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Biocatalytic Synthesis of Novel Fructooligosaccharides and Fructans by Levansucrase and Levanase from Discovery to Application

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PURPOSE OF THE ABSTRACT
The enormous potential of biocatalysis as a key technology for the sustainable synthesis of tailor-made oligo/polysaccharides and glycostructures is widely recognized. When compared to chemical routes, biocatalytic approaches offer excellent regio/stereoselectivity, mild operating conditions, higher product quality, and sustainability benefits. Carbohydrate-based biomolecules are essential compounds in innumerable biological functions. Their tailor-made synthesis, shaped on demand, is of high importance in various fields and industries, including food, pharmaceutical and chemical industries.

Levansucrases (2,6-ß-fructan:6-ß-D-fructosyl transferase) have attracted much interest because of their ability to directly use the free energy of cleavage of sucrose to transfer the fructosyl group to an acceptor. We have pioneered the development of this glycosylation route based on levansucrase-catalyzed transfructosylation of sucrose for the synthesis of ß-(2-6)-oligolevans and levans. Furthermore, the synthesis of hetero-fructooligosaccharides by levansucrase was achieved in the presence of various acceptors. For efficient synthesis, we have successfully developed for the first time a novel bi-enzymatic system for the synthesis of ß-(2-6)-fructooligosaccharides of controlled size from sucrose, in which levansucrase mainly catalyzes the synthesis of levans, while levanase through its hydrolytic activity regulates the product molecular size and acceptor availability. As part of the proof of the applicability of the synthetic activity of levansucrase, we successfully used, for the first time, this enzymatic glycosylation to convert low-grade maple products into high value-added ones enriched with FOSs, oligolevans and levans and to produce functional sweetener, lactosucrose, from dairy by-products.

The presentation will cover our progress from discovery of new levansucrase and levanase to developing strategies for improving their actions and to exploiting them in advanced applications.

FIGURES

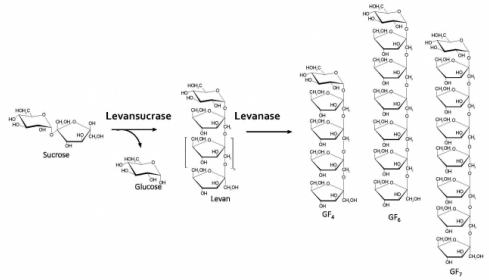

FIGURE 1

Combined use of Levansucrase and Levanase

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FIGURE 2

KEYWORDS

Levansucrase | Levanase | Carbohydrate | Glycosylation

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