Working With Intense Sweeteners

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When the French government gave its temporary approval to Rebaudioside A (Reb A), the natural sweetener derived from the stevia plant, many food manufacturers began to look again at their product formulations. As a natural sweetener, Reb A has attractions for some food producers that an artificial sweetener cannot match. However, that is not to say it will be the best option in every circumstance, and there are still many applications in which the current artificial options produce a better product, and many more still in which sugar is irreplaceable.

Sweetener Options

As any global food producer will acknowledge with some frustration, not all sweeteners are approved in all countries. For that matter, not all sweeteners have the approval of every consumer.

However, the main barrier to the use of any intense sweetener, whether artificial or natural, is a technical one. It is never easy to replicate the mouthfeel and taste of a full sugar product. It requires the careful blending of sweeteners, alongside the use of flavour and texture enhancing ingredients, to optimise the sensory characteristics, and to bring a low/zero calorie product in to line with the 'full-sugar' version.

Indeed, these days, sugar-free products are more often targeted at image-conscious consumers looking for that 'full-on' taste and experience, rather than at weight or calorie conscious consumers per se.

Helping to create that ‘full-on’ experience is the role of the product development specialist, and as noted above, there are several sweetener options that might be considered.

Intense Sweetener Options

Sucralose

Sucralose is considered to be around 500-600 times as sweet as sucrose in most applications. It delivers a very good quality of taste and is very stable in use. There is no significant danger of the sweetness level in products changing over shelf-life and there is no need to consider losses through most food processing operations, even those that utilise heat for extended periods. Maximum permitted use-levels in all foods and drinks is usually sufficient for it to be used as the sole sweetener in formulations if this is desired.

Aspartame

Aspartame is approximately 200 times sweeter than sucrose and delivers a good quality sweet taste. It is frequently blended with acesulfame-K and saccharin. Despite the negative publicity surrounding aspartame, all serious scientific study to date indicates that it is safe for use, except in the case of people who suffer from the inherited disease phenylketonuria (PKU), who are unable to metabolise phenylalanine.

Twinsweet™

The salt of aspartame-acesulfame, otherwise known by its tradename of Twinsweet™ dissociates completely to its constituent sweeteners in solution and then performs very similarly to a blend of aspartame and acesulfame-K prepared in a 60:40 weight ratio. Twinsweet™ is easy to dissolve and is not hygroscopic. It also has one major performance benefit in chewing gum, where the sweetness is extended so that gums have a "chew" significantly longer than is the case when the equivalent amounts of aspartame and acesulfame-K are added separately.

Acesulfame-K
Acesulfame-K is a high intensity, non-calorific sweetener, approximately 200 times sweeter than sucrose, that works best in blends with other sweeteners. It has a clean, quickly perceptible, sweet taste that does not linger and is not metabolised. It has the further advantage of being stable at high temperature so can be processed and used within many food products.

Saccharin
Long established, and much studied, there is still a big role for saccharin to play in sweetening a wide range of food products, but typically when blended with other intense sweeteners and/or sucrose.

Neotame
Neotame (N-[N-(3,3-dimethylbutyl)-L- -aspartyl]-L-phenylalanine 1-methyl ester) is a derivative of the dipeptide composed of the amino acids, aspartic acid and phenylalanine. It was approved for use in Europe late in 2009, and has a clean sweet taste like sugar, but is 7-13,000 times sweeter. Hence, only very small amounts are needed in products, for example, only about 6mg of neotame is needed to sweeten a 330ml serving of beverage. It can be used alone or as part of a blend system with other non-nutritive or nutritive sweeteners. Unlike other sweeteners containing phenylalanine, neotame is not considered a risk to those with phenylketonuria.

Alitame
Alitame (not approved in Europe) is a di-peptide of L-aspartic acid and D-alanine, with a terminal *N*-substituted tetramethylthietanyl-amine moiety. It has a sweetness potency 2000 times greater than that of sucrose. It is considered to have no aftertaste, and is more stable than aspartame under hot or acidic conditions (though less stable than saccharin and acesulfame potassium). Prolonged storage in acidic conditions at higher temperatures can result in some off-flavour.

Natural Intense Sweetener Options

Thaumatin
This is the only natural sweetener currently approved throughout the EU. Thaumatin is a protein that can be obtained from the seed shells of the fruits of the katemfe shrub. It is around 3000 times sweeter than sucrose and can be used as a sweetener and taste enhancer. However, it is only possible to use thaumatin as a sweetener in blends as it has a liquorice / cooling taste at high concentrations.

Rebaudioside A
The attraction of Reb A for European food producers is that it does have a track record elsewhere. It is already widely used in South America, Asia (in Japan stevia has roughly 40% of the sweetener market) and the USA. Reb A is just one of the many steviol glycosides in stevia leaves that provide sweetness, but it is Reb A (at 95% purity) that recently achieved self affirmed Generally Recognized As Safe (GRAS) status in the USA, and has now been approved by France. It is approximately 250 to 300 times sweeter than sucrose. It can be used in many products, such as beverages, confectionery, chocolate and desserts. Indeed, some drinks producers in Europe have already begun working with RSSL to develop new formulations containing Reb A.

Lo Han Guo (spellings can vary)
Also known as monk fruit, is another natural sweetener with many potential applications. It is extracted from a Chinese fruit and has traditionally been used as a treatment for respiratory complaints, since it is a natural expectorant. The active ingredients are tri-terpene glycosides that are some 200 times sweeter than sugar. In January 2010, Biovittoria received FDA GRAS Notification status for its monk fruit concentrate, Fruit Sweetness™.

Use of Sweeteners

Regardless of the sweetener (and the above list is not exhaustive), it is always a feature of any product development project that changing one aspect of the formulation will require changes to other aspects, and not always in a predictable way. So, fine tuning the right blend can be a case of trial and error, although working with experienced product development specialists can shorten development times considerably.

The use of trained sensory panels can be an advantage, particularly where the aim is to recreate the characteristics of a full-sugar product in a low calorie alternative. Regular consumers of a specific brand can be very sensitive to even the smallest changes, and sensory profiling can help in keeping differences to a minimum. Sensory profiling is also useful in giving a precise definition of the product differences, enabling product development specialists to focus in on certain characteristics. When trying to improve a formulation, the observation of a trained panellist that a particular blend scores more highly on bitter or metallic attributes is more useful than a vague observation that the product 'doesn't taste quite right'.

Conclusion

There is a lot of work going on around the edges of sweetener development, although there is little yet to challenge the dominance of aspartame, sucralose, acesulfame-K and saccharin. That may change of course, and certainly the potential for natural sweeteners is the one area that promises the most growth in the next few years.

In the meantime, there is plenty of opportunity to blend different sweeteners in combination with other ingredients, such as flavour enhancers, taste masking compounds and ingredients that confer bulk and texture, in order to create the desired sweetness alongside maintaining other essential sensory characteristics. However, given the infinite combinations that might be considered, it is worth seeking expert help so that the product development process is affected rapidly rather than becoming an endless drain on time and resources as manufacturers attempt to develop the perfect blend and to achieve the sweet taste of success.