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"Harnessing Banana Peel for Green Bioprocesses: Enzyme Production and Fungal Comparative Insights"

Banana peel, constituting nearly 30–40% of global banana fruit waste, represents an abundant lignocellulosic substrate with significant potential for sustainable microbial enzyme production. This work integrates a review of banana peel valorization strategies with experimental insights into the enzyme-secreting potential of two fungal strains—Aspergillus japonicus and Aspergillus carbonarius—isolated from decayed peel. Literature consolidates the peel's biochemical richness in cellulose, hemicellulose, and pectin, making it suitable for producing industrially relevant enzymes such as cellulase, pectinase, protease, lipase, and L-asparaginase. Comparative enzymatic profiling revealed species-specific capabilities: A. japonicus showed superior pectinase, protease, and L-asparaginase activities, while A. carbonarius exhibited higher cellulase and lipase yields. These findings underscore the dual significance of banana peel: first, as a sustainable feedstock supporting circular bioeconomy initiatives, and second, as a platform for targeted fungal enzyme production tailored to diverse applications in food processing, biofuels, pharmaceuticals, and environmental bioremediation. The synergy of review-based evidence with experimental results strengthens the case for scale-up studies, bioreactor optimization, and integration of banana peel bioprocessing into sustainable industrial pipelines.

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