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Microbial Lipase Production: Protein Engineering for Industrial Application

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Structured Abstract

Background: The study focuses on the production and modification of microbial lipases, which are enzymes capable of breaking down fats into fatty acids and glycerol. These enzymes are important in industries such as food processing, biofuel production, and pharmaceuticals. This study emphasises the enhancement of microbial lipase properties through protein engineering and advanced technologies to fulfil industrial demands. This can be achieved by understanding the mechanism, properties, and conditions required by microbes to produce specific lipase enzymes needed for industrial processes.

Literature Review: Microbial lipases have received attention due to their versatility, environmental friendliness, and high efficiency in catalysing reactions. Compared to lipases from animal or plant sources, microbial lipases are easier to modify, more stable, and can be produced in larger quantities. Current studies show their ability to function under extreme temperatures, varying pH levels, and in the presence of organic solvents. However, natural lipases still face challenges such as low stability and specificity in harsh industrial settings, leading researchers to explore methods like protein engineering, immobilisation, and cost-effective purification systems. The study is pivotal in advancing the identification of the most strategic methods to optimise microbial lipase performance for industrial applications.

Objective: This review aims to explore prevailing challenges and recent advancements in microbial lipase production for industrial applications. Specifically, it seeks to analyse several production methods designed to produce lipases with enhanced catalytic properties, discuss strategies to improve the stability and activity of these enzymes, and highlight cost-effective techniques for large-scale lipase purification. Additionally, this review aims to identify commonly used microbial strains known for high lipase yield and examine recent trends and future directions in protein engineering that support improved enzyme performance and industrial applicability.

Conclusion: This review highlights protein engineering, immobilization, and chemical modification to enhance lipase stability and activity, and recommends Aqueous Two-Phase Systems (ATPS) and Reversed Micellar Systems (RMS) as cost-effective methods for large-scale production and purification. Bridging the remaining research gaps will enhance the scalability and performance of microbial lipases, supporting more sustainable and cost-effective industrial processes.

Keywords: Microbial Lipase, Protein Engineering, Lipase Production

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