Lignin Valorization – A Challenge

Description

Considering that lignocellulose biomass is one of the most abundant renewable resources, its comprehensive conversion into value-added products, including lignins, is of great importance due to its great abundance and its high carbon content. However, the difficulties of lignin extraction, its recalcitrance to common enzymatic fractionation together with its chemical variability makes of its valorization a complex challenge. Nevertheless, several prospective utilizations and conversion processes of lignins have been studied in view of adding value to this family of phenolic polymers (see reviews Ragauskas et al., 2014Rinaldi et al., 2016. Catalytic depolymerization is a way for producing aromatic molecules. An effective strategy to render lignified biomass more easily amenable to bioconversion is to modify its lignin composition and structure via bioengineering technology Vanholme et al., 2012. In another strategy, the polymer forms of lignin may be directly incorporated as one of the components in polymer matrices for high performance composite applications Thakur et al., 2014. The co-polymer may be synthetic or bio-based Lora & Glasser, 2002. Due to its polyphenolic nature lignin acts as a radical scavenger, and exhibits effective antioxidant activity Pan et al., 2006. Interestingly, lignin matrix was recently reported to be successful in the immunosensing for HIV with antigenic peptides, bringing the prospect of another domain of application of this biopolymer Cerutti et al., 2015. The weak solubility of lignins in most conventional solvents largely impairs its utilization. Recently, various novel solvents such as ionic liquid solvents of the imidazolium-derived family have been implemented (see revieww Brandt et al., 2013Hiltunen et al., 2016. Solubilization in appropriate solvent condition is explored in the concept of integrated bio-refinery to improve the further depolymerization of lignins towards value-added phenolic compounds Ragauskas et al., 2014 Kasakov et al., 2015.
It is clear, now, that lignin is the subject of multidisciplinary research efforts to develop cost competitive applications of this versatile natural polymer in a variety of domains Agrawal et al., 2014.

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