Nanobioconjugant of lipase with quantum dots for sustainable synthesis of flavor ester ‘pentyl valerate’: Characterization, optimization and application in organic synthesis

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Nanomaterials have been studied as enzyme support systems since they exhibit large surface area resulted in improved enzyme loading, which in turn showed increased apparent enzyme activity per unit mass or volume as compared to that of enzyme systems immobilized onto conventional materials. Thus, we explored the potential of nanomaterials for lipase immobilization. In present study, lipase from Candida rugosa was immobilized on CdS nanoparticles enriched with silane moieties. Characterization before and after modification were conducted using Infrared Spectroscopy (FT-IR), Transmission Electron Microscopy (TEM), Florescence Microscopy and Thermal Gravimetric Analysis (TGA). The effects of the reaction parameters such as pH, temperature, and molar ratio of the substrate to the solvent, acid to alcohol chain length on esterification are discussed. The results demonstrated that immobilized biocatalyst demonstrated 1.6 fold increased catalytic activity than crude lipase and recycled 15 times retaining 80% of its initial activity. \( K_m \) and \( V_{max} \) for immobilized lipase was found to be 0.38 mM and 205 \( \mu \)moles/mg/min; where as for free lipase \( K_m \) was 1.4 mM and \( V_{max} \) was 25 \( \mu \)moles/mg/min. Thus, the application of enzyme immobilized on functionalized CdS verifies to be promising system for ester synthesis in non-aqueous environment.

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Potentials of solid state fermentation upgrading by using strategy of Tween-80® supplementation

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Solid state fermentation batch experiment was carried out to assess the use of Tween-80® as additives on the performance of the fermentation process. The substrate used in this study was Organic Fraction of Municipal Solid Waste (OFMSW) supplemented with Mixed Culture Bacteria (MCB) under thermophilic condition (55±2 °C). Results showed that adding of Tween-80® had a positive impact on carbohydrate degradation, in turn, hydrogen production and hydrogen yield. Maximum hydrogen production was 679 mL achieved at concentration of 1.8% Tween-80® which 1.31 times higher than control bottle. This corresponds to the maximum hydrogen yield of 88.9 mL H2/g COD\(_{init}\) and was mainly due to consumption of COD (23.4%) and carbohydrate (42.9%).

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