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Microwave-assisted efficient depolymerization of alkaline lignin in methanol/formic acid media

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Abstract

Microwave-assisted degradation of alkaline lignin in methanol/formic acid media was investigated, concerning the effect of formic acid (FA) amount, reaction temperature, and reaction time on lignin depolymerization. The highest bio-oil yield of 72.0 wt% including 6.7 wt% monomers was achieved at 160 ^{o}C and a FA-to-lignin mass ratio of 4 after a reaction time of 30 min. Among the monomers, the yield of 2,3-dihydrobenzofuran was the highest (3.00 wt%), followed by *p*-coumaric acid (1.59 wt%). Formic acid acted mainly through acid-catalyzed cleavage of the linkages in lignin. Oligomers in bio-oil were mainly composed of dimers (molecular weight: 253-378) and trimers (molecular weight: 379-510) according to the Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS) analysis. A possible mechanism about microwave-assisted depolymerization of lignin in methanol/formic acid media was proposed. This study will provide an efficient