ABSTRACTS (MASTER THESIS)

Analysis of interaction between carbohydrate-binding module (CBM) and lignin

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In lignocellulosic biorefinery, disintegration of plant cell walls by decomposing lignin network is the initial key process. Many physico-chemical, structural, and compositional factors hinder the hydrolyzability of plant cell wall polysaccharides with hydrolases. In enzymatic hydrolysis, the reaction starts from direct physical contact between the enzymes and exposed polysaccharides. However, nonspecific adsorption of enzymes on lignin decreases the reactivity, even after the rupture of the cell wall structure. Although the adsorption of cellulase to lignin depends on the structures of protein and lignin, the interactions are still poorly understood at the molecular level. Carbohydrate-binding module (CBM) of cellulase is a protein component adsorbing the enzyme on non-soluble substrates, cellulose and hemicelluloses. However, CBM also preferentially binds to lignin mainly *via* hydrophobic interaction, and the adsorbed enzyme rapidly loses its activity. Therefore understanding of the interaction between CBM and lignin is important to reduce the enzyme cost by suppression of the non-productive binding. Filamentous fungus *Trichoderma reesei* is known to be hyper producer of cellulolytic enzymes, and is widely used for commercial scale production of cellulases and hemicellulases. In this study the interactions of lignin with a fusion protein between GFP and CBMs of cellulases from *T. reesei* and bacteria were analyzed using Quartz Crystal Microbalance (QCM), and the binding properties to lignin was analyzed. Inhibition and adsorption of soluble lignin monomers, vanillic acid, syringic acid, vanillin, syringaldehyde, *p*-hydroxybenzaldehyde and *p*-hydroxybenzoic acid to cellulase are also analyzed. The results showed that the adsorption and inhibition depends on the structure of the lignin monomers. These lignin monomers inhibited adsorption of the CBM-GFP to cellulose.