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Effect of the type of immobilization of β -galactosidase on the yield and selectivity of synthesis of transgalactosylated oligosaccharides.

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Abstract

Aspergillus oryzae β -galactosidase was immobilized by crosslinking and aggregation (CLA), and by covalent attachment to monofunctional glyoxyl agarose (GA) and to the heterofunctional supports: amino-glyoxyl agarose (Am-GA), carboxy-glyoxyl agarose (Cx-GA) and chelate-glyoxyl agarose (Che-GA) with the purpose of determining the effect of immobilization on the performance of the biocatalysts in terms of yield, productivity, kinetic parameters and product distribution in the synthesis of transgalactosylated oligosaccharides (lactulose, galacto-oligosaccharides and fructosyl-galacto-oligosaccharides). In all transgalactosylation reactions, yield was barely affected by the type of immobilization; however, a strong effect on productivity was observed, being the highest with the enzyme immobilized in CLA- β G and Am-GA and the lowest with the enzyme immobilized as Cx-GA and Che-GA. The type of immobilization had a strong influence on the apparent kinetic parameters of the biocatalysts, affecting product composition during the synthesis of transgalactosylated oligosaccharides. Diffusional restrictions of the biocatalysts increased with the degree of crosslinking, particle size and enzyme load; however their effect on the synthesis of the transgalactosylated products was low since reactions are conducted at very high substrate concentrations. Results suggest that, because of the operation conditions, immobilization has a more critical impact on the hydrolysis of lactose than in its transgalactosylation where the use of very high substrate concentrations is mandatory.

Graphical abstract

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