

A Compelling Case for Custom Sweetening Solutions



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Creating the right flavoring combination for a food, beverage or packaged product can require multiple attempts on the bench and in the pilot plant. The speed with which the product passes through the lab will depend largely on the skills of the product developer. Even with in-depth knowledge of ingredient interactions and processes, the product may hit a snag in manufacturing. Working with small levels of ingredients, such as spices, flavorings or high potency compounds requires exact measurements, plating and pre-blending. The slightest misstep can summon QC to call for rework.

That's why savvy companies seek the expertise of the supplier's specialists. Not only do they save the cost of research and development by relying on the supplier's R&D team. They will likely save manufacturing expenses by using a pre-blend. Adding one ingredient to the mix, rather than five or a dozen means there's less room for error. Assurance of purchasing a consistent product is a strong advantage.

This is especially true for high-intensity sweeteners. Sweetening strength varies from sweetener to sweetener. Because a sweetener may be up to 600 times as sweet as sugar, it must be used in precise, minute quantities. A measuring error of as little as a hundredth percent can skew the flavor profile and throw the finished product out of spec.

Inserting a high-intensity sweetener into the mix is more complicated than replacing sugar. Utilizing the R&D resources of a sweetener supplier maximizes efficiency by use of their intuitive knowledge. Every sweetener has unique sensorial attributes. All fall short of a drop in replacement for sugar.

Like spices or flavors, each sweetener imparts its own taste and functional properties. While sugar's sweetness builds, rounds and drops off slowly, high-intensity sweeteners tend to hit sharply and then linger. The presence or absence of other ingredients can magnify or mute sweetener tendencies. When certain sweeteners are used in tandem, their value exceeds their solo contribution. Making the most use of synergies optimizes flavor while lowering the levels of each must be used, ultimately reducing cost.

Combinations of sweeteners yield the most pleasant results. Flavors become melded, smoothed and fuller. The flavors of blends of high intensity sweeteners are balanced so, in some formulations, there may be more leeway.

Understanding the nuances of each sweetener, the ways that it functions and the ways that it interacts with other ingredients will shorten time to delivery of the idealized sweetening system for a beverage, confectionery, baked good or other product. Custom sweetening solutions deliver exactly the right sweetness for the product they are designed for.



Understanding sweeteners

Taste is more than the interaction of flavor molecules upon the tongue. The way a product is perceived is the sum of multiple experiences, many of which are subliminal. How quickly sweetness is noted, how long it lasts, if it ends cleanly or lingers, if it imparts fullness or if it is described as thin are qualities that come into play.

Relative sweetness is part of the equation. If sugar is the gold standard, how much sweetness does a sweetener impart in comparison? Assigning a value of 1.0 to sugar, xylitol is as sweet. Fructose is 1.3 times as sweet. Stevia can be 300 times as sweet.

Compared to sugar, fructose is detected up front on the tongue. Sugar delays slightly. Xylitol imparts rapid sweetness, but it's most notable for its pleasant cooling effect. Erythritol shares this cooling quality to a lesser degree. It is 70% as sweet as sugar.

Because stevia is hundreds of times sweeter than sugar, it can hit hard and fast. Its aftertaste is often described as licorice like.

Sweetness is only a component of the flavor. In the case of stevia, actual extracts from the South American stevia plant, *Stevia Rebaudiana* determine the sensory profile. Within the leaves of the plant there are multiple glycosides. The sweetness of each, as well as their sensory properties, varies. Dulcoside A and Rebaudioside C, for example, have a relative sweetness of 50 to 120. The relative sweetness of Rebaudioside D and Rebaudioside A is 250-450. Stevioside, Rebaudioside B, Rebaudioside E and Steviolbioside fall in the 100 to 300 relative sweetness range. Rebaudioside A has the least bitterness, but it is also the most intense.

The presence or absence of these glycosides and the ratios in which they come together will determine the final flavor.

Source is also critical to the flavor of stevia products. Growing conditions, including soil, water and weather will determine the composition and strength of the plants. Because the purity and proportions of the glycosides extracted will determine the overall flavor of the stevia product, there can be great differences among stevia products from different suppliers.



The method of extraction will also affect the taste of the product. Water extraction yields a purer flavor compared to chemical extraction. The absence of any residue is evident in a cleaner taste.

Building mouthfeel

Having a library of sweeteners to pull from and an intricate knowledge of their idiosyncrasies is important to developing the sweetening target. Sometimes additional ingredients are required to create the perception of fullness. The human tongue is sensitive to viscosity.

Consider traditional Coca-Cola®. It has a quality that can be described as syrupy. Diet sodas, in comparison, are watery. People develop preferences based on this attribute. Because high-intensity sweeteners are used at very low levels, solids are reduced. Unless these are put back by use of a bulking agent, a beverage will seem thin.

