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Versatile platform for enzymatic polyphenol glucosylation – biocatalyst production and reaction optimisation

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PURPOSE OF THE ABSTRACT

Glycosylation is a useful strategy for modifying the chemical and biological properties of natural products. Glycoconjugates exhibit enhanced bioavailability, stability, and water solubility, making them more desirable compounds for industrial applications [1]. As the costs and environmental concerns associated with chemical processes continue to rise, biocatalysis is gaining attention as a more sustainable alternative [2]. In nature, glycosylation processes are largely mediated by glycosyltransferases, a class of enzymes (EC 2.4) that transfer glycosyl moieties from activated (nucleotide of phosphorylated) sugars to nucleophilic glycosyl acceptors [3].

One well-established strategy for highly regio- and stereoselective glucosylation is coupling a nucleotide diphosphate (NDP)-dependent Leloir glycosyltransferase with sucrose synthase in a self-efficient enzymatic cascade [4-6]. With the inner regeneration system of expensive and low-available NDP-glucose, it makes enzymatic glucosylation more profitable and applicable in industrial settings.

In the presented study, a collection of polyphenol glucosyltransferases from various sources (bacteria, fungi, and plants) were selected and heterologously co-expressed in Escherichia coli cells with the highly active soybean sucrose synthase (GmSuSy). The resulting library of biocatalysts enabled the stepwise optimization of enzyme production and evaluation of the influence of reaction conditions on enzyme specificity. The collected data allowed for the development of a standardized protocol for the production and application of glucosyltransferases from various sources. Furthermore, the vast substrate promiscuity of the selected biocatalysts created a comprehensive glucosylation platform.

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FIGURES

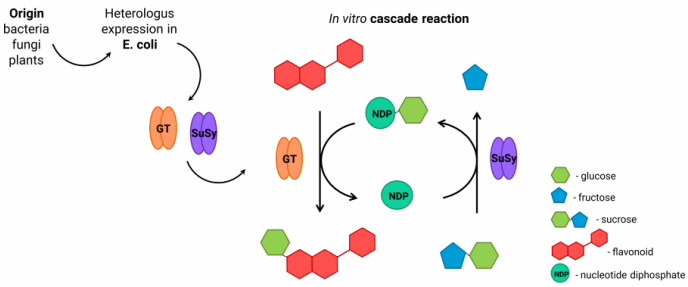

FIGURE 1

Schematic concept of the research

GT - glycosyltransferase

SuSy - sucrose synthase

FIGURE 2

KEYWORDS

sucrose synthase | cascade reaction | flavonoids | expression optimisation

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