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Solvent and catalyst effect in the formic acid aided Lignin-to-liquids

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Abstract

The effect of the type of solvent, ethanol or water, and a Ru/C catalyst were studied in the formic acid aided lignin conversion. The best results were obtained in the presence of the Ru/C catalyst and using ethanol as solvent at 300 °C and 10 h (i.e. 75.8 wt.% of oil and 23.9 wt.% of solids). In comparison to the water system, the ethanol system yields a significantly larger amount of oil and, at 300 °C and 10 h, a smaller amount of solids. The main reasons for this positive effect of the ethanol solvent are i) the formation of ethanol-derived esters, ii) C-alkylations of lignin fragments and iii) the generation of more stable lignin derivatives. The Ru/C exhibits significantly higher lignin conversion activity compared to other Ni-based catalysts, especially at 300 °C, which is related to the enhanced activity of the Ru⁰ sites towards hydrogenolysis, hydrodeoxygenation and alkylation reactions.

Keywords: lignin, LtL, formic acid, Ru/C, bio-oil, ethanol, water

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