

# Sensing the BENEFITS

When it comes to natural sweeteners, options abound for not only a cleaner label but also functionality and nutrition.

by Donna Berry

Pourable and pumpable, viscous sweeteners are plant-derived liquids that bakers use to not only sweeten products but also add color, flavor and even nutrition. They are appreciated for their ability to bind ingredients and moisture, too. Some of them are minimally processed extracts, such as agave nectar and maple syrup, while others are produced commercially with assistance from acids, enzymes and/or heat. Think corn syrup and molasses. Concentrated fruit slurries also qualify as viscous sweeteners, as does honey.

Those with a healthful natural halo provide permission for consumers to enjoy a sweet treat. Economical options make baked foods affordable, often extending product shelf life and thus reducing waste.

Bakers value the ease of working with liquid sweeteners, as they can be metered and dispensed for quick dissolution in batter and dough. They are also more sanitary than their dry counterparts, as particles do not linger in the air.

“From a processing standpoint, viscous sweeteners can be easily incorporated into formulations and provide a smooth, homogenous texture in comparison to granulated sweeteners,” said Tom Sanders, global applications manager, ASR Group-DFI Specialty Ingredients.

The most cost-effective options tend to be flavorless

and colorless with their primary purpose to provide sweetness, humectancy or both. Examples include corn syrup, high-fructose corn syrup (HFCS) and invert sugar. Others are more complex, thereby contributing to the sensory profile of the product.

## Chemical compositions

Sucrose, also known as table sugar, is the base by which various ingredients are compared in terms of relative sweetness. Sucrose has a value of 1.0. It is a disaccharide of glucose, also known as dextrose, which has a sweetness of 0.7, and fructose with a sweetness of 1.2 to 1.8. Therefore, viscous sweeteners vary in relative sweetness based on their composition.

They also differ in their ability to brown through the Maillard reaction. This is a function of the presence of reducing sugars and is measured by dextrose equivalent (DE). The DE may also be an indicator of sweetness for ingredients that have a high DE value being sweeter than those with a lower value.

“Depending on the makeup of the liquid sweetener, it can either help or hinder the browning of the finished product,” said Tim Christensen, research and development, bakery applications, Cargill. “Both agave and honey, for example, contain reducing sugars. Some of

Some liquid sweeteners, such as those derived from sweet potatoes, impart the nutritional profile of their sources to the finished baked good.

Carolina Food Ingredients

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these are simple sugars that can caramelize at lower temperatures, further contributing to crust color. In contrast, regular corn syrup contains dextrins, which do not brown as easily as some sugars.”

### The buzz in bakery

Honey is a viscous sweetener that carries unique advantages ranging from flavor to functionality to marketability, according to Catherine Barry, director of marketing, National Honey Board. It is composed of fructose and glucose, making it up to 50% sweeter than sugar. This may allow a product developer to reduce the overall amount of sweetener ingredients used in a formula.

“The complex nature of honey gives it a natural dynamic you can’t find in other sweeteners,” Ms. Barry said. “Honey may seem simple on the surface, but if you analyze it, you’ll find it has more than 180 components including all-natural minerals, antioxidants, vitamins and prebiotics, as well as a host of carbohydrates and acids that give honey its complex flavor profile.”

Honey lends depth and complex flavor profiles to baked foods. It also is the only sweetener with a vast array of flavor profiles and varieties, all of which are naturally developed based on a honeybee’s diet.

“Monofloral honeys, such as orange blossom, buckwheat or watermelon, give bakers the ability to impart specific flavor profiles on their finished bakery foods,” Ms. Barry explained. “In monofloral varieties, honeybees predominantly visit one type of plant, and the nec-

tar they pull from the flowers imparts a unique color, flavor and aroma on the honey. There are more than 3,000 varieties of honey worldwide.”

In addition to its flavor and functionality, honey’s key benefits include its lack of processing. Most natural sweeteners have been significantly manipulated using extreme heat, chemicals or machines to turn leaves, fruit and sap into powders or concentrated syrups.

“In contrast, honey is just honey,” Ms. Barry said. “Honeybees do all the heavy lifting, and beekeepers take the excess honey and extract it by removing the wax caps with a heated knife and spinning the honey to separate it from the comb.”

Most people think of sweetness when they think of honey, but there is also a tartness in the ingredient’s acidity. This profile balances flavors in baked foods without overwhelming sweetness. The acidity (average pH 3.91) also helps inhibit mold growth.

