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Combination of Superheated Steam with Laccase Pretreatment Together with Size Reduction to Enhance Enzymatic Hydrolysis of Oil Palm Biomass

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Abstract. Oil palm empty fruit bunch (OPEFB) and oil palm mesocarp fiber (OPMF) are lignocellulosic biomass that abundantly generated in palm oil mills. However, the presence of these oil palm wastes has created a major disposal problem. Current treatment is either by mulching at the plantation of dumping at side of the mill. Since these materials are rich in carbohydrate these OPEFB and OPMF has been widely reported as suitable raw materials to produce fermentable sugars. However, the presence of lignin and hemicellulose in their composition hinders the access of cellulase to hydrolyse cellulose. Effective pretreatments are required to reduce the recalcitrance of lignocellulosic structures and therefore improve the fermentable sugars production. Combination of physico-chemical and biological pretreatment was proposed to obtain better fermentable sugar production from OPEFB and OPMF. Physico-chemical pretreatment like superheated steam (SHS) was used in this study as it can modify the lignocellulosic materials. However, based on previous studies, SHS pretreatment alone does not able to produce high fermentable sugars. Therefore combination pretreatment of SHS with laccase from *Trametes Versicolor* has been studied to improve delignification and at the same time enhance the production of fermentable sugars. In addition, the effect of size reduction prior to laccase pretreatment was also conducted to reduce particle size to expose large surface area so that the laccase can accessible attack to the lignin structure. This study revealed that glucose yield was successfully enhanced by combining SHS with laccase pretreatment together with size reduction of OPEFB and OPMF.

Keywords: Oil palm empty fruit bunch, oil palm mesocarp fiber, superheated steam pretreatment, laccase pretreatment, delignification, glucose