Enzymatic Production of Fructose Monoacrylate and Validation of HPLC method for Quantification of Products

Authors:

Bianca T.Ayres, Gustavo P.Valença, Telma T.Franco

Affiliation:

School of Chemical Engineering, State University of Campinas, PO box 6066, zip code 13083-852, Campinas, São Paulo, Brazil.

Abstract

Sugar ester applications are continuously expanding with studies about the influence of different acyl donors and of different carboxylic acids. The search for a broader variety of building blocks to be polymerized to hydrogels can be partially satisfied by esterification of short-chain carboxylic acids, due to its low hydrophobicity (Patil et al., 1996, Boeckh et al., 2005).

Enzymatic esterification of acrylic acid with fructose in tert-butanol, catalyzed by lipase B commercial immobilized Candida antarctica was studied. The influence of reaction parameters to produce only fructose monoacrylate such as molar ratio, amount of lipase and water content in the system was studied. Increasing the molar ratio of 1:3 to 1:5 increased the conversion of the fructose from 28% to 42%, but production was shifted to the multiacrylation.The amount of commercial immobilized lipase from C.antarctica was studied to allow the activity of the lipase and toward the production of the monoacrylate. The amount 20g/L of lipase in the system resulted near conversion of fructose when the amount was higher.

Addition of 3 g of molecular sieve in 25 mL of the reaction system increased the synthesis of esters of producing 49.5mM monoacrylate with a fructose conversion of 84%. Determination of the concentration for reaction products (mono-, di- and triester) could not be made by the use of calibration curves by HPLC-RI since there are no commercial standards for fructose

acrylates. In order to estimate the amount of each product, the response factors for the esters were calculated by multiple linear regression based on the peak areas and the the reaction with mass balance. After separation of the reaction mixture by flash chromatography, the response factors of the pure products were measured. The results agree within 20% with the estimated values.

Keywords

Enzymatic esterification, sugar ester, acrylic acid, lipase, fructose

References

Boeckh, D., Hauer, B., Haering, D. Enzymatic synthesis of sugar acrylates. WO 03/042227 BASF ktiengesellschaft, Germany, 2005;

Patil, N.S., Dordick, J.S., Rethwisch, D.G. Macroporous poly(sucrose acrylate) hydrogel for controlled release of macromolecules. Biomaterials v.17, p.2343-2350, 1996;

List of the last authors publications

Ayres, B. Vagetti, E., Valença, G., Franco, T.T. Parameter Optimization for Enzymatic Production of Fructose Monoacrylate and Validation of HPLC method for Quantification of Products. *Journal of Molecular Catalysis B: Enzymatic*, 2011.

Tsukamoto J, Haebel S, Valença GP, Peter MG, Franco TT. Enzymatic direct synthesis of acrylic acid esters of mono- and disaccharides. *Journal of Chemical Technology and Biotechnology, v.93, p.*1486-92, 2008.