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Deconstruction of lignocellulosic biomass to bio-oils with zieglar-natta catalyst in ethanol and water

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Lignocellulosic biomass (grape seeds) was deconstructed in both hydrothermal and supercritical ethanol media with Zieglar-Natta catalyst components ($TiCl_4/MgCl_2$) to produce the bio-oils. The use of catalyst in the deconstruction in supercritical ethanol achieved the highest bio-oil yield of 49.2% at 300 °C with a residence time of 30 min, which was 37.4% higher than the bio-oil yield obtained from the same condition. Both the hydrothermal and supercritical ethanol deconstruction reactions with the highest catalyst loading ($TiCl_4/MgCl_2$=4mmol/4mmol) produced the bio-oils with a higher heating value (HHV) of 35 MJ/Kg which was comparable of the HHV of petroleum based liquid fuels. Most significantly, gas chromatography–mass spectrometry (GC-MS) analysis of the bio-oils showed that the major products in bio-oils from the hydrothermal deconstruction were acids while majority products in bio-oils form the supercritical ethanol deconstruction were esters. 31P Nuclear magnetic resonance (NMR) data suggested that both non-catalytic and catalytic hydrothermal/supercritical ethanol deconstruction reactions significantly reduced the C5 substituted phenolic OH in bio-oils.

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