

ON THE REACTIVITY OF MONO-LIGNOL DERIVATIVES

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The valorization of lignin, the second most abundant component of lignocellulosic biomass, has remained a challenge for many years. Given the large concentration of phenolic groups, lignin appears to be a good potential candidate for the production of aromatic chemicals such as catechols and p-vinyl phenols. Production of such chemicals requires the ability to depolymerize lignin in a controlled manner. The thermochemical route uses fast pyrolysis to crack lignin polymers to smaller fragments. In order to be able to do so in a guided way, the thermal decomposition chemistry of lignin needs to be understood in great detail.

Lignin is mainly built from three lignols, which are derivatives of cinnamyl alcohol and distinguish themselves through the aromatic unit, viz. p-hydroxy phenyl (H), guaiacyl (G), and syringol (S). Lignols are connected via ether and C-C linkages. It is assumed that both, the substitution pattern of the benzene ring and the linkage between the units have strong impacts on the product distribution. Efforts are underway to generate kinetic models able to describe these impacts and to predict pyrolysis product spectra as a function of operation condition.

The current work presents a comprehensive study of the fast pyrolysis of guaiacol, syringol, phenol, and their p-vinyl and p-hydroxymethylvinyl derivatives. This study is performed with a two-stage micropyrolyzer setup connected on-line to a two dimensional GC coupled with FID and TOF-MS. The light molecules are analyzed using a special GC with TCD and PDD detectors. The first stage of the micropyrolyzer is used for vaporization and the second stage acts as an isothermal plug flow reactor, which can be operated up to 900C. The obtained pyrolysis product profiles will be interpreted with mechanistic information found in the literature and utilized in the future to construct a detailed kinetic model for lignin decomposition.

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