GLUCOSE DEGRADATION USING *ASPERGILLUS NIGER* IMMOBILIZED IN ALGINATE BEADS AT DIFFERENT CONCENTRATIONS

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Introduction. Cell immobilization is an alternative technique to improve the biodegradation of certain compounds and reduce biomass production, which can be an advantage in those processes where the excess of biomass is undesirable. Calcium alginate is one of the most frequently used materials for cell immobilization (1). The alginate concentration used to immobilize cells influences the size and porosity of the resulted beads (2), so it is important to identify the best alginate concentration to obtain stable beads.
The objective of this work was to study the effect of alginate concentration on the degradation of glucose and biomass production by immobilized *Aspergillus niger*.

Methods. The effect of alginate concentration was identified preparing beads by mixing pellets of *A. niger* with a solution of 2 or 3% (w/v) of calcium alginate for the conformation of the gel (3). The resulting beads were incubated in 100 mL of mineral medium (4) containing 20 g/l of glucose, at 35°C and 200 rpm for 10 days. The residual glucose was quantified by DNS and the produced biomass by dry weight. In order to know glucose absortion on alginate beds and free cell behavior, two control experiments were developed: beads poisoned with sodium azide and a culture developed with free cells.

Results. As shown in Figure 1, biomass production with free cell was 1.34 g/L, which is similar to that obtained with cells immobilized on 2% alginate (1.4 g/L). However, increasing the alginate concentration in the immobilization mixture caused a decrease in bead porosity, limiting the development of biomass in the bead. So, when 3% of alginate was used the biomass obtained was 0.8 g/L. These results indicate that the use of 3% alginate reduced biomass production, 1.6 times with respect to free cells. It is important to note that in both assays were immobilized cells were used, a biomass release occurred. So the biomass concentrations reported here includes free and retained biomass.
On other hand, glucose consumption by free cells reached 96%, meanwhile for the immobilized cells (with 2% and 3% of alginate) the corresponding values were 99% and 97%, respectively.
The poisoned cell beds immobilized with 2% and 3% of alginate absorbed 0.34 and 0.04 g of initial glucose, respectively. This indicates that the removal of glucose can be attributed mainly to degradation process developed by *A. niger.*

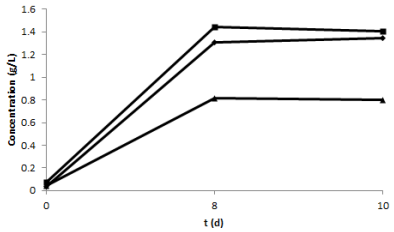

Fig.1 Biomass production by free cells (♦), cells immobilized with 2% alginate (■) and cells immobilized with 3% alginate (▲).

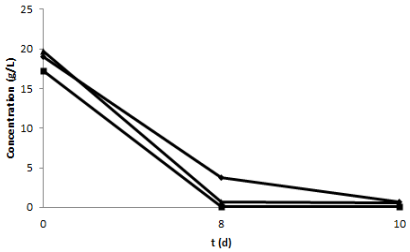

Fig.2 Glucose consumption by free cells (♦), cells immobilized with 2% alginate (■) and cells immobilized with 3% alginate (▲).

Conclusions. High alginate concentration make beads with low porosity, which absorb lower glucose quantities, though provoke a slight release of biomass. However, the immobilized cells showed a good substrate consume behavior.

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References.

1. Jobanputra, A Hemra. Karode B Ashok. and Bhaskar S. 2011. Biotechnol. Bioinf. Bioeng. 2011, 1(4):529-535.
2. Gombotz Wayne R and Wee Siow Fong. 1998. Advanced Drug Delivery Reviews 31:267–285.
3. Ki-Yong Lee and Tae-Ryeon Heo. 2000. Appl Environ Microbiol. 66: 869–873.
4. Coca J., Hernández O., Berrio R., Martínez S., Díaz E. and Dustet J.C. 2001. Biotecnología Aplicada18:216-220