Insight into the Lytic Polysaccharide Monooxygenases for Plant Biomass Valorization

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Abstract

Metalloenzyme lytic polysaccharide monooxygenase (LPMO) is a breakthrough enzyme, acting as a catalyst in the process of plant biomass conversion to biofuels. LPMOs oxidize polysaccharide in crystalline area, providing accessibility to other polysaccharide hydrolases for enhancing the saccharification process. In this review an in-silico analysis explores the active copper center and evolutionary relationship of LPMO. A radial phylogram of 168 LPMO genes from archaea to terrestrial plant infers their evolution as a paralogous enzyme catalyzing the same function in different domains. The review also emphasizes on the mechanism, electron flow, and diversity of electron-donating system for LPMO. The 3-D modeling of unexplored bacterial LPMO derived from extreme environment and its structural comparison by super positioning with well-defined TfAA10A (LPMO) of Thermobifida fusca was investigated. Result indicates the conservation in active copper center and flat surface for substrate binding from halophilic archaea to deep marine bacteria. Furthermore, annotation of different CAZymes in bacterial species with characterized LPMO and full range of glycoside hydrolase overcomes the need for consortia. The vast diversity and substrate flexibility of LPMOs along with its crucial role in pre-treatment steps of plant biomass, nano-cellulose formation, and insecticidal activity opens a wide array of biotechnological applications.

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