSt as the magnesium content increased. Magnesium promoted
19 a repolymerization reaction leading to increases of the average molecular weight and solid
20 content of the bio-oil from 950 Da to 1,670 Da and 0.37 wt% to 0.73 wt%, respectively. Also,
21 the amounts of levoglucosan and other small molecules detected by gas chromatography-
22 mass spectroscopy analysis decreased as large fractions such as oligomers or char fines were
23 formed. Meanwhile, the yield and elemental composition of the bio-oil barely changed.
24 Following the pyrolysis, most of the inorganic metals remained in the bio-char. Furthermore,
25 the various forms of aromatic hydrocarbons obtained from the non-condensed pyrolytic gas
26 fractions were identified and quantified in this study.

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

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