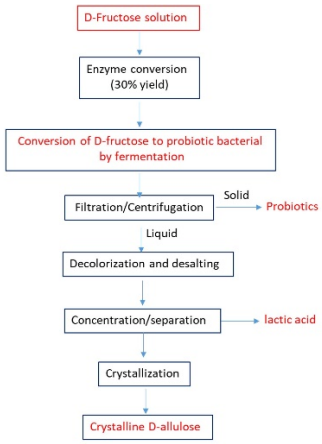
A Novel Biological Process to Produce D-allulose, an Ultra-low Calorie Functional Sugar



Technology Overview

D-allulose (Also called D-psicose) is a rare sugar that exists in extremely small quantities in nature. It has 70% of the sweetness of table sugar (sucrose), offers similar taste and texture of table sugar but with only 10% calorie of sucrose. Unlike other caloric sugars, D-Allulose has no impact on blood glucose or insulin levels. Although there are promising applications in the food and pharmaceutical industries, it is difficult for mass production of D-allulose. Currently D-allulose is produced from partial conversion of D-fructose by the D-psicose 3-epimerase (DPEase) family of enzymes. One of the bottlenecks in the production of D-allulose lies in the separation of D-allulose from D-fructose. These two sugars share similar physical and chemical properties, separating them using current technologies e.g. column chromatography, is very expensive at the industrial scale. To solve this problem, researchers have focused on increasing the D-fructose to D-allulose conversion rate. However, the inherent DPEase reaction equilibrium make it unable to obtain 100% conversion of D-fructose to D-allulose. Therefore, the issue for separation of these two sugar epimers has to be solved.

Here, we develop a novel biological process to bypass D-fructose and D-allulose separation. A probiotic fermentaion is used to convert all unconverted D-frutose in the sugar mixture to L-lactic acid and keeps all the D-allulose unchanged. In the end, besides the D-allulose, the process can also produce L-lactic acid and probiotics as valuable side products. This new process would benefit the current manufacturers for the D-allulose and other rare sugars production.

Technology Features & Specifications

This technology comprises a novel approach to produce D-allulose starting from D-fructose. Briefly, D-fructose is partially converted to D-allulose followed by adding a probiotics to initiate the fermentation, which can convert unreacted D-fructose into L-lactic acid and the D-allulose will not be consumed by the probiotics. Under optimum conditions, at the fermentation end the broth contains 60 g/L of D-allulose, 107 g/L of L-lactic acid, add 4.5 g/L of probiotics.

Potential Applications

The current food ingredients manufacturing industry is the main target industry for this process technology. D-allulose has been obtained GRAS status and has application in the following industries.

1. Food industry. Because of its unique ultra-low calorie and similar taste and texture to table sugar, D-allulose is expected to be the most promising replacement of table sugar in the near future. The applications for D-allulose allowed by the FDA include carbonated and non-carbonated beverages; rolls, cake, pie, pastries, biscuits and frostings; yogurt, both regular and frozen; frozen dairy desserts, including regular ice cream, soft serve, sorbet; salad dressings; jams and jellies; chewing gum; hard and soft candies; sweet sauces and syrups; gelatin, puddings and fillings; fat-based cream used in modified fat/calorie cookies, cakes and pastries; medical foods; and coffee mix. This presents a potentially huge market.

2. Health supplements industry. Because of the distinct therapeutic effects of D-allulose, it can be an important ingredient for various health supplements.

Customer Benefits

Our process does not require sugar-sugar purification, which is usually conducted by chromatography like simulated moving bed (SMB). The scale-up of SMB is complicated and high cost which renders the high price of D-allulose. Our process also produce lactic acid and probiotics as valuable side products could make the whole process more attractive.

OVERVIEW

- Technology Category Foods - Ingredients
- Technology Status Available
- Technology Readiness Level TRL4
- Keywords sugar, low sugar, glucose, Probiotics, L-lactic, Efficient

NGEE ANN POLYTECHNIC

CONTACT:

Technology Development and Innovation Office
Website : www.np.edu.sg/tdi
Email: dept-tdi@np.edu.sg