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EFFECT OF CELL IMMOBILIZATION ON THE PRODUCTION OF 1,3-PROPANEDIOL

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Abstract

The feasibility of stainless steel wire, glass raschig ring and Vukopor®(a porous ceramic cube) as immobilization materials were investigated for the continuous production of 1,3-propanediol (1,3-PDO) from waste glycerol with locally isolated *Klebsiella pneumoniae (*GenBank No: 27F HM063413*)*. In addition, the effect of hydraulic retention time (HRT) on the production of 1,3-PDO were also investigated. Continuous cultures with immobilized cells revealed that 1,3-PDO production was more effective and more stable than suspended culture system. A HRT of 0.5 h is the best one in terms of volumetric production rate. However, 1,3-PDO concentrations reached the highest values when a HRT of 12 h was used. Furthermore, cell immobilization had also obvious benefits especially for resistance of the production for extreme conditions. The results indicated that immobilized cells achieved a 2.4 fold higher productivity (4.8 g 1,3-PDO/L/h) in comparison to suspended cell system (2.0 g 1,3-PDO/L/h). The degree of cell immobilization was measured via the biomass suspended and attached on the immobilization materials. The results indicated that successful immobilization between the ranges of 70-78% was achieved for ceramic and glass materials, however a lower percentage (58%) of immobilization was observed with the immobilized bioreactor filled with stainless steel wire. This process has the ability to work in smaller reactor volumes with shorter total fermentation periods. Therefore, it allows using high dilution rates and raises 1,3-PDO productivity. As a matter of fact, HRT was found to be a significant factor. All three of the materials are good candidates for immobilization purpose; however, glass Raschig ring is a better support material than stainless steel wire and Vukopor® in terms of immobilization ratios. The results clearly indicated that 1,3-PDO production in immobilized packed-bed reactors is superior to suspended cell culture systems. The results reported in this study may help to save the cost of 1,3-PDO production since higher production in smaller bioreactors could be achieved. Therefore, continuous fermentation in a packed-bed bioreactor system is a suitable method to enhance 1,3-PDO production.