Discovery of a novel lignin degrading biocatalyst: a catalytic promiscuity in tyrosinase

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Recent concerns about the depletion of fossil fuels and climate change lead research interests and efforts towards the development of the biorefinery systems from renewable biomass. Especially, lignocellulosic biomass received attention as the substrates because it is most abundant and does not compete with food chains. In order to use lignocellulosic biomass efficiently as a feedstock, the degradation of lignin must be proceeded in prior to convert cellulose and hemicellulose to fermentable sugars which microbes utilize for valuable chemicals production. However, already known lignin degrading biocatalysts have been limited to apply large scale biorefinery due to the drawbacks such as a low activity, a poor stability, etc. Herein, we discover a novel catalytic promiscuity, which is the ability to catalyze different types of chemical transformation, in tyrosinase to overcome the limitations in already known lignin degrading biocatalysts. The novel catalytic promiscuity in tyrosinase was investigated using lignin monomer and dimer model compounds as the substrates, the products were identified by GC/MS, and the catalytic mechanism about the promiscuity was proposed based on the molecular docking simulation.