Environmental Engineering and Management Journal *March 2012, Vol.11, No. 3, Supplement, S126*
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

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

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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.