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NEW MATERIALS AND POLYMERS FROM SOFTWOOD KRAFT LIGNIN: CARBON FIBERS, HEAT STABLE THERMOPLASTICS

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The complexity of native softwood lignin when coupled with the complexity of the kraft pulping process is known to lead to a rather heterogeneous material that has eluted us to date. During this lecture a new structural constitutional scheme will be proposed for Softwood Kraft Lignin. This effort attempts to unify and rationalize our current knowledge of kraft pulping chemistry with a series of focused NMR and Chromatographic measurements. This effort will thus introduce the foundations for describing our systematic efforts in the following areas aimed at arriving at practical applications for an otherwise intractable raw material. More specifically the lecture will cover our efforts in: Refining technical kraft lignin, so as to expose its potential as a source for reactive polyphenols of well-defined molecular weight polymers and oligomers. We will then demonstrate that a continuum of narrow fractions can be isolated from softwood kraft lignin, common to a variety of such sources irrespective of the manufacturing details of the pulping process. Such consistently homogeneous lignin streams from technical lignins offer significant commercial ramifications; creating heat stable kraft lignin copolymers with heat stabilities approaching 3000; creating novel blends with polylolefins; creating new thermoplastic lignin polymers and precursors to carbon fibers by applying propargylation derivatization chemistry followed by thermal treatments. This approach offers a versatile novel route for the eventual chain extension and utilization of technical lignins with a significant amount of molecular control.