Xylanase gene from indigenous *Bacillus sp.*

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Abstract
An indigenous *Bacillus licheniformis* p7 from UNIMAS MGL culture collection showed xylanolytic activity. Thus, the aim was to isolate and characterize the xylanase gene from this bacterium. Two distinct fragments of about 650 and 750bp were successfully amplified. Both PCR products were cloned into *E. coli* XL-1 Blue. Sequencing revealed a 762bp and a 642bp sequence. A BLAST search confirmed that the 642bp sequence was a family 11 endo-1,4-beta-xylanase gene with 98% homology with *Bacillus subtilis* xylanase. However, the 750bp product matched a hypothetical protein with still unknown function from *B. licheniformis* ATCC genomic DNA with 99% homology. *In silico* characterisation of the shorter fragment showed an open reading frame encoding a 213 amino acid sequence with molecular weight of 23.3kDa and a theoretical pI of 9.42.

Introduction
Xylan is the second most abundant biopolymer in the world after cellulose. It is the major component of hemicellulose which is found abundantly in plant cell walls (Khanderparkar & Bhosle, 2006) and can consist up to 35% dry weight of higher plants (Silva *et al*., 1999). Xylan consists of a β-1,4-linked D-xylose backbone substituted to varying degrees with *O*-acetyl, α-*L*-arabinofuranosyl, 4-*O*-methylglucuronic acid groups or α-1,2-linked glucuronic acids (Singh *et al*., 2003). Xylan is abundantly found in agro-industrial waste and in Malaysia, it can be found in sago pith waste, oil palm waste, paddy husks, and sugarcane bagasse. Degradation of xylan can be achieved by xylanolytic anzyme such as xylanase.

Using xylanases, xylan can be degraded to xylose, which can be fermented by bacteria and yeasts into ethanol or organic acids. Therefore, bioconversion of agricultural waste not only reduces pollution but also offers a renewable source of energy. Other potential uses of xylanases are in biobleaching (Morris *et al*., 1998; Viikari *et al*., 1994), production of oligosaccharides (Khandeparker & Numan, 2008), bakery industry (Romanowska *et al*., 2005), and in animal feed and fruit juice production (Beg *et al*., 2001). Thus, the aim of this work is to identify the xylanase gene from indigenously isolated Bacillus licheniformis p7 that showed xylanase activity from earlier work.