INDUSTRIAL INTEREST HYDROLASES PRODUCED IN SOLID STATE FERMENTATION OF *Aspergillus niger* WITH TRITICALE

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Key words: Aspergillus niger , hydrolases, enzymatic activity .

Introduction. *Aspergillus* spp. strains produce several enzymes like phytases, xylanases, cellulases, proteases, amylases and lypases, which have been exploited in industry, mainly in food industry, during solid state fermentation. Triticale (wheat and rye synthetic hybrid) generates agricultural waste that may be applied as substrate in microbial enzymes production by solid state fermentation (SSF) and may be an appropriate option because of its availability throughout the year in North of Mexico. However, triticale use as a substrate for solid state fermentation has not much background to date.

The goal of this research was to evaluate activities of industrial interest enzymes in solid state fermentation (SSF) of *Aspergillus niger* with triticale as solid substrate, mainly phytases.

Methods. Mixtures of triticale spike and stalk (1:1 and1:3 w/w) of different mature stages (mature and immature) were used as substrate for the SSF. Ammonium sulfate was applied as nitrogen source (0.20 g/ml) and the medium was inoculated with 25 ml of pellet solution of *Aspergillus niger* to have a moisture of 62%. Cultures were incubated at 25°C for four days. Crude extract was analyzed by different enzymatic activity tests (qualitative and quantitative): cellulase, xylanase (1, 2), amylase (1, 3), phytase (4), protease, and lipase (2, 5).

Results. Extracts from fermentations on mature triticale at both proportions showed the highest phytase activity. However, the lower cost of stalk than spike, makes that the proportion of 1:3 was the most indicated to be used as substrate for make other enzymes determinations, in wich the highest hydrolysis halo was observed in protease test, followed by cellulase and amylase, as well as xylanase and lipase activities tests (Fig. 1). Peteira *et al.* (6) got similar results for protease activity from *Pochonia chlamydosporia*. Diorio *et al.* (7) reported similar cellulase and amylase activities for *Saccobolus saccoboloides* between 2 and 4 days of growth in a synthetic liquid medium, while in xylanse test, hydrolysis halo was not clear until 8th day (7).

Cellulase activity detected by quantitative test was 84.15 U/gSs, and was similar to activity reported by Kang *et al*. (8) for SSF performed with *A. niger* on wheat bran and rice straw. On the other hand, xylanase level (17.18 U/gSs) was similar to reported by Presertsan *et al.* (14.79 U/gSs) (9). Torres (2) reported specific protease activity (22.32 U/mg protein) lower than that detected in the present work (29.08 U/mg protein); likewise specific phytase activity was higher (30.12 U/protein mg) than reported by Torres (13.58 U/protein mg).

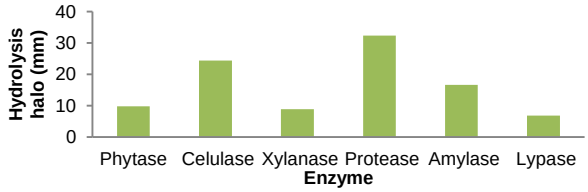

Figure 1. Hydrolysis halos quantified by means of activity tests for different enzymes using crude extract obtained at 4th day of *Aspergillus niger* SSF on triticale.

Table 1. Activity level of different enzymes produced by *Aspergillus niger* in SSF with triticale after 72 h of incubation.

Enzyme	Activity	Specific activity U/mg protein
Cellulase	84.15±2.3 U/g Ss	6731.81
Xylanase	17.18±0.0002 U/gSs	1374.32
Phytase	0.37±0.007 U/ml	30.11
Lipase	100.84±5.04 UI/ml	--
Amylase	5.26±1.19 UI/ml	--
Protease	0.36±0.139 UI/ml	29.08 U/mg prot.

Conclusions. Triticale can be applied to produce several enzymes of industrial interest, mainly lipases, cellulases and xylanases, by *Aspergillus niger* in SSF.

Acknowledgements. The authors would like to thank CONACYT for COAH-2012-C20-2-188837 grant and to FCCyT for the financial support through the program "*Verano por la Innovación en la Empresa 2012"*.

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