TOWARD A SUSTAINABLE STRATEGY FOR THE PRODUCTION OF BIOACTIVE FLAVONOLS

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Flavonols, a prominent subclass of flavonoids, have emerged as biomolecules of considerable scientific and clinical interest owing to their wide-ranging bioactivities, including antioxidant, neuroprotective, cardioprotective, anti-aging, and cytotoxic effects [1–3]. Despite their therapeutic promise, the biomedical application of flavonols is often hampered by poor aqueous solubility and limited bioavailability. Glycosylation has been identified as a powerful strategy to overcome these challenges, as it enhances solubility and stability, thereby improving the pharmacological performance of flavonols [4–5]. UDP-glycosyltransferases (UGTs) represent a particularly attractive class of biocatalysts for this purpose, offering high substrate specificity, environmentally benign processes devoid of toxic reagents, and scalable, cost-effective production [6–7]. However, the industrial implementation of UGT-based systems requires further optimization to address issues of enzyme stability, reusability, and cost efficiency. Immobilization of UGTs onto agro-industrial lignocellulosic biomass provides a sustainable and economical solution, as it not only improves operational stability and reduces protein leaching but also enables catalyst recyclability, thereby lowering overall production costs. Within this context, agricultural residues such as rice husk and groundnut husk represent abundant, low-cost, and underutilized resources with potential for high-value applications. Beyond their role in waste management, these by-products offer favorable structural and compositional features that make them promising candidates as immobilization matrices for UGTs. Our preliminary investigations address the morphology, chemical composition, surface area, and porosity of biomass-based materials, since these parameters play a crucial role in defining their performances as supports for biocatalysts, ultimately contributing to the development of a cost-efficient and sustainable route for flavonol glycoside production.

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