

**QUANTITATIVE DEPOLYMERIZATION OF UNCONDENSED TECHNICAL LIGNIN AT 120 °C  
WITH SUPPORTED NICKEL CATALYSTS**

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The low cost and practical production of monomers from technical lignin could greatly facilitate the development of biorefineries. However, lignin condensation caused by formation of inter-unit carbon-carbon linkages during biomass pretreatment dramatically reduces lignin monomer yields; in addition, high temperatures and noble-metal catalysts are generally required for catalytic biomass deconstruction and lignin hydrogenolysis.

Recently, we have developed two processes that could help address aforementioned issues. First, we have found that adding formaldehyde during biomass pretreatment produces a soluble uncondensed lignin liquor that can be converted to guaiacyl and syringyl monomers at near-theoretical yields during subsequent hydrogenolysis. Formaldehyde was found to react with alpha- and gamma- hydroxyl groups on the lignin side-chain to form a stable 1,3-dioxane ring structure which prevents condensation. Second, the uncondensed lignin fraction can be readily depolymerized at temperatures as low as 120°C with a cheap Ni/Al<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> catalyst. We achieved a yield of 45% for beech wood, and a yield of 78% for transgenic poplar wood (based on native lignin). We attribute these high yields obtained at low temperatures to the high accessibility of ether bonds in the uncondensed lignin to the heterogeneous catalysts.