

## Naturally Sweet

Natural is in. And sweeteners are one category seeing heightened demand.

Many of us have an opinion of what qualifies as “natural” in the world of food ingredients. This includes FDA.

In a July 2008 letter to the Corn Refiners Association, Washington, D.C., FDA stated that, depending on the process used to manufacture high-fructose corn syrup (HFCS), it is possible the ingredient can be considered natural. The letter explained that FDA would not object to use of the term “natural” when describing HFCS derived from a manufacturing process whereby the enzymes for making HFCS are fixed to a column by a synthetic fixing agent called glutaraldehyde, but the agent does not come into contact with the syrup. However, FDA would object if a synthetic substance was present in the HFCS.

This position, along with the preamble to the nutrient content claims rulemaking in 1993, which states that natural means “nothing artificial or synthetic has been included in, or has been added to, a food that would not normally be expected to be in the food,” is all FDA offers the food industry for use of the term natural in terms of sweeteners.

“It is very possible that someday FDA will choose to define the term,” says Jason Hecker, director of marketing, PureCircle USA Inc., Oak Brook, IL. “I have no reason to believe they would not maintain a definition in line with the 1993 preamble. But this is just speculation, as FDA would have to consider a very broad range of food categories, with sweeteners being just one of them.”

### **Unregulated, yet powerful**

“Consumers seem to be equating ‘natural’ with ‘healthy,’” says Jim Mitchell, development manager, Ciranda Inc., Hudson, WI. “This means that any purely scientific look at an ingredient’s production process will not be enough to satisfy the consumer’s definition of natural.

“Any attempt at defining natural should follow the pattern of the organic industry, and have input from the companies and consumers who are interested in natural products,” adds Mitchell. “The market for natural products is far too large to be set by FDA without an advisory panel from consumers and industry.”

Indeed, there are many opinions and positions on natural in the marketplace today. “Some sweetener manufacturers claim their products are natural, but in reality are created with chemicals, solvents and alcohols,” says Jim May, founder and president, Wisdom Natural Brands, Gilbert, AZ. “In my opinion, this negates the very concept of being natural. I believe strongly the term natural should be reserved for products that come from nature and are not altered by chemicals in the laboratory.”

Many companies self-define natural in the absence of regulation. “Most of the companies we work with have a general in-house definition of natural that eschews genetically modified ingredients and most synthetic chemicals,” says Mitchell. “Defining natural beyond these general principles is difficult in that all consumers are not alike.” For example, extreme naturalists consider table sugar unnatural because it is refined. Even filtered honey is too processed for some.

“We label our ingredients as natural because they are produced without the use of any artificial additives, preservatives, colors or synthetic substances,” says Bob Hansen, technical services manager, Briess Malt & Ingredients Co., Chilton, WI. “In addition, all methods used to produce our ingredients, including malting, roasting, instantizing, brewing/extraction, drying and milling, involve minimal processing that could be accomplished—on a smaller scale—using simple equipment in home kitchens. In most cases, these processes involve only water as an ingredient and control of heat, time and grain sprouting as controls. Generally, consumers can easily relate to, and understand, messages similar to these.”

### Harvesting sweetness

The controversies surrounding HFCS’s naturalness were overshadowed at the end of last year when FDA recognized the self-affirmed GRAS status of *Stevia rebaudiana* plant extracts.

Numerous companies have identified processes to extract the the steviol glycosides known as rebaudioside A (reb A), producing a product that is 200 to 400 times sweeter than sucrose. As an added bonus, stevia is non-cariogenic, so it does not stimulate tooth decay. It is noncaloric and has a zero glycemic index, making it safe and suitable for diabetics.

“Reb A is one of nearly a dozen sweet-tasting compounds known as steviol glycosides found in the stevia plant,” says Melanie Goulson, applications manager, Cargill Health & Nutrition, Minneapolis.

Two major steviol glycosides are found in the stevia plant. Stevioside, which is 250 to 300 times as sweet as sucrose, comprises the largest percent of the leaf—5% to 10%. The sweetest component—reb A—makes up 2% to 4% of the leaf. FDA has not actually permitted the stevia plant itself to be used as a food ingredient, only the reb A extract, and only extracts that have a reb A purity of 95% or higher. Stevioside, which can contribute sweetness, has been associated with contributing bitter, licorice off flavors to various applications. It can be part of that 5%, as can other less-sweet compounds found in the stevia leaf.

From stevia’s 1982 introduction in the American market to present day, “the ability to isolate the various sweet glycosides and provide a delicious, high-intensity sweetener have constantly been improved,” says May.

