



Recovery of molecules with high biotechnological interest from agriculture wastes using adsorption in solid bed

Ana Catarina Santos Leite Da Silva¹, Nadia Woitovich Valetti¹, M. Emilia Brassesco¹, José António Couto Teixeira²
Guillermo A. Picó¹

¹Instituto de Procesos Biotecnológicos y Químicos (IPROBYQ - CONICET). Universidad Nacional de Rosario, Argentina.

²Centre of Biological Engineering, Universidade do Minho, Braga, Portugal.
gpico@fbiof.unr.edu.ar

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It is well established that the downstream processing costs for enzyme production account for about 50–80% of the total process cost. The adsorption of proteins in batch systems is an important method of protein concentration and purification especially when the target protein is in a feed stock. Adsorption has been widely used as one of the main steps of downstream operations in various fields, such as biology, medicine, biotechnology and food processing. The development of low-cost adsorbents with high adsorption capacity and selectivity has been a great challenge. Moreover, adsorption should be perfectly reversible to optimize recovery while preserving the activity of the desorbed (recovered) enzyme.

In the last years, the use of natural polymers to obtain non-soluble matrixes has received much attention in the downstream process of industrial enzymes (1, 2, 3). Alginate (Alg) and Chitosan (Chi) are the most extensively studied polysaccharides used in the formation of non-soluble matrixes for protein adsorption in a reversible manner. Alg (a weak polyacid) beads can be prepared by extruding a solution of sodium alginate as droplets into a divalent cation solution such as Ca^{++} . However, the working pH range of the matrix is limited and when calcium is lost, so the alginate-calcium complex is destroyed. Alg can be used with other non charged polysaccharide such as gum guar. The Alg - gum guar bed can be transformed in non soluble matrix by crosslinked with epichlorhydrin, the matrix showed stability over a wide pH range.

In the present work, beads made from a mixture of alginate and guar gum crosslinked with epichlorhydrin were used to study the adsorption of different enzymes from waste of meat and agricultural industries, or produced by fungi. We are testing the adsorption capacity of this matrix in enzymes such as: chymotrypsin (bovine), peroxidase from soybean hull, cellulase from fungi, etc.

Experiments of adsorption/desorption were performed in order to find the best working condition. Adsorption isotherms, obtained at two temperatures, showed a sigmoid shape. The maximal enzyme amount absorbed by the matrix at pH 5.0 was between 60 - 80%, while desorption showed 80% of the biological activity recovery of enzyme, under the condition of 500 mM NaCl. The capacity of matrix adsorption was around 10 mg enzyme per g of humid matrix. Because, 1 g of matrix has around 98% of water, 1 g of dry matrix can absorb around 0.5 g of enzyme, a capacity similar to the commercial matrixes. The time necessary to complete the adsorption process was around 10-30 min, while desorption process was completed in 10 min. When successive cycles of adsorption/washing/desorption were performed, it was observed that the matrix remained functional until the fourth use. These results are important in terms of diminishing of cost of bioseparation process using a friendly environment and non expensive polymers.

References

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