“Honey’s fructose content helps clean label breads hold in moisture and naturally extends shelf life. This reduces dryness and crumbliness of baked foods, making for a more acceptable finished product,” Ms. Barry said. It’s an amazing binder, holding together bars and bakery foods with a significant amount of inclusions. There is a reason so many fruit-, nut- and seed-dense bars contain honey.”

Like most sugar compounds, honey caramelizes during baking and contributes a desirable golden color to products.

Prune juice adds structure and texture to gluten-free pumpkin bread, eliminating the need for xanthan gum.  
Sunsweet Ingredients



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“However, since honey’s main sugars are glucose and fructose, the Maillard reaction triggered by honey will be sped up,” Ms. Barry explained. “This allows bakers to lower their oven temperature or bake time and still maintain a quality color through their bake.”

## Converting juices into syrups

While honey may be considered the most minimally processed viscous sweetener, others come close. These are juices extracted directly from plants and simply purified, heated, filtered and sometimes reduced.

Agave nectar, also called agave syrup, is the naturally sweet juice extracted from the agave cactus plant. It is about 1.4 to 1.6-times sweeter than sucrose with the same 4 calories per gram. The juice is a concentrated source of inulin, a dietary fiber that is not sweet by nature but, when heated, gets hydrolyzed into fructose.

Filtering determines the agave nectar’s flavor and color. The rule of thumb is that one cup of sugar can be replaced with ¾ cup agave, along with a minor adjustment to added liquids. Depending on the application, agave nectar may add richness and enhance other flavors. Because fructose’s browning point is significantly lower than that of sugar, when working with agave nectar, baking times and temperatures are often reduced.

“Agave is less common in baked goods partly due to its premium price and strong browning effect when heated,” Mr. Sanders said. “But its high sweetness factor and clean label status makes it ideal for nutrition bars.”

Pure maple syrup is made by concentrating the slightly sweet sap of the sugar maple tree. The sap is simply boiled down into syrup. Color and flavor vary according to time of harvest. Light amber maple syrup, for example, is extracted early in the season and, as the



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name suggests, has a light golden amber color with mild maple flavor. As the harvest season progresses, the sap gets darker and more flavorful. It is the end-of-season syrups that are mostly used as commercial ingredients. These full-bodied syrups have intense maple flavor and a dark color.

Fruit syrups are another all-natural option. Prune juice concentrate, for example, is dark with a lightly caramelized flavor. It contains about 36% total sugars. More than half is glucose with the rest fructose and sorbitol.

“Just a small amount added to a reduced-fat and -sugar brownie recipe improves flavor and texture,” said Kate Leahy, spokesperson, Sunsweet Ingredients. “Prune juice concentrate may also help extend the shelf life a few days longer for baked goods designed for grab-and-go displays, in particular in gluten-free products. In gluten-free pumpkin bread, for example, the pumpkin

As far as viscous sweeteners go, honey offers bakers flavor and functionality in addition to marketability.  
National Honey Board

and prune juice concentrate work together to enhance moisture and structure, eliminating the need for xanthan gum.”

Fresh plum concentrate is another option. It is a dark red syrup with a tart cherry flavor.

“It is a little higher in acid than prune juice concentrate (pH is 3.4-3.9) and not quite as sweet,” Ms. Leahy said. “Both can contribute to the Maillard reaction, which can be especially beneficial in baked goods such as gluten-free products that tend to have difficulty browning. Both concentrates also can add sheen to items such as sauces and fruit compotes, so making a switch to them from HFCS and other sweeteners will not cause a product to lose its luster.”

Carolina Innovative Food Ingredients uses the sweet potato to make natural viscous sweeteners. One ingredient is a cloudy sweet potato juice that adds flavor, color and a nutritional boost. There’s also a clarified version that is an alternative to HFCS and sugar.

### Rich and thick

Several viscous sweeteners rely on the sugars found in grains such as corn, oats and sorghum. Others are made from sugar beet or sugarcane.

Basic corn syrup, for example, is starch extracted from corn kernels treated with an acid or enzyme to create a sweet syrup. HFCS takes that corn syrup a step further by using enzymes to break down some of the glucose into the sweeter-tasting fructose sugar.

Molasses is a natural byproduct of the manufacture of granulated sugar from sugar beet or sugarcane. It is the thick, brown syrup that remains after the extracted juice is boiled down and cooled to form sugar crystals. The molasses may go through many boils; each time, sugar crystals get removed and the syrup thickens, concentrating the flavor and nutrients while intensifying in color. Blackstrap is the darkest molasses available. It has a bittersweet flavor and is loaded with vitamins and minerals.

