Production, Optimization and Characterization of Thermostable, Halotolerant, Detergent Compatible Cellulase from a *Bacillus* sp using Agricultural Residues

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Lignocellulose biomass is considered to be the most copious and renewable organic material on the planet. Agricultural residues are a great source of lignocellulose biomass which is inexpensive, renewable and environmentally friendly. Cellulose is the predominant constitute, while hemicellulose, pectin, and lignin are present as minor components. Cellulase is the key to achieve economically valuable high-energy molecules via effective enzymatic hydrolysis. Cellulases are adaptive enzymes which are synthesized by microorganisms during their growth in the media when cellulosic substrates are present. The current study was focused on optimizing the production conditions of cellulase-producing bacteria isolated from garden soil using inexpensive agro wastes as the sole carbon source. Furthermore, the cellulase enzyme was partially purified and characterized under different parameters. Bacterial strain, *Bacillus clausii* was manifested to produce extracellular thermostable, halotolerant and detergent stable cellulase. The culture conditions for the growth of the enzyme producer were optimized with respect to incubation time, pH, temperature, carbon sources and nitrogen sources. Cellulase production was instigated at 12 hours as soon as the bacterium entered the exponential phase and reached its maximum at 48 hours. The production of cellulase was active in a significant range of pH from pH 7 to 11. Optimal pH was recorded to be pH 11. The maximal cellulase activity was obtained between 30ºC to 40ºC. The yield of cellulase was enhanced nearly by 45% in the presence of agricultural residues including 1% of corn husks and jack fruit peel powder. Cellulase was partially purified by 60% of ammonium sulfate precipitation method followed by the dialysis. Partially purified cellulase was subjected to characterization. Maximum enzyme activity was recorded at pH 5 and 50ºC. The enzyme was thermostable perpetuating 100% original activity at 60ºC for 1 hour. The enzyme was active over a broad spectrum of sodium chloride of 2 % to 14% and the enzyme activity was induced by 8% of Sodium Chloride (NaCl). Cellulase activity was significantly inhibited by the presence of mercury (ii) ion. Detergent compatibility was varied with different types of commercially available laundry detergents. Cellulase depicted its apex of stability with respect to Surf Excel. In addition, cellulase rendered its stability in the presence of 1% Sodium Dodecyl Sulphate (SDS) and it might give an indication to be used as a potential additive in the detergent industry. We believe that the utilization of garden soil bacteria upon cellulosic waste is an inexpensive approach to reduce the enzyme production cost. And also, indirectly it helps to reduce environmental pollution. Besides, the production of cellulases that can actively participate in harsh environmental conditions is considered to be an important application from the industrial perspective.

Keywords: *Bacillus clausii*, Cellulase, Agricultural residues, Thermostable, Detergent stability, Halotolerant

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