CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME III

Editors:

Md. Zahangir Alam
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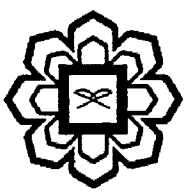
Department of Biotechnology Engineering
Faculty of Engineering
International Islamic University Malaysia



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THE USE OF MODIFIED POLYMERIC POLYHIPE AS AN IMMOBILIZED CELL MATRIX

Dzun Jimat and Azlin Azmi

Department of Biotechnology Engineering, Faculty of Engineering,
International Islamic University Malaysia, P.O. Box 10, 50728 Kuala Lumpur, Malaysia

ABSTRACT

Utilization of modified-polyHIPE polymer matrix in the immobilization cell system is probably can substitute conventional cell matrix. The confined microenvironment was designed to promote the bacterium growth and its metabolic activity. The applied forced-flow seeding technique yielded a more uniform distribution of cells within the polymeric support, which also helps to improve nutrient transport. This also prevents significant growth of cells around the outer surface of matrix. The microstructure of the matrix with respect to its physico-chemical characteristics, which include appropriate pore and interconnect sizes as well as surface chemistry (i.e. hydrophobic, hydrophilic), are very important with respect to the flow of nutrients and waste material and also for cell migration. As a result, the developed immobilized matrix can be performed effectively and essential in the area of bioprocess development specifically for microbial fermentations.

Keywords: polyHIPE polymer matrix, immobilization cell, microenvironment, forced-flow seeding, physico-chemical characteristics

INTRODUCTION

The immobilization of the diverse types of microbial species in various bioprocesses that they are currently applied to (e.g. wastewater treatment, production of enzymes and solvents etc) has shown that this cultivation system offers a number of advantages over conventional free cells (planktonic) cultures. The advantages of this system include high cell concentrations and high productivity for metabolites and proteins, the maintenance of plasmid stability, the ease of biomass removal from the bulk liquid and a reduction in cell washout associated with high dilution rates. The careful selection of immobilization technique, as well as the matrix material used, is essential for ensuring the efficiency of the system and the minimalization of problems such as cell leakage and restricted substrate diffusion.

Cell immobilization can be defined as the physical confinement or localization of viable microbial cells to a defined region of space in such a way as to exhibit hydrodynamic characteristics which differ from those of the surrounding environment (Karel et al., 1985a). There are three components that can be differentiated in the immobilized cell systems,