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BIOTRANSFORMATION OF AGRICULTURAL WASTES WITH INNOVATIVE ENZYMES

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Abstract

Among potential alternative bioenergy renewable resources, lignocellulosics have been identified as the prime source of biofuels and other value-added products, due to their high polysaccharides content. The partial or total degradation of the polysaccharide fractions is an ambitious target that can be efficiently reached with eco-friendly enzyme-based process. The description of new hydrolytic enzymes is an important step in the development of techniques which use lignocellulosic materials as a starting point for fuel production and/or value added products (ex: xylo-oligosaccharides).

So, the main goal of this work is the study of new hydrolytic enzymes from non-conventional microorganisms for the production of fermentable sugars from some agricultural wastes. In this context, a screening of some microorganisms, including thermophilic and halophilic bacteria, was carried out from which the strains *Anoxybacillus* sp. strain 3M and *Geobacillus thermodenitrificans* were selected, due to their interesting xylanolytic activities.

Herein, we show the characterization of the xylanolitic activities of both strains and compare the potential of their xylanases to transform two types of raw materials: brewer's spent grain (BSG) and grape cane. These residues were subjected to several pre-treatments to allow a better release of the sugars by the action of the enzymes. In particular the materials were treated with ammonium (10% v/v) and potassium hydroxide (10% v/v) in the following operational conditions: 70º C for 22h and 121° C for 30 min, for ammonia and potassium hydroxide soaking, respectively.

The results obtained showed that for both strains the presence of xylanolytic enzymes was revealed in the culture supernatant supplemented with xylan, with the highest amount produced in the late stationary phase (1.34 U/mL for *Anoxybacillus* sp. strain 3M and (0.95 U/mL for *G. thermodenitrificans*). The hydrolysis tests of pretreated BSG and/or grape cane with the novel enzymes from both strains are in progress for the polysaccharide fraction degradation to xylo-oligosaccharides or xylose. In the hydrolysis studies with *G. thermodenitrificans* xylanases the highest xylan degradation yield was obtained in grape cane, after 48 h incubation. In this assay, 25% xylan was hydrolyzed to xylose, revealing the presence of both xylanase and beta-xylosidase activities in the supernatant.