Production of Galacto-oligosaccharides during lactose hydrolysis by *Aspergillus oryzae* β-galactosidase immobilized on polysiloxane-polyvinyl alcohol magnetic support

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Galactooligosaccharides (GOSs) are nondigestible food ingredients that encourage proliferation of selected groups of the colonic microflora, thereby altering the composition toward a more beneficial community. The GOSs can be formed enzymatically and are produced from lactose by the action of β-galactosidases which have transgalactosylation activity. β-Galactosidase is an enzyme with wide industrial applications, mostly in the dairy industry for the hydrolysis of lactose and, more recently, in the synthesis of galactooligosaccharides.

The GOS produced during lactose hydrolysis by *A. oryzae* β-galactosidase immobilized on Polysiloxane-Polyvinyl Alcohol Magnetic (mPOS-PVA) was studied. The initial lactose concentration in the reaction media affected the total amounts and types of GOS produced. In general, higher initial lactose concentrations produced more and larger GOS. A maximum GOS production of 25-26% (w/w) of total sugars was achieved at near 50% lactose conversion from 400 g/L of lactose at pH 4.5 and 40 ºC. The major types of GOS formed were tri-saccharides, accounting for more than 70% of the total GOS produced in the reactions. Any changes in GOS formation were observed in different temperature and pH, but the reaction rate was affected. The concentrations encountered near maximum GOS greatly inhibited the reactions and reduced GOS yield in the presence of galactose and glucose. The mPOS-PVA as the support matrix for enzyme immobilization did not affect the GOS formation characteristics of the enzyme, suggesting no diffusion limitation in the enzyme carrier. Furthermore, the mPOS-PVA β-galactosidase preparation retained about 70% of the initial activity after being reutilized 15-times. Data obtained were fitted to kinetic model based on the Michaelis-Menten mechanism by non linear regression to determine the influence of the temperature and the lactose concentration on the activity of the enzyme.

Hence, one can conclude that mPOS-PVA is an attractive and efficient support for β-galactosidase immobilization, due to the simplicity of the matrix preparation and immobilization methodology, the catalytic properties of the derivative thus produced and the straightforward removal of the enzymatic derivative from the reaction medium by simply applying a magnetic field around the bioreactor.