Hecker notes that his company manufactures a range of sweeteners from stevia leaves. “In the United States,” he says, “our stevia sweetener contains at least 97% reb A and is 300 times sweeter than sugar.

“We are confident that reb A and other stevia extracts will continue to qualify as natural,” adds Hecker, describing the extraction process as “very natural. Extraction of the sweet glycosides from the leaf follows a process of steeping the leaves in water, using a brewing method that is similar to brewing tea. The resulting extract is purified through a proprietary process using natural solvents.”

Another 97% reb A ingredient “can be formulated to successfully deliver a clean, sweet taste in a wide variety of food and beverages,” says Goulson. “It is very stable across a wide range of pH and temperature conditions. Food and beverages sweetened with reb A will maintain good sweetness through thermal processing and shelf life. It can be successfully blended with other natural caloric sweeteners, such as erythritol and sugar, to create natural sweetener systems for reduced-calorie food and beverages.”

Another recently introduced natural, high-intensity stevia-based sweetener “is 200 to 300 times sweeter than sucrose or HFCS, while contributing zero calories to a formulation,” says Ron Deis, vice president, applications research & technical services, Corn Products International, Inc., Westchester, IL. “Since usage levels are low, similar in comparison to aspartame, the texture of sucrose must be replaced by another natural bulking agent.”

Cecilia McCollum, executive vice president, Blue California, Rancho Santa Margarita, CA, says: “We use a proprietary method to isolate and purify reb A to achieve 99% to 100% purity on an ‘as is’ basis. At this level of purity, we are eliminating any aftertaste and ensuring the best possible taste for use in food products.

“Reb A 99% is also very stable,” continues McCollum. “It can be heated to 380°F, so it is suitable for baking and cooking. Reb A can be used in a large variety of food products. In some cases, sugar can be replaced completely. In others, sugar may still be an important component for its functionality, but sugar reduction is definitely an option for most food products.”

### **Bulk options**

Isomaltulose is a disaccharide produced from beet sugar. Enzymatic rearrangement of the alpha-1,2 bond between the glucose and fructose molecule to an alpha-1,6 bond converts sucrose into isomaltulose, giving this natural carbohydrate sweetener some unique functionalities.

“Isomaltulose is a fully digestible carbohydrate, meaning it still contains four calories per gram. However, we call them ‘clever calories,’ as the carbohydrate is the only one that has a low glycemic index and provides longer-lasting energy at the same time,” says Stephan Hausmanns, head of new business development and management new ingredients, Beneo-Palatinit, Mannheim, Germany. “It is digested much slower than other sugars. Energy levels are sustained for longer, as it is slowly metabolized by enzymes in the gut and gradually supplies the body energy in the form of glucose.

“Its sensory profile closely resembles that of sucrose, but is about half as sweet,” continues Hausmanns, noting that the ingredient’s “mild, natural sweetness” is not marred by any unpleasant aftertaste.

Isomaltulose has been proven—and recognized by FDA—as being non-cariogenic. “The enzymatic rearrangement of the bond between the glucose and fructose molecules makes isomaltulose microbiologically very stable,” says Hausmanns, as it cannot be split by the bacteria in the mouth.

In some ways, however, isomaltulose resembles sucrose. For example, in addition to providing 4 calories per gram, it has the same storage characteristics as sugar. It replaces sugar in a 1:1 ratio in formulations and can be processed in exactly the same way.

“Since it is resistant to microbial fermentation, it has application in yogurt and fermented dairy beverages,” Hausmanns says. “Because isomaltulose is non-hygroscopic, it remains dry and free-flowing, even during prolonged storage and at high temperatures. Thus, it is readily processed into both ready-to-drink beverages and instant drinks.”

Erythritol, another option, “is a natural bulk sweetener that has zero sugar, zero calories and zero aftertaste,” Goulson says. “It tastes about 60% to 70% as sweet as sugar, provides bulk and masks the aftertaste of intense sweeteners.”

According to Peter Bradbury, market development manager, health & nutrition, Jungbunzlauer, Inc., Newton Centre, MA, the company’s technology for making erythritol “relies on the inherent ability of certain natural yeasts to convert a natural, renewable carbohydrate into erythritol via fermentation. The resulting erythritol is purified, dried and sieved. “The low caloric load, solubility, bulk, mouthfeel and sweetness levels make it suitable for beverages and dairy products, including ice cream,” Bradbury continues. “Erythritol is FDA GRAS,” he notes, but the agency sets limits on its use level. While erythritol-containing sugar substitutes can contain 100% of the sweetener, other products range from 3.5% in reduced- and low-calorie carbonated and non-carbonated beverages, and dairy drinks such as chocolate and flavored milks, to 99% in hard candies. (For more information on formulating with erythritol, see “**Sweetener Blends with Erythritol.**”

## Grain goodness

All-natural extracts from various grains provide sweetness, bulk and often extra nutrition.