“Generally, molasses boosts spice flavors such as cinnamon and ginger in baked goods, which provides cost-in-use benefits,” Mr. Sanders said. “Molasses can also increase the viscosity of doughs to make them easier to handle and process.”

Its use is limited by its strong earthy flavor notes and dark color. It is less sweet than sugar and usually used with other sweeteners. As a result, sometimes molasses is added more for flavor and color than sweetness.

“Using syrups high in fructose really helps with moisture retention in cakes, cookies and other chemically leavened bakery products due to the hygroscopic nature of the sugars in these syrups,” Mr. Christensen explained. “Syrups can also help limit sugar crystallization, keeping cookies soft, preventing glazes and water icings



Malt extracts enhance fermentation, improve browning, soften the crumb and extend shelf life.  
Malt Products



from separating, and limiting sugar bloom on donuts.”

Cargill’s tapioca syrup portfolio includes a lower-DE syrup that provides a neutral taste and adds mouthfeel while preventing crystallization. The mid-range (43 DE) tapioca syrup is mildly sweet and helps bind ingredients together and also contributes to mouthfeel.

“Our 63 DE and 50% high-maltose syrups add more sweetness, help with moisture and humectancy, and improve body,” said Dave Lindhost, technical services manager, Cargill. “We even have an option for sugar-conscious formulation. This reduced-sugar tapioca syrup enables sugar reductions of 20% or more while still providing the benefits of a viscous sweetener, including binding and clean taste.”

The company’s corn syrup

portfolio includes options for less sweet applications along with HFCS for intense sweetness.

“We have liquid dextrose corn syrup that is ideal for products that need high fermentation,” Mr. Lindhost said. “The high sweet HFCS helps with crust color and humectancy. To keep sugar levels in check, our reduced-sugar corn syrup can help reduce sugar content by 20% or more.”

Malt Products Corp. offers a wide range of viscous sweeteners, from grain-based formulas such as malt and oat extracts to agave, corn and molasses-based liquid sweeteners. They offer functional, nutritional and flavor advantages.

“Meanwhile, they also offer crystallization control, which is particularly crucial in the baking segment because too much crystallization can mimic premature staleness,” said Peeyush Maheshwari, director of business development, Malt Products Corp.

Liquid malt extract tastes like molasses while not being as sweet as sugar or honey. Used at 1 to 3% in yeast-raised doughs, malt extract delivers sweet, malty/

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### HONEY LENDS DEPTH AND COMPLEX FLAVOR PROFILES TO BAKED FOODS.

caramel flavor that improves the overall flavor and color of the finished product. It is functional as well. It enhances fermentation, improves browning, softens and improves the crumb, and extends shelf life.

"Malt extracts are natural humectants that retain moisture in baked products, delaying the staling process," said Wiwid Paramita, technical sales specialist, Briess Malt & Ingredients Co. "Malt extract gives bagels their expected flavor and helps develop color on the surface."

Rice syrups and tapioca syrups, Mr. Sanders added, are commonly used in cereal bars and granola where their high viscosity binds ingredients together while complementing nut and grain flavor profiles.

"Dark syrups, such as molasses, can be used in combination with the more expensive honey to synergistically extend the honey taste and reduce the overall cost," Mr. Sanders said.

Most high-intensity sweeteners are available in liquid format with the amount of water influencing viscosity. The water may dilute these sweeteners' flavor profiles, but their high-intensity allows the sweetness to still come through. Allulose is the exception.

"Allulose is a sweetener that tastes and functions like sucrose and is in the family of rare sugars," said Joanne Wang, sweetener technical service customer solutions, Ingredion, Inc. "Allulose is absorbed by the body but not metabolized, making it nearly calorie-free. Allulose is one of the many types of monosaccharides that exist in nature in small quantities and can be found in certain fruits, including figs, raisins and jackfruit. Allulose has a texture and performance behavior like sucrose, providing comparable bulk, sweetness and functionality."

In bakery products, it has a similar browning effect as fructose. Liquid allulose reduces calorie content while delivering a caramelized flavor note in the finished product. In some products, allulose can replace HFCS while maintaining a moist, tender texture over the shelf life. That's because allulose has a high humectancy, which makes it suitable for soft baked goods and chewy cereal bars.

"Determining which viscous sweetener to use is highly dependent on the application and the desired finished product," Mr. Lindhost concluded. "It's worth noting they don't have to do it all alone. Formulators can use syrups in conjunction with other sweeteners to provide the desired finished product profile." ●