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Bio-Furan Based Poly (β-Thioether Ester) Synthesized via Thiol-Michael Addition Polymerization with Tunable Structure and Properties

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Abstract : A derivative of 5-hydroxymethylfurfural (HMF) was synthesized for the thiol-Michael addition reaction. The efficiency of the catalysts (base and nucleophiles) and side reactions during the thiol-Michael addition were investigated. Dimethylphenylphosphine efficiently initiated the thiol-Michael addition polymerization for synthesizing a series of bio-based furan polymers with different structure and properties. The benzene rings or hydroxyl groups present in the polymer chains increased the glass transition temperature (Tg) of poly (β-thioether ester). Additionally, copolymers with various compositions were obtained via adding different ratio of 1,6-hexanedithiols to 1,4-benzenedithiols. 1H NMR analysis revealed that experimental ratios of two dithiols monomers matched well with theoretical ratios. The occurrence of a reversible Diels-Alder reaction between furan rings and maleimide groups allowed poly (β-thioether ester) to be dynamically crosslinked. These polymers offer the potentials to produce materials from biomass that have both practical mechanical properties and reprocessing ability.

Keywords : copolymers, Diels-Alder reaction, hydroxymethylfurfural, Thiol-Michael addition
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