PRODUCTION OF INDUSTRIAL ENZYMES IN SOLID STATE FERMENTATION OF AGRICULTURAL WASTES BY ZYGOMYCETES

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Large amount of corn-stalks and leaves arise as agricultural waste during the agro-industrial processes. Solid-state fermentation to produce different industrial enzymes such as cellulolytic enzymes, lipases and proteases, and bioconversion to ethanol may provide an alternative and economic path to utilize these residues. Zygomycetes fungi have been assumed to play an important role in the decomposition of plant and other organic materials in consequence of their effective extracellular enzyme production. Several members of them are commonly used in different biotechnological applications for the large scale production of industrial enzymes, however, production of these enzymes on agricultural wastes are poorly characterized until to date. The aim of our present study was to investigate the activities of cellulolytic enzymes and the production of lipase and protease by zygomycetous strains on agro-industrial wastes such as corn-stalks, corn-leaves and wheat bran.

The *Mucor*, *Rhizomucor*, *Gilbertella* and *Rhizopus* isolates selected for this study have proven to be good extracellular β-glucosidase producer in our previous experiments in which submerged cultivation on cellobiose and solid-state fermentation on wheat bran were used (TAKÓ et al, 2010). In these studies, solid-state fermentation generally resulted in significantly higher enzyme activities than the liquid cultures. Therefore, two solid state fermentation systems were used in the present assays: mixture of chopped corn stalks and corn leaves, and their mixtures with wheat bran at a ratio of 1:1. Fermentations were carried out for 12 days at 25 °C or 37 °C, and enzyme activities were determined from the crude water extracts obtained every second day of the cultivation. Isolates grew intensively on these substrates, and high activities of the cellulolytic enzymes and lipase have been observed during the fermentation period. The total cellulolytic activity of the crude extracts was determined by using Whatman No. 1 filter paper as substrate; in case of each isolate, the highest amount of reducing sugar was measured at the second day of the fermentation. It is worth to point out that significantly higher total cellulolytic activity was usually detected in the crude extracts derived from fermentation medium containing wheat bran. It might be due to the fact that wheat bran supplied convenient amount of nutrients and porosity for oxygen supply. In both fermentation systems, cellobiohydrolase activity of the tested fungi was found to be significantly lower than their endoglucanase and β-glucosidase activities; additionally, it was detected that the activity of endoglucanase generally reaches its maximum during the first half of the incubation, while β-glucosidase on the sixth day or later. Among the tested representatives of the abovementioned genera, a *Rhizomucor* sp. and a *Rhizopus* sp. strains proved to be outstanding in its lipase, and protease producing ability, respectively. The investigated fungi could potentially be applicable for biodegradation of agro-industrial wastes and efficient production of industrial enzymes on these cheap, easily available substrates.

TAKÓ, M., FARKAS, E., LUNG, SZ., KRISCH, J., VÁGVÖLGYI, CS., PAPP, T. (2010): Identification of acid- and thermotolerant extracellular β-glucosidase activities in Zygomycetes fungi. Acta Biologica Hungarica, Volume 61. pp. 101-110.