Gums may be used to build body in beverages, sauces and salad dressings, but care must be used. Each gum behaves differently. It's important to choose a gum with thickening properties as opposed to perceptible gelling properties. Ease of dispersion is critical. Lumping or clumping is as unenticing as it is ineffective. And some gums have a tendency towards sliminess, a particularly unappetizing characteristic.

Knowing which gum will function optimally in different environments and processing conditions is important. Gum manufacturers offer a variety of gums whose particle size and polymer chain length have been modified to provide different functionalities. The methods by which they are modified or extracted also vary. Natural or semi-refined gums are available. It's not uncommon for a blend of gums to express synergies, cost saving and optimal functionality.

Fructooligosaccharides (FOS) are another way to build body. These prebiotic fibers are derived from the chicory root. With 70% the sweetness of sugar, they provide excellent bulking to a wide range of foods. Their low calorie contribution — 1 calorie per gram — is an added benefit. Plus, they are synergistic with other sweeteners.

Inclusion of a sugar alcohol, particularly erythritol is a more effective way to reduce calories while building bulk. Erythritol contributes 0.2 calories per gram while imparting 70% the sweetness of sugar. It too is synergistic with other sweeteners.

If maximum calorie reduction is not the goal, savvy food techs might consider adding fructose. This is the sweetest of all the naturally occurring nutritive sweeteners. Compared to sugar, it is 1.3 times as sweet. It has 4 calories per gram. Unlike sugar, it carries a low glycemic load so it's safe for diabetics.

Besides adding mouthfeel, bulk is necessary to round out formulas. If sugar is removed from a product, solids are lost. Low-level usage of a high-intensity sweetener will automatically raise the percentages of all of the other ingredients. The difference must be accounted for or the finished product will not likely resemble the intended target.



Enhancing flavor

Ideally, sweetening solutions should be customized to enhance the flavor of whatever product they are incorporated into. At the very least, they should never detract from flavor.

Stevia's tendency toward bitterness makes it incompatible with foods that have a bitter nature. That is, if used alone. The incorporation of an effective masking agent can alleviate the tendency toward magnification. To a lesser effect, bulking agents such as gums, FOS, fructose and erythritol will also contribute toward masking. Vanilla and tea flavors pair especially well with stevia.

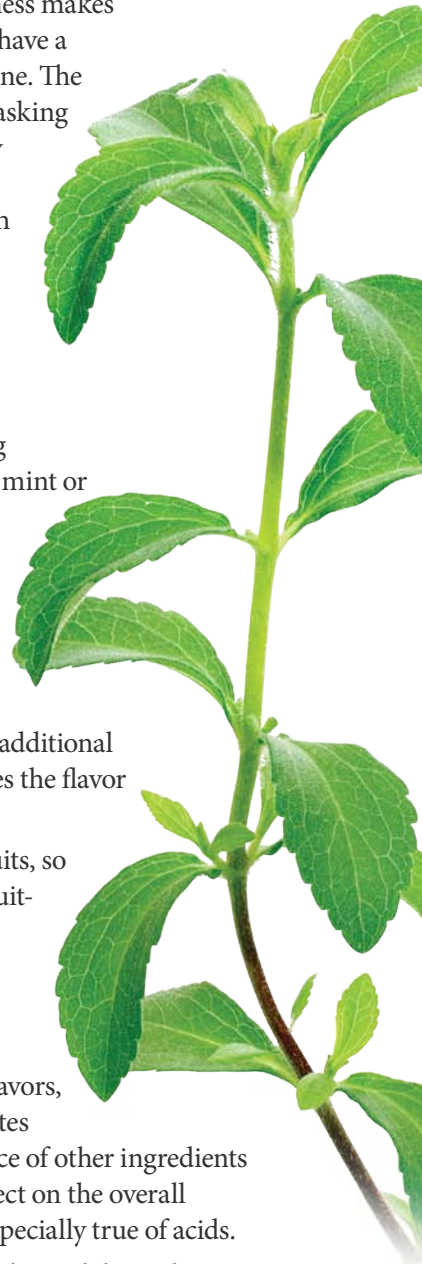
Erythritol's and xylitol's cooling characteristics make it ideal for mint or menthol applications. Citrus flavors are also compatible. The flavor of erythritol is neutral enough to be used in a wide range of food products.

FOS imparts minimal sweetness cleanly and without additional flavor contributions. It improves the flavor of a variety of foods.

Fructose naturally occurs in fruits, so it is a natural addition to any fruit-flavored food. It also enhances honey flavors, caramel flavors and spice flavors.

Just as these sweeteners can heighten the impact of some flavors, they can also soften the top notes of others. Similarly, the presence of other ingredients in the formula will have an effect on the overall perception of flavors. This is especially true of acids.

The ratio of the sweetener and the acid depends on the food product. Some foods seek an ideal balance, but others are weighted toward sweet or sour. Yet there's not a clear cut demarcation. Acids are similar



to sweeteners in that they come on at different times. They may dissipate quickly or they may linger. Citric acid comes on very quickly, so it wouldn't automatically balance well with a high intensity sweetener. Malic acid, on the other hand is delayed.

