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Banana Peel as a sustainable substrate for microbial enzyme production

Banana peel, a readily available lignocellulosic agro waste, has gained increasing attention as a low-cost and environmentally
sustainable substrate for microbial enzyme production. This review emphasizes current scientific advances in utilizing banana
peel for the biosynthesis of industrially significant enzymes, including pectinase, cellulase, amylase, lipase, catalase, protease,
peroxidase and L-asparaginase, through fungal and bacterial fermentation systems. The influence of banana varietal
composition, ripeness stage, and substrate pretreatment on enzyme yield, along with comparing fermentation methods such as
solid-state and submerged fermentation, is assessed. Prominent microbial strains—including Aspergillus niger, A. japonicus,
Trichoderma reesei, Paenibacillus lactis, and Yarrowia phangngaensis—are highlighted for their enzyme efficiency.
Industrial applications are discussed in the context of biofuel generation, food processing, textile treatment, and environmental
remediation. Despite scale-up limitations and variability in substrate composition, integrating banana peel bioprocessing with
circular bioeconomy frameworks can transform food waste into valuable bioproducts, contributing to sustainable development
goals (SDGs).

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