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Lignin Fast Pyrolysis –Mechanistic Studies of Model Compounds

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Catalytic fast pyrolysis is an effective method for polymerization and stabilization of reactive intermediates.1 Understanding the depolymerization mechanism during pyrolysis is evidently critical for establishing the parameters that influence the selectivity and yield of the products. During fast pyrolysis many different reaction mechanisms compete2, but also radical formation by homolytic fission of ether bonds is dominant.3 We performed fast pyrolysis of diphenylether and guaiacol under collision reduced conditions using the iPEPICO at the X04DB VUV Beamline at the Swiss Light Source and under ambient pressure (pyrolysis-GC/MS) in order identify the formed primary radicals and the stabilized end products in situ.4 Our primary objective was to determine the relationship between depolymerization initiation and the final product distribution. We found three reaction pathways depending on the conditions and the nature of the formed radicals. The formed intermediates either decomposed further, as the phenoxy radical into cyclopentadienyl radical by decarbonylation2 or the radicals recombined steadily. Radical initiated rearrangement reactions dominated the selectivity in ambient conditions. New radicals were formed and then rearranged internally, like 1-hydroxybenzaldehyde from guaiacol.5 Importantly the temperature dependent selectivities of guaiacol resemble that of lignin.

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