Sweeteners can also mask acids. The levels of the acid in the formula may need to be increased to get the desired effect. Acidic foods and beverages, as well as carbonation, diminish sweetness perception. In these cases more sweetener may be required.

Understanding the potential interactions and perceptions of all of the ingredients combined in the formula is key to developing the optimal sweetening system.

Functionality

If replacing sweetness were the only criteria, developers would be sufficiently challenged. But taste is just one of the roles sugar plays in foods.

In baked goods, sugar provides humectancy. Cakes, muffins and breads stay softer. The moisture level of the product remains consistent. Water activity is controlled. Shelf life is improved.

Hygroscopicity is a characteristic of some sweeteners that affects handling. Hygroscopic sweeteners pull moisture from the air. They can become sticky. Dried products may cake and become less free-flowing.

Fructose is more hygroscopic than sugar. Fructose also functions nicely as a humectant. When combined with high intensity sweeteners, calories can be reduced.

The same is true for FOS. Calories can be reduced to a greater extent while maintaining texture. Hygroscopicity is mild.

Xylitol also functions effectively as a humectant. It too has high hygroscopicity. With very low hygroscopicity, erythritol falls at the opposite end of the spectrum.

Volume is an important parameter in cakes and muffins. Baked goods sweetened with xylitol or erythritol will not have as much rise as traditionally sweetened products because the molecular weights of these two compounds is significantly lower than sugar.

Browning, or participation in the Maillard reaction, gives baked goods their golden color. For this reaction to occur, reducing sugars and amino acids are required.



Sugar alcohols like xylitol and erythritol are incapable of reacting. High-intensity sweeteners do not contribute to the reaction. Fructose, FOS or other sweeteners that contain reducing sugars must be present.

Viscosity affects batters, beverages, sauces and a variety of food products. By virtue of its low molecular weight, erythritol contributes very low viscosity to solutions.

Solubility contributes to the mouthfeel of the product. From a practical consideration, it impacts processing. Fructose is more soluble than sugar. Xylitol has high solubility. Erythritol exhibits medium solubility.

Granulation also comes into play. Dry sweeteners may be granular or powdered. A 100 mesh sweetener will have a density comparable to 10X sugar.

Customizing sweeteners

Some formulas come together easily. A trek to the R&D pantry and a few tweaks to percentages may be all that's necessary to hit the sweetness target. It's rarely that simple.

Product development is more often an exercise of repetition. It's trial and error with multiple formulation attempts.

Relying on a partner who has deep sweetening experience can simplify the process. Beginning with an understanding of the confidential ingredients in a formula, a seasoned applications team can customize a sweetening system to hit all the targets from sensory to functional attributes.

Just like a seasoning house combines blends of spices, colors and flavorings, a sweetener company can create blends of sweetening compounds to deliver the optimum sweetness profile for a specific product. Maximizing synergies among sweeteners and other ingredients in the formula can reduce the cost of the formula. Sweetening premixes offer additional cost saving benefits. Adding one ingredient instead of many reduces manufacturing steps as well as inventory, a benefit to both R&D and QC.

Every application has its own requirements, so understanding the nuances of sweeteners, alone or in tandem, must be undertaken in the context of the finished product. Working with a knowledgeable supplier will maximize efficiency in the number of passes at the bench and in the pilot plant, but also in terms of cost savings. Capitalizing on synergies between sweeteners and other ingredients can reduce the use of higher cost ingredients such as flavors. Partnering with a sweetener expert will bring their intuitive knowledge to your development efforts and will help take the mystery out of reduced calorie formulations.

Steviva Ingredients works with manufactures to create custom sweetening solutions of all particle sizes that function as a plugin to replace sucrose, 10x sugar, invert sugar and high fructose corn syrup. When you collaborate with Steviva Ingredients you can be assured of chemical-free processing, 100% natural products, clean label ingredients, GMO-free, gluten-free diabetic safe and kosher.

Since 1999 Steviva Ingredients has been a leading global ingredient supplier of: SteviaSweet RA98 – highly purified 98% minimum Rebaudioside A, available in both conventional and organic, SteviaSweet 95-60 – optimized ratio of steviol glycosides available in both conventional and organic, Steviva Blend – 2x drop in replacement for sucrose, Steviva Blend 100 mesh – replaces 10X powdered sugar, Fructevia – stevia fortified crystalline fructose with fiber, Erysweet Non-GMO erythritol, Erysweet100 Non-GMO erythritol 100 mesh, Nectevia stevia fortified agave nectar with Stevia – replaces DE42 high fructose corn syrup naturally, Fruitose – Non-GMO crystalline fructose, Oliggo-Fiber-Fructooligosaccharides FOS, XeroSweet xylitol, XeroSweet+ stevia fortified xylitol both 100 mesh and standard particle size. ■

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Make Steviva Ingredients your reliable supply chain partner.

Steviva Ingredients, where sweeteners come naturally.



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