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Optimization of Poly-β-Hydroxybutyrate Recovery from Bacillus Subtilis Using Solvent Extraction Process by Response Surface Methodology

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Abstract : Polyhydroxybutyrate (PHB) is an interesting material in the field of medical science, pharmaceutical industries, and tissue engineering because of its properties such as biodegradability, biocompatibility, hydrophobicity, and elasticity. PHB is naturally accumulated by several microbes in their cytoplasm during the metabolic process as energy reserve material. PHB can be extracted from cell biomass using halogenated hydrocarbons, chemicals, and enzymes. In this study, a cheaper and non-toxic solvent, acetone, was used for the extraction process. The different parameters like acetone percentage, and solvent pH, process temperature, and incubation periods were optimized using the Response Surface Methodology (RSM). RSM was performed and the determination coefficient (R2) value was found to be 0.8833 from the quadratic regression model with no significant lack of fit. The designed RSM model results indicated that the fitness of the response variable was significant (P-value < 0.0006) and satisfactory to denote the relationship between the responses in terms of PHB recovery and purity with respect to the values of independent variables. Optimum conditions for the maximum PHB recovery and purity were found to be solvent pH 7, extraction temperature - 43 °C, incubation time - 70 minutes, and percentage acetone – 30 % from this study. The maximum predicted PHB recovery was found to be 0.845 g/g biomass dry cell weight and the purity was found to be 97.23 % using the optimized conditions.

Keywords : acetone, PHB, RSM, halogenated hydrocarbons, extraction, bacillus subtilis.
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