Report

Controlling Sweetness in Plant-Based Milk Substitutes Using Enzymes

Due to the rise in environmental awareness and health consciousness, plant-based milk substitutes are growing in popularity around the globe. Currently, there are three main types of milk substitutes. These are: those derived from beans, such as soy milk and pea milk; those derived from grains, such as oat milk and rice milk; and those derived from seeds, such as almond milk and coconut milk (or so-called nut milks). Of these, consumption of oat milk has been growing especially rapidly in recent years, particularly in Europe and the United States. In addition to being a good alternative for people who are lactose intolerant or have a soy allergy, oat milk also contains nutrients such as B vitamins and dietary fiber, and lacks the strong bean-like flavor that some other types of milk have, making it more pleasant to drink—all of which contributes to oat milk's growing popularity.

Generally, oat milk is made by grinding oats, adding water, heating to gelatinize the starch, then adding alpha-amylase to partially break down the starch and reduce the viscosity of the mixture, turning it into a liquid. While adding only alpha-amylase reduces the viscosity, it results in a milk with few low-molecular-weight sugars that form the basis of sweetness, making it not very sweet. As the milk would be unpleasant to drink with such a low level of sweetness, saccharification enzymes are used to add sweetness. There are multiple types of saccharification enzymes (Figure 1), including glucoamylase, which isolates sugars in glucose; β-amylase, which isolates sugars in maltose; maltotriohydrolase, which produces maltotriose; and transglucosidase, which produces isomaltooligosaccharide through glycosyl transfer. The sugars produced by these enzymes each have a different type of sweetness (Figure 2). Glucose is used in products such as candy and has a pleasant sweetness, maltose has a mild sweetness like that of baked sweet potatoes, maltotriose has a clean, clear sweetness, and isomaltooligosaccharide has a complex sweetness like that of mirin rice wine. By appropriately using different saccharification enzymes, it is possible to produce oat milk with a variety of different flavors.

While we used oat milk as the example here, this technology can also be applied to other grain-derived milk substitutes as well, such as rice milk. We are also in the midst of developing technology to similarly add value to non-grain-derived milk substitutes, such as bean and seed milks, as well. At Amano Enzyme, we work tirelessly to enhance the value of foods using the power of enzymes.

Figure 1: Responses of different saccharification enzymes

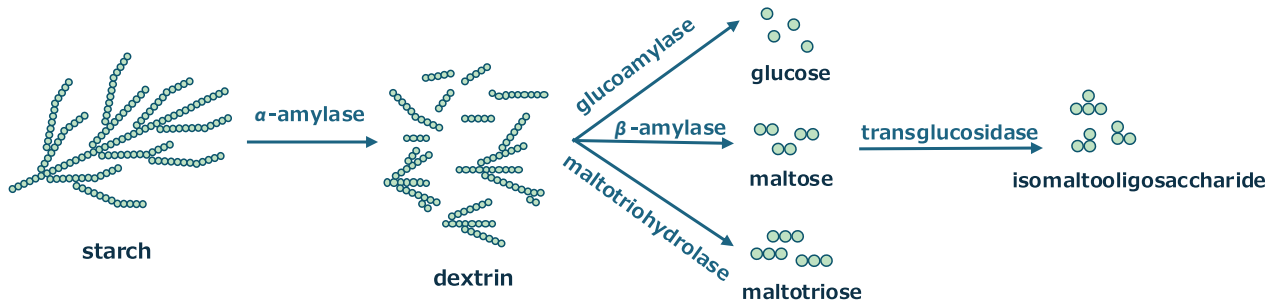

Figure 2: Sugar composition in oat milk by saccharification enzyme

G1:glucose、**G2**:maltose、**G3**:maltotriose、**IMO**:isomaltooligosaccharide(g/L)