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Production of Medium-Chain-Length Polyhydroxyalkanoates by Fed-Batch Fermentation, Using Oleic Acid as Carbon Source

K.L. Cheong, M.S.M. Annuar and I.K.P. Tan

Institute of Biological Sciences, Faculty of Science, University of Malaya

The production of medium-chain-length polyhydroxyalkanoates (mcl-PHA) by *Pseudomonas putida* PGA1 using palm oil and its derivatives as carbon substrates had been established in this laboratory. PHAs are elastomers with low crystallinity, and they have attracted global interest as potential substitutes for petrochemical plastics. Thus there is a requirement for higher quantities of this biopolymer for applications evaluation. Scaling up studies was performed using 5 litre, 10 litre and 50 litre fermenters implementing a fed-batch system with oleic acid as the sole carbon source in mineral salts medium. Intermittent feeding of magnesium sulfate solution minimizes the precipitation between the medium's mineral components and oleic acid. The production of mcl-PHA was significantly improved when double-limitations of nitrogen and phosphate elements were imposed on the culture as compared to the single-limitation of either element. The 5L fermentation runs had consistently generated about 40g/L total biomass (dry weight) of which 38% was mcl-PHA. By employing optimal feeding strategy and maintaining dissolved oxygen at a constant level in the liquid medium, total biomass and mcl-PHA content obtained for the 10L fermentation runs averaged 52 g/L and 48%, respectively. The 50L runs presented a classic case of scaling-up issue with mass transfer limitation; the total biomass yield was reduced to 11 g/L, nevertheless the mcl-PHA content remained significant at 48% of the total biomass.