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Cellulolytic and Xylanolytic Enzymes from Mycelial Fungi

Authors : T. Sadunishvili, L. Kutateladze, T. Urushadze, R. Khvedelidze, N. Zakariashvili, M. Jobava, G. Kvesitadze

Abstract : Multiple repeated soil-climatic zones in Georgia determines the diversity of microorganisms. Hundreds of microscopic fungi of different genera have been isolated from different ecological niches, including some extreme environments. Biosynthetic ability of microscopic fungi has been studied. Trichoderma ressei, representative of the Ascomycetes secrete cellulolytic and xylanolytic enzymes that act in synergy to hydrolyze polysaccharide polymers to glucose, xylose and arabinose, which can be fermented to biofuels. The other mesophilic strains producing cellulases are Allesheria terrestris, Chaetomium thermophile, Fusarium oxysporium, Piptoporus betulinus, Penicillium echinulatum, P. purpurogenum, Aspergillus niger, A. wentii, A. versicolor, A. fumigatus etc. In the majority of the cases the cellulases produced by strains of genus Aspergillus usually have high β-glucosidase activity and average endoglucanases levels (with some exceptions), whereas strains representing Trichoderma have high endo enzyme and low β-glucosidase, and hence has limited efficiency in cellulose hydrolysis. Six producers of stable cellulases and xylanases from mesophilic and thermophilic fungi have been selected. By optimization of submerged cultivation conditions, high activities of cellulases and xylanases were obtained. For enzymes purification, their sedimentation by organic solvents such as ethyl alcohol, acetone, isopropanol and by ammonium sulphate in different ratios have been carried out. Best results were obtained with precipitation by ethyl alcohol (1:3.5) and ammonium sulphate. The yields of enzyme according to cellulase activities were 80-85% in both cases. Cellulase activity of enzyme preparation obtained from the strain Trichoderma viride X 33 is 126 U/g, from the strain Penicillium canescence D 85–185U/g and from the strain Sporotrichum pulverulentum T 5-0 110 U/g. Cellulase activity of enzyme preparation obtained from the strain Aspergillus sp. Av10 is 120 U/g, xylanase activity of enzyme preparation obtained from the strain Aspergillus niger A 7-5–1155U/g and from the strain Aspergillus niger Aj 38-1250 U/g. Optimum pH and temperature of operation and thermostability, of the enzyme preparations, were established. The efficiency of hydrolyses of different agricultural residues by the microscopic fungi cellulases has been studied. The glucose yield from the residues as a result of enzymatic hydrolysis is highly determined by the ratio of enzyme to substrate, pH, temperature, and duration of the process. Hydrolysis efficiency was significantly increased as a result of different pretreatment of the residues by different methods. Acknowledgement: The Study was supported by the ISTC project G-2117, funded by Korea.

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