HYPERTHERMOPHILIC β-GLUCOSIDASES: BIOCHEMICAL AND BIOPHYSICAL PROPERTIES AND POTENTIAL APPLICATIONS

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Actually there is substantial abundance of low-cost agro-industrial and forest wastes, which can be used to generate more value added products. β-Glucosidases are an important enzyme class that can be applied in several processes in food industry, and also in enzymatic hydrolysis of biomass for biofuels production. Here we describe the biochemical and biophysical properties and mode of operation of 3 hyperthermostable β-glucosidases (TpBgl3, TpBgl1, PfBgl1). The genes were identified from a survey of thermo-bacterial and archaeal genomes (\textit{Thermotoga petrophila} and \textit{Pyrococcus furiosus}), and overexpressed in \textit{E. coli}. Biophysical techniques like spectroscopy and SAXS, and biochemical analysis like temperature versus pH optimization, time of half-life, kinetics and inhibitory assays, were carried out to understand enzymes properties. Functional studies disclosed a high-temperature operating enzymes, capillary zone electrophoresis demonstrated that they can operate like exo-acting enzymes and both β-glucosidases can hydrolyze β(1,4) and β(1,3) bonds. The optimal conditions for activity of these enzymes were reached to be ranging from 80 to over 100 °C for temperature and from 3.5 to 7.5 for pH. The time of half-life for these enzymes can reach up to a 8 hours at 90 °C. Molecular dynamics were employed to investigate the experimental data through structure-based models. These results contribute for the understanding of different enzymatic specificities. Our findings suggest that these proteins work fine at high temperatures and therefore are useful in food industries processes and hot water biomass pretreatments.