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Laccase-facilitated synthesis of hyperbranched lignin polymers

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Lignin is one of the major chemical constituents of woody biomass and is thus one of the most abundant biopolymers found in nature. The pulp and paper industry produces lignin on the scale of millions of tons annually as a by-product of the kraft pulping process. Historically, lignin has been viewed as a waste material and burned as an inefficient fuel for the pulping process. However, in recent decades, research has focused on more economical ways to transform lignin into value added commodities, such as bioenergy, biomaterials, and biochemicals, developing and strengthening the concept of fully integrated biorefineries. Owing to the highly aromatic structure of lignin, it is possible to enzymatically modify its surface using laccases (benzenediol:oxygen oxidoreductases, EC 1.10.3.2). These environmentally friendly enzymes use oxygen as their only co-substrate and produce water as their sole by-product, and have thus found great industrial application. By grafting various hydroquinone monomers (A2) onto the surface of kraft lignin via laccase-catalyzed coupling reactions, it is then possible to attach branching thiol monomers (B3) onto the surface quinones. Further copolymerization of the type A2-B3-A2-B3 and so forth is achieved via laccase-generated quinones (A2) to produce hyperbranched lignin polymers. The presented is a sustainable, ecofriendly, economic method to create exciting novel biomaterials from renewable feedstocks while further enhancing lignin valorization.

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Synthesis and rheological characterization of acrylamide based hydrogels

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Polyacrylamide hydrogels were synthesized by free radical polymerization of various acrylamide cross linker ratios at room temperature using BZ mixture in place of conventional initiators and accelerators. FTIR spectroscopy was used to characterize the polymer. The reaction between monomer and cross linker results in the formation of 3D polymer gels. Rheological studies were done to study the change in viscosity with the change in monomer cross linker ratios. Both elastic modulus (G') and viscous modulus (G'') are measured for the prepared polymer gels between parallel rheometer plates. The elastic modulus remains constant with frequency and is significantly larger than viscous modulus. Effect of temperature on the polymer gels was studied. Bromate being the main radical initiator in the BZ mixture. Effect of its concentration on the viscosity of one of the polymer gel was considered.

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