

## Sweet Facts about Maltitol

By Nicholas L. Rozzi, Ph.D., Contributing Editor

Maltitol is a sugar alcohol, or polyol, a member of a group of carbohydrates that occur naturally in various fruits and vegetables. Since the first polyol, sorbitol, was discovered in the berries of the mountain ash (*Sorbus aucuparia*), the industry has found additional polyols, each providing different benefits to the food industry.

Small amounts of maltitol occur naturally in chicory leaves and in roasted malt. Commercially, maltitol is produced from the starch of cereals such as corn, potatoes and wheat. Manufacturers use the catalytic hydrogenation of D-maltose to make a hydrogenated disaccharide consisting of a glucose molecule and a sorbitol molecule bound together. The primary structural difference between a polyol and its sugar counterpart is the reduction of the carbonyl group (ketone or aldehyde) of the sugar molecule to an alcohol group.

Maltitol is a bulk sweetener used for partial to full replacement of sugar in sugar-free, no-sugar-added or reduced-calorie versions of traditional foods. Because it provides both sweetness and bulking properties, its performance is very close to sucrose. Moreover, its taste is very similar to that of sucrose, and it is characterized by a natural sweetness (90%) close to that of sugar. However, for formulations that require additional sweetness, manufacturers can use maltitol in conjunction with high-intensity sweeteners. And, like many other sugar alcohols, it helps mask some of the bitter note associated with high-intensity sweeteners.

### Performance characteristics

When investigating the chemical and physical properties of polyols, product designers must compare them to sucrose, as it is the most widely used sweetener in the world. In their purest forms, both sucrose and maltitol are white powders consisting of anhydrous crystals with similar crystalline structures. Crystalline maltitol has a molecular weight (MW) very close to that of sucrose—the difference in MW is only 2, with maltitol having an MW of 344, and sucrose having an MW of 342. Therefore, maltitol can replace sucrose in many applications on a weight-for-weight basis.

Of the polyols, maltitol has the solubility curve closest to that of sucrose. It is freely soluble in water: The solubility is 200 grams maltitol in 100 ml of water at 37°C, while the solubility of sucrose is 220 grams sucrose in 100 ml of water at 37°C. Once dissolved, the viscosities of maltitol and sugar solutions are comparable, with viscosities of 23 millipascal seconds (mPa.s) and 18 mPa.s (50% solution in water at 20°C), respectively. Its similar solubility allows maltitol to dissolve in the mouth in exactly the same way as sucrose, preserving the mouthfeel of the food product's traditionally sweetened counterpart.

Due to its chemical nature and high crystalline purity, maltitol in its pure, crystalline form is less hygroscopic than sugar. At 40°C, maltitol absorbs atmospheric moisture only at relative humidities of 82% and above, compared to 80% for sucrose. This helps provide increased shelf stability to

products made with maltitol vs. those made with sucrose, when stored under most ambient climatic conditions. When used as a coating on panned chewing gum and confections, maltitol's low hygroscopicity allows for a long-lasting crunchiness.

The reduction of the carbonyl group during the conversion from maltose to maltitol also increases maltitol's thermal and chemical stability. It does not react with amino acids when heated, which prevents the Maillard reaction from occurring, thus reducing the potential for unwanted browning.

### Sweetener sense

A sensory study using a trained panel to generate quantitative data, conducted by Leatherhead Food International, Leatherhead, England, showed the very close similarity in taste, aftertaste and mouthfeel of pure, crystalline maltitol and sugar ("Psychophysical characterization of new sweeteners of commercial importance for the EC food industry," *Food Chemistry*, 1996; 56(3):291-302). These similarities allow maltitol's use alone as a bulk sweetener in most sugarfree applications. Maltitol has a low cooling effect compared with other polyols (-16.3 cal per gram for maltitol vs. -36.6 cal per gram for xylitol), but slightly higher than that of sugar (-4.3 cal per gram for sucrose). It also displays none of the negative effects, such as a metallic flavor, a licorice aftertaste or acidic notes, found in some high-intensity sweeteners.

Maltitol has a low glycemic response of 29 and caloric value of 2.1 kcal per gram in the United States (in Europe, it's been officially determined to have 2.4 kcal per gram)—lower figures than those for traditional bulk sweeteners such as sucrose. Depending on the overall formulation, products containing maltitol can display a number of label claims, including "no sugar added," "sugar free" and "reduced calorie." Because oral bacteria don't ferment pure maltitol, it is not acidogenic or cariogenic. These properties make it safe for teeth and useful in sugar-free chewing gum and other confectionery applications.

With its similarities to sucrose, maltitol can replace sucrose on a weight-for-weight basis in many formulations. This allows for the creation of many healthy snacks, including those that are "sugar free" or have "no added sugar." Maltitol's low hygroscopicity makes it the polyol of choice for applications such as chocolate, where it contributes to high stability during conching and storage. Other common applications include reduced-sugar baked goods, where it acts as a 1:1 replacement for sucrose; its bulking and sweetening properties are equivalent to sucrose, so it provides all of the same effects.

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