GLUCOAMYLASE PRODUCTION IN SUBMERGED AND SOLID STATE CULTURE BY *ASPERGILLUS NIGER* 10

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Introduction. Two of the most used cultures in biotechnology are submerged and solid state culture. Submerged culture is more often used in the industry, in spite the advantages that have been reported for the solid state culture[1]. To the moment, there are no known reasons for the differences between these two cultures.

Glucoamylase production is carried out by these two cultures is (EC 3.2.1.3.). This enzyme hydrolyses starch by attacking both α-1,4 and α-1,6 glucosidic linkages from the non-reducing end of the molecule[3]. Its main application is in the production of high-glucose syrups from starch[2,4].

The objective of this work was to compare the production of glucoamylase in submerged and solid state culture as a model to try to understand the differences between these two cultures.

Methods. The fungi used was *Aspergillus niger* 10. Submerged cultures were carried out in 250 mL Erlenmeyer flasks with 50 mL of sterile medium[3] with soluble starch as carbon source inoculated with $1x10^6$ spores/mL. Crude extract was obtained filtrating with Whatman paper No. 41. Solid state cultures were carried out in 125 mL Erlenmeyer flasks with 3 g of perlite and 4.5 mL of sterile medium[3] with soluble starch as carbon source inoculated with $1x10^7$ spores/mL. For this culture crude extract was obtained adding 25 mL of water and agitating 200 rpm in a rotary shaker, afterwards the extract was filtrated with Whatman paper No. 41.

Glucoamylase activity was measured using maltose as substrate[4]. Protein concentration was determined with BioRad DC Protein Assay.

Results.

Submerged and solid state cultures were carried out using a defined medium with starch as carbon source to produce glucoamylase by *Aspergillus niger* 10.

Glucoamylase activity was determined for the last two days of culture with the highest values of protein (Table 1). As expected, there was more activity per mL of medium in solid state culture. The highest value of glucoamylase activity, 1.8 U/mL medium, obtained in solid state culture was three times higher than the value obtained in submerged culture. This behavior has been observed in comparing these two cultures in the production of other enzymes like tannases[1].

Table 1. Glucoamylase production in submerged and solid state culture by *Aspergillus niger* 10.

Time (days)	Glucoamylase activity (U/mL medium)	
	Solid state culture	Submerged culture
3	0.5 ± 0.04	0.02 ± 0.05
4	1.8 ± 0.3	0.06 ± 0.05

Fig. 1 shows that extracellular protein concentration in SSF is higher than in submerged culture.

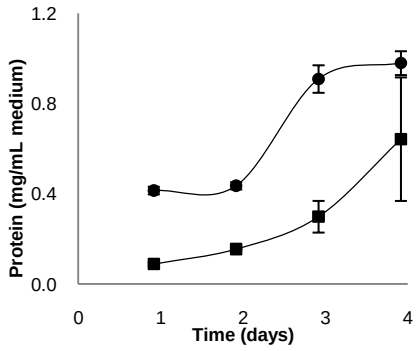

Fig.1 Protein production in submerged (■) and solid state (●) culture by *Aspergillus niger* 10.

Conclusions. The protein and glucoamylase activity values produced per mL of medium in solid state culture were higher than those obtained in submerged culture in the same conditions.

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