Fed-batch operation for the synthesis of lactulose with β-galactosidase of *Aspergillus oryzae*

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Fed-batch operation for the synthesis of lactulose with β-galactosidase of *Aspergillus oryzae.*

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Abstract

Fed-batch synthesis of lactulose from lactose and fructose with *Aspergillus oryzae* β-galactosidase was evaluated, obtaining a concentration of 40.4 $g \cdot L^{-1}$, which is 20 % higher than obtained in batch, while the concentration of transgalactosylated oligosaccharides (TOS) was reduced by 98%. Therefore, selectivity of lactulose synthesis can be significantly higher by operating in fed-batch mode. The enzyme-limiting substrate mass ratio (E/S) is a critical variable in fed-batch operation. Higher values favor lactose hydrolysis over transgalactosylation, being 400 IU/g the limit for proper lactulose synthesis in fed-batch operation. Selectivity of lactulose synthesis increased with E/S being quite high at 800 $IU_H \cdot g^{-1}$ or higher. However, this increase was obtained at the expense of lactulose yield. Lactulose synthesis in fed-batch operation was a better option than conventional batch synthesis, since higher product concentration and selectivity of lactulose over TOS synthesis were obtained.

Keywords: β-galactosidase, lactulose, fed-batch operation, batch operation, Aspergillus oryzae.

1. Introduction

Dairy industry has been revitalized in recent decades by the introduction of functional food products (Casiraghi et al., 2007). Within this scenario, non-digestible oligosaccharides have gained importance by selectively stimulating the activity and/or growth of healthy bacteria within the colon microbiota and providing immunity against some pathogenic species (Gibson & Roberfroid, 1995; Huebner et al., 2007). Among them, lactulose stands out for