EFFECT OF THE VINYL GROUP ON THE REACTIVITY OF LIGNIN H, G, S UNITS DURING BIOMASS FAST PYROLYSIS

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Fast pyrolysis of lignocellulosic biomass is being considered as a viable alternative to fossil resources for the production of transportation fuels, commodity and fine chemicals. However, valorization of the lignin fraction remains a challenge despite the fact that it consists of chemically interesting aromatic functional groups. Gaining a thorough understanding of the pyrolysis chemistry of lignin would help to optimize the lignin pyrolysis process and provide guidance as to which lignin structure yields the most valuable chemicals.

Basically, lignin contains p-hydroxy phenyl (H), guaiacyl (G) and syringyl (S) units that are linked together through propanoic chains. A step forward towards the understanding of the thermal decomposition of lignin is to study the pyrolysis reactions of these three units. Most experimental data available in the literature are taken at slow heating rates and non-isothermal, multi-phase conditions. From these results it is difficult if not impossible to extract intrinsic kinetic information. Therefore, a new two-stage micro-pyrolyzer experiment with GCxGC separation and ToF-MS, FID and TCD detectors was constructed. The micro-pyrolyzer allows (a) fast pyrolysis studies of solids using only the first reactor, and (b) investigations of the gas phase chemistry of solid fuels that can be vaporized. The first stage is used for vaporization while the chemical changes take place at isothermal conditions in the plug-flow-type second reactor.

The present study describes pyrolysis results obtained with phenol, guaiacol and syringol and their para-vinyl or para-hydroxymethylvinyl substituted derivatives. Para-vinyl phenols are of interest as they are found in large quantities in bio-oils. The experimental results will be compared to predictions using literature mechanisms. The obtained chemical insights provide one essential piece of information needed for the construction of a complete lignin decomposition model.

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