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Biocatalytic transformation of *Ganoderma lucidum* by porcine pancreatic li...

# Biocatalytic transformation of *Ganoderma lucidum* by porcine pancreatic lipase in hydrophobic deep eutectic solvents

By

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**Abstract** Enzyme applications in industry are often limited by low stability, poor reusability and challenging recovery. This study presents a sustainable strategy for enhancing enzyme performance by immobilizing porcine pancreatic lipase (PPL) onto *Ganoderma lucidum* using a hydrophobic deep eutectic solvent (HDES) as a reaction medium to facilitate enzyme immobilization. Among several HDESs tested, menthol:decanoic acid (HDES 1) showed the highest lipase activity (198.38%) and was selected for immobilization. Under optimized conditions (3 h, 40 degrees C, pH 7.0), the immobilized PPL achieved 212.41% catalytic efficiency, a 13 day half-life and retained activity over two reuse cycles. FTIR analysis revealed a shift in the secondary amide band from 3312 to 3306 cm<sup>-1</sup>, indicating modifications in protein hydrogen bonding. BET and EDX analyses confirmed enzyme adsorption and successful loading, while GC-MS identified fatty acid derivatives, demonstrating effective catalysis. Notably, HDES 1 enabled the immobilized enzyme to replace hexane in esterification reactions, achieving similar to 90% fatty acid conversion surpassing the free enzyme. Molecular docking further highlighted strong interactions between HDES 1 and PPL's catalytic residues, validating its stabilizing role. Overall, the *G. lucidum*-HDES 1 platform provides a green, efficient and versatile biocatalytic system with significant potential for bioenergy production and sustainable applications in the oil industry.

**Keywords** **Author Keywords:** [Green solvent](#); [Menthol-decanoic acid](#); [Enzyme immobilization](#)

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