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Green Polymers- from Photo-responsible Reversible Polymers to Lignin Based Polymers

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3:25 p.m.
109 Goergen Hall

Reversible polymers represent a relatively new class of materials that possess bonds capable of reversibly connecting and disconnecting monomers in response to stimuli such as heat or light. These reversible bonds can be used to construct a recyclable polymer via material polymerization and depolymerization, on demand (**Fig. 1**). Several reversible polymerizations have been reported in the literature, however these are each based on thermally-reversible reactions, like the Diels-Alder reaction, which require high energies for depolymerization. These versatile photoreactions have been used to prepare simple cyclobutane-dimers, complicated organic molecules with constrained geometries such as ladderanes and cyclophane, and also regiospecific oligomeric and polymeric species. Photo-chemical reactions, on the other hand, are considered to be greener synthetic pathways because photons do not leave residues, they can be conducted at ambient temperature, and often in the solid-state. Using these green chemical principles, our reversible-polymer designs centre on a biologically-inspired mechanism. Thymine, one of the nucleic acid bases of DNA, has the propensity to reversibly photo-dimerize in the solid-state. Our research exploits this reversible dimerization to develop a novel, reversible, polymer-recycling system using di-thymine monomers. The design and synthesis of various di-thymine monomers, determination of monomer crystal structures, and characterization of the photoproducts using Nuclear Magnetic Resonance, UV-Visible Spectroscopy, Gel-Permeation Chromatography, and other polymer characterization techniques will be discussed in the presentation.
Catalytic "chemical" depolymerisation of lignin will also be discussed. A new lignin chemical depolwp4(5 1)1Ty0(a)7(2y5(i)0(b-5 1 (b-515A n))aai)36u)-A nbvelh