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INVESTIGATION OF OIL PALM EMPTY FRUIT BUNCHES IN BIOSODA PULPING BY TROPICAL WHITE-ROT FUNGI, *Ganoderma australe* (FR.) PAT.

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ABSTRACT

Ganoderma australe, a white-rot fungus, is well-known as a decomposer of logs and stumps in the Malaysian forest. We investigated *G. australe* (KUM60848) strain for production of ligninolytic enzymes i.e. lignin peroxidase (LiP) and laccase, and hydrolytic enzymes, i.e. cellulase and xylanase, using oil palm empty fruit bunches (EFB) in solid-substrate fermentation (SSF). EFB was shown to support good mycelial growth for *G. australe* during 28 days of solid-substrate fermentation. All tested enzyme activities demonstrated highest activities of LiP (0.18±0.02 U/ml), laccase (1.92±0.03 U/ml), cellulase (0.72±0.11 U/ml) and xylanase (0.42±0.01 U/ml) throughout the 28 days of incubation. Compared to an untreated control, the pre-treated EFB yield increased to a maximum of 18% during biopulping. Fourteen days of SSF had the highest degree of material dissolved, as shown by pulp yields and the optimum values (29.8 Nm/g tensile index and 2.73 Kpa m^2/g burst index) acceptable to obtain paper sheets.

Key words: white-rot fungi, *lignocellulolytic* enzymes, biopulping, oil palm wastes

INTRODUCTION

Fungi are the main organisms responsible for wood biodegradation. The white-rot fungi are able to degrade lignin and carbohydrates efficiently. In Peninsular Malaysia, one of common white-rot species encountered is *Ganoderma australe* (Mohamad-Hasnul *et al.,* 2012). To degrade lignin, the white-rot fungi produce extracellular oxidative enzymes such as laccase, lignin peroxidase (LiP), manganese peroxidase (MnP) and low molecular mass compounds that mediate the action of these enzymes (Kirk and Cullen, 1998). This non-specific oxidative system makes white-rot fungi useful for biotechnological applications, for instance, in the pulp and paper industry for pitch control, biopulping and biobleaching (Akhtar *et al.*, 1998). In recent years, incubation of wood chips with white-rot basidiomycetous fungi has been studied as a pre-treatment step in mechanical or chemical pulping.

Biopulping is a process of treating wood chips with lignin-degrading fungi prior to pulping. Pre-treatment of wood with lignin-degrading fungi, especially white-rot fungi, enables modification of the wood and lignin, with the aim of easing fibre separation and lignin removal in the mechanical or chemical pulping process, respectively. Various species of white-rot fungi have been used in biopulping: *Ceriporiopsis subvermispora* has proven to be very competitive both on softwoods and hardwoods (Ferraz *et al.*, 2007). White-rot fungi and their extracellular enzymes (especially ligninases and xylanases) are used for the treatment of wood chips prior to pulping. While ligninases attack the lignin content of wood, xylanases degrade hemicellulose and make the pulp more permeable for the removal of residual lignin (Singh *et al.*, 2010). The list of benefits reported for using this bio-treatment includes energy saving during defibration, an increase in the rate of delignification, a decrease in alkali consumption and improvement of pulp strength properties (Akhtar *et al.*, 1998; Mendoça *et al.*, 2002).

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