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Sucrose-active enzymes : Green tools for the synthesis of tailored oligosacharides or glucoconjugates

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Abstract:

Glycosylation is a major reaction in numerous biological processes, including cell communication, signaling and protection, and in energy storage. The demand for oligosaccharides and glycoconjugates has steadily increased over the last decades, because well-defined structures are needed to investigate the role of glycosylation in biological phenomena. In addition, there is a growing interest in the application of bioactive oligosaccharides and glycoconjugates in the food, health, and cosmetic industries. *In cellulo*, the transfer of a glycosyl unit from a donor substrate to an acceptor molecule is almost exclusively catalyzed by Leloir glycosyltransferases (GTs) [1]. But GTs are not ideal candidates for the *in vitro* and large-scale synthesis of glycoproducts, since they use nucleotide sugars as donors, which are expensive and in limited supply. But an alternative rely in the use of glycoside-hydrolases (GHs), especially retaining GHs that cleave the osidic bond and retain the anomeric configuration. These enzymes use abundant substrates, such as disaccharides, oligosaccharides, and polysaccharides, which is advantageous for bioeconomic development.

In this context, our group has a long-standing interest in very efficient bacterial alpha-transglucosylases that catalyze the production of high molar mass polysaccharides of glucosyl units from sucrose (our table sugar) such as dextran, the best known polysaccharide of this family. These enzymes are classified in the family 70 of Glycoside-Hydrolases, which comprises today around 1300 sequences for only about sixty enzymes biochemically characterized, that remains low. However, by combining bioinformatics, screening technologies and enzyme structure-function relationship studies, we recently discovered and/or engineered several enzymes dedicated to the production of tailor-made glucans of various sizes and structures, as well as well-defined oligosaccharides or glucoconjugates [2]. After a brief overview of these intriguing enzymes, the presentation will focus on our last developments regarding the functionalization of secondary metabolites such as polyphenols, terpenoids or mycosporine-like amino acids for improving their solubility and/or stability for pharmaceutical or cosmetic applications [3].

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