Malted barley extracts and syrups are made from rice, grain sorghum and tapioca starch. “While these deliver less sweetness than table sugar or HFCS at equivalent usage rates, they deliver a great deal of functionality, such as improved browning, humectancy, bulking and binding,” says Hansen. They also retain many of the original nutrients from the raw materials from which they are processed.

“For example, malt extracts contain about 8% protein on a dry basis, and more than 25% of the RDI of riboflavin, niacin and vitamin B6,” adds Hansen. “This is why malt extracts were used in some of the original health drinks, such as Ovaltine. Natural grain sweeteners continue to be used by many manufacturers of health and nutrition products for this reason.”

David Janow, CEO, Axiom Foods Inc., Los Angeles, says: “We have developed a line of brown rice syrups that functionally compare to corn syrup in terms of sweetness and viscosity. But nutritionally,

they are superior, as the syrups retain whole-grain goodness from the brown rice. In fact, because they contain soluble fiber, they deliver 3.6 calories per gram, as compared to corn syrup's 4."

The brown rice syrups come in a variety of forms, including clarified (clear) and unclarified (amber-brown). "They are produced using an all-natural, organic fermentation process," says Janow. "The proprietary process breaks down the starches, resulting in extremely versatile and relatively healthy sweeteners. This process results in a final product that consists of glucose, maltose and soluble complex carbohydrates, which delivers a steady supply of energy.

"Their low glycemic index renders them suitable for all types of diabetic products," Janow adds. "They also function very well as a binder for nutrition bars—at the same time, they provide humectancy."

Agave and tapioca also yield a variety of natural and organic sweeteners. "The tapioca syrups are designed as a non-GMO, naturally processed replacement for corn syrups or rice syrups," says Mitchell, noting that the variety available covers most of the functionality spectrum in terms of sweetness, humectancy, bodying ability, crystallization control and emulsifying.

"In comparison to table sugar and HFCS, the tapioca syrups range from about 20% to 90% as sweet," adds Mitchell. "Being starch-based syrups, tapioca syrups tend to be high glycemic index sweeteners."

However, although agave syrup is a high-intensity sweetener, roughly 1.3 times as sweet as table sugar, says Mitchell, it's inulin-based, so "the glycemic index is very low at about 17. Agave syrup has excellent browning ability and humectancy properties, along with very high freeze-point depression."

Maple is the source of an all-natural sweetener commonly used in baked goods, as well as condiments and desserts. "Maple is a natural sweetener and can enhance the flavor of any recipe," says Joan Kimball, director of international marketing, Québec Delegation and Do More With Maple, Chicago.

Evaporating the sap of sugar-maple trees yields maple syrup. "It takes approximately 40 gal. of sap, which is also called maple water, to produce one gallon of maple syrup," says Kimball. "While maple syrup is the most-common form of maple available, other forms of maple products include sugars, jelly, butter, cream, concentrate/glaze and maple flakes."

As a general rule, lighter-colored maple syrups have a more-delicate flavor, while darker-colored maple syrups have a stronger flavor. The flavor is also influenced by the trees' growing region.

### **The final buzz**

The sweetener often viewed as the most natural of the natural sweeteners is honey. Consumers know it is made by bees. It's not grown in a field or in a fermentator.

“The bees collect nectar from flowers and convert that into honey,” says Bruce Wolk, marketing director, National Honey Board, Firestone, CO. “Beekeepers remove the honey from the hive, filter it and bottle it. Nothing is added. Nothing is changed.

“Honey is hygroscopic and can extend the shelf life of baked goods,” Wolk continues. “In some cases, using honey can eliminate the need for preservatives, which are unattractive to consumers on the label.”

Honey not only adds its own unique flavor, but also contains naturally occurring organic acids that, notes Wolk, “bring out the flavor of other ingredients. Honey is about 25% sweeter than sucrose, on a dry-weight basis, due to its higher fructose content. Honey can replace all of the sucrose or HFCS in a formulation; however, the moisture content of honey (17.6%) must be accounted for in the recipe.”

Honey also adds another benefit: antioxidants. It contains a variety of phenolic and non-phenolic antioxidants—the exact composition depends mainly upon the floral source used by the bees. Typically, darker honeys, like buckwheat, contain a higher antioxidant level than lighter-colored honeys.

And that’s the buzz on natural sweeteners.

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