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DEVELOPMENT OF A BIOFILM TECHNOLOGY FOR THE PRODUCTION OF 1,3-PROPANEDIOL (1,3-PDO) FROM CRUDE GLYCEROL

Silvia Casali¹, Mine Gungormusler², Lorenzo Bertin¹, Fabio Fava¹, Nuri Azbar²

¹Department of Civil, Environmental and Materials Engineering (DICAM), Environmental Biotechnology and Biorefineries Research Unit Faculty of Engineering, University of Bologna Via Terracini 28, 40131 Bologna, Italy; ²Bioengineering Department, Faculty of Engineering, Ege University, 35100 Bornova, Izmir, Turkey; Phone: +90 232 3880378x138, fax: +90 232 388 4955, e-mail: nuriazbar@gmail.com

Abstract

Glycerol is the main by-product of transesterification of fats in the biodiesel production. 1,3-propanediol (1,3-PDO) is a valuable chemical that can be obtained from glycerol by microbial conversion. A number of Enterobacteriaceae species are able to produce 1,3-PDO from glycerol in stirred tank freely suspended cell bioreactors. Little is known about the use of crude glycerol in the production of 1,3-PDO and about the opportunity to intensify the process via strain immobilization in packed bed bioreactors.

In this work, Citrobacter freundii, strain DSM 15979, and Pantoea agglomerans, strain DSM 30077, were tested for their ability to produce 1,3-PDO from crude glycerol in shaken flask batch conditions and in packed bed biofilm reactors operating under continuous conditions. Three different hydraulic retention times (HRT) were comparatively tested (8, 4 and 2 h) in order to understand its effects on 1,3-PDO production under immobilized cell conditions. The study revealed that HRT significantly influenced the process performances. The best productivities were observed when a HRT of 2 h was applied. However, both strains were found to be good candidates for 1,3-PDO production in biofilm reactors, even though P. agglomerans displayed quite higher productivities (3.6 g/(L h)) than the other strain.

Using a novel microbial strain and packing material, namely, P. agglomerans and VUK, respectively, in the bioconversion of crude glycerol into 1,3-PDO in packed bed biofilm reactors. In particular, P. agglomerans appears as a promising microorganism for 1,3 PDO production than C. freundii, which however was for the first time found to produce 1,3 PDO from crude glycerol. This study provides experimental evidence of the possibility of using P. agglomerans as immobilized cells in a fixed bed bioreactor system for the continuous production of 1,3PDO from crude glycerol.