**Designer lignins: harnessing the plasticity of lignification**

Lignin, a complex polyphenolic constituent of plant secondary cell walls, is one of the most abundant biopolymers on the planet and is an immensely important global carbon sink. The chemical recalcitrance of lignin, however, poses a major challenge for industrial biomass processing, most notably in pulp and paper production and in the emerging cellulosic biofuels industry. Inspired largely by the recalcitrance of lignin to biomass processing, plant engineering efforts have routinely sought to alter lignin quantity, composition, and structure by exploiting the inherent plasticity of lignin biosynthesis. More recently, researchers are attempting to strategically design plants for increased digestibility by incorporating monomers that lead to a lower degree of polymerization, reduced hydrophobicity, fewer bonds to other cell wall constituents, or novel chemically labile linkages in the polymer backbone. In addition, the incorporation of value-added structures could help valorize lignin. Designer lignins may satisfy the biological requirement for lignification in plants while improving the overall efficiency of biomass utilization. This review article summarizes the progress in lignin engineering, presents developments within the past three years in the area of designer lignins, and charts a course forward for producing less recalcitrant and more valuable lignins, thereby highlighting the potential to enhance the overall utility of this abundant natural polymer. Designer lignins will likely be a key feature of advanced biofuel crops, providing for easier, more cost-effective processing as well as the production of renewable, high-value chemicals.

**References:** Mottiar, Y., Vanholme, R., Boerjan, W., Ralph, J., Mansfield, S.D. (2015) Designer lignins: harnessing the plasticity of lignification. Current Opinion in Biotechnology, **37**, 190-200, doi:10.1016/j.copbio.2015.10.009.

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