Cellulose and Lignin Degrading Thermozymes from Compost for Biotechnological Application.

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Plant organic matter is mostly composed of cellulose and hemicellulose. A large part of the biomass is also lignin and lignocellulose. In composting, the organic matter is degraded and therefore cellulases and ligninases are important in this process [1]. Temperatures rise to 50C or higher and the thermophilic microorganisms that degrade this organic matter at these temperatures produce thermophilic enzymes. The aims of this study were to isolate thermophilic microorganisms from compost and to screen for cellulase and ligninase activity. The temperature optima of the enzymes were also determined. Temperature stability studies were performed. The other aim was to identify the compost microorganisms using 16S rRNA sequences. The microorganisms were isolated and assayed for cellulase, using dinitrosalicyclic acid (DNS) and carboxymethylcellulose (CMC), polyphenol oxidase (using L-DOPA) and laccase (using ABTS) activities. The temperature optima for cellulases and polyphenol oxidases were 70C and 40C, respectively. No laccase activity was observed. The cellulase activities reached 1.333 mg glucose released.ml-1.min-1. The polyphenol oxidase activities reached 5.111 M.min-1. The cellulases were stable over a period of an hour and to an extent the high temperatures induced enzyme production. 16S rRNA analysis was performed using PCR primers that were specific for the 16S rRNA region of Actinomycetes. The PCR product was ligated into the pGEM-T easy vector and sequenced. The nucleotide-nucleotide BLAST of the sequencing results showed that the microorganisms that were isolated from compost were Bacillus sp. These thermozymes have a high potential for industrial application because of their high temperature optima (specifically the cellulases).

[1] Uhlig, H. and Linsmaier-Bednar, E.M. (1998). Industrial Enzymes and their Applications, pp 89-93, 96-99, and 226-227, John Wiley & Sons, USA.