A SWEET EQUATION:

Erythritol and allulose bring synergy to sweetness

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Cargill | Nourishing the world

With consumers wary of added sugars, Cargill continues to push the envelope – harnessing its deep ingredient and application knowledge to bring forward solutions to address key formulation gaps. The latest addition, allulose, exemplifies this commitment, offering unique synergies with the company's erythritol and stevia sweeteners. We caught up with Cargill's Principal Food Scientists, Smaro Kokkinidou and Wade Schmelzer, to learn more.

Q. Why bring allulose into the Cargill sweetener portfolio?

WADE: Sugar reduction is rarely easy. There's no single solution that mirrors sugar's functionality and flavor, so having more tools at our disposal means that we have more robust solutions to offer our customers.

Q. Where do you see allulose having the most impact?

WADE: We've found allulose is a great partner with erythritol. They complement each other in so many ways, allowing us to deliver greater reductions in sugar while creating finished products with improved taste and texture. It's really a case of two ingredients achieving more than the sum of their parts!

Q. Don't erythritol and allulose have a lot of similarities?

SMARO: That's true. They have similar sugar-like flavor profiles, and their sweetness intensity is about the same too – 70% that of sugar. On U.S. Nutrition Facts panels, they are considered carbohydrates – so they both support no-sugar-added formulations – and neither sweetener has a significant impact on glycemic response.

WADE: There are notable differences, however. Some are fairly subtle. Erythritol is a zero-calorie polyol that can be found in nature. Allulose, a rare sugar, has a small caloric impact on formulations with 0.4 kcal/gram – roughly 90% fewer calories than sugar. Erythritol also has a slight edge when it comes to digestive tolerance, though both score well in this regard.

SMARO: Other differences – especially around functionality in bakery and dairy applications – are very complementary, resulting in finished products with improved taste, texture and visual appearance.

Q. Let's start with bakery. What synergies do you see in these formulations?

WADE: The combination of erythritol and allulose helps fill some important functional gaps. For example, while polyols like erythritol don't contribute to browning, allulose does participate in the Maillard reaction, yielding the golden-brown color we expect in most baked goods. Allulose has a strong affinity for water, too, which results in baked goods with a softer, more tender texture.

SMARO: Using the two sweeteners together also enables deeper sugar reductions. Both allulose and erythritol have inclusion limits which vary by application. When we use them together, we can replace more sugar and achieve greater calorie reductions versus either bulk sweetener alone.

WADE: There are even sweetness and flavor benefits when blending allulose and erythritol. In our application work, whether it was cakes, cookies or muffins, the finished product tasted better, looked better and had a better texture when we paired erythritol and allulose together.

Q. Every sweetener has its own unique flavor profile. How do erythritol and allulose compare?

SMARO: They both have a similar taste profile to that of sugar, but erythritol can bring some cooling effect in certain applications, including baked goods and confectionery. Incorporating both erythritol and allulose to the formula minimizes that sensation, and results in an improved overall sensory experience.

WADE: Erythritol's cooling effect can be a positive. If you have a formulation with some back-end bitterness, those cooling properties often help mask lingering off notes – even when there's some allulose in the formula.

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Complementary sweetness

	ERYTHRITOL	ALLULOSE
Taste	Sugar-like taste	Sugar-like taste
Calories	Zero calories	0.4 kcal/g
Solubility	Moderately soluble	Highly soluble
Functionality	Supports freezing-point depression	Supports browning

SMARO: Good point. This comes up in high-protein formulations – or really, any time you have an ingredient that imparts bitterness perception during the second half of the sensory experience. It's a bit counterintuitive. Both allulose and erythritol have a fairly quick sweetness onset and very little sweetness linger, so you wouldn't expect them to have much effect on tail-end bitterness or astringency. However, erythritol's cooling effect does provide a flavor-masking benefit, especially when the sweetener blend is carefully balanced to deliver cooling with the appropriate temporal profile.

Q. What other applications are good candidates for erythritol-allulose sweetener blends?

WADE: They are very synergistic in frozen desserts and ice creams, thanks to two critical properties: freezing-point depression and solubility. Freezing-point depression is what makes ice cream scoopable. Normally, sugar fulfills this role, but in a reduced-sugar ice cream, it's usually erythritol. Allulose is much more soluble than erythritol. Include too much erythritol in an ice cream recipe, and it will crystallize, defeating the whole purpose of using it for freezing-point depression. However, when we use a combination of the two sweeteners, we can replace more sugar in a formula and still have a creamy, scoopable treat.

SMARO: Creaminess is so important in frozen desserts and ice creams – and many ingredients can impact that sensory experience. For example, erythritol can enhance creaminess and improve overall mouthfeel. It's one of its more surprising benefits.

Q. What about stevia? Do you need a high-intensity sweetener when you use both allulose and erythritol?

SMARO: Typically, yes. Neither allulose nor erythritol has the sweetness intensity of sugar. That's where we turn to stevia to fill the sweetness gap. Of course, sweetness perceptions aren't just about intensity; the timing, or temporal sweetness, is important too.

WADE: Both allulose and erythritol have a fairly quick sweetness onset. This makes them complementary to stevia, which typically lacks some up-front sweetness. When we use the three sweeteners together, we create a more balanced sweetness profile.

SMARO: With allulose, you have less time to maximum sweetness compared to sucrose. In other words, the sweetness goes away faster. Erythritol is a little different: it has a similar early sweetness onset and maximum sweetness which dissipates quickly. But then, it has a second, smaller increase in sweetness intensity before it fades away completely. Pairing allulose and erythritol evens the sweetness out. Then, when we add a small amount of stevia to the sweetening system, we get even closer to the temporal sweetness profile of sugar. Erythritol's ending cooling effect completes the picture, helping to mask the lingering sweetness we sometimes see with stevia.

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Q. It sounds like a complicated puzzle.

SMARO: We've devoted countless hours to researching these molecules, so we have a deep understanding of how they work independently and in sweetener systems, as well as how they are perceived by consumers. Having all three of these tools in our sweetness development toolkit enables us to be very nuanced in how we approach different applications, flavor profiles, sugar-reduction goals and sweetness targets.

Some flavor profiles perform better with a little bit of sweetness linger; allulose alone can't do that. In other situations, higher erythritol inclusion levels may result in too much cooling effect. By leveraging our application and ingredient knowledge, we can help brands fine-tune their sweetening solutions and reach their product development goals.

Q. So what's next for Cargill when it comes to sugar reduction?

WADE: With the addition of allulose to our product line, customers can feel confident that we have the expertise and tools to help them create the next generation of great-tasting, reduced- and no-sugar-added products. And there's more to come. We continue to build out our ingredient toolbox and invest in groundbreaking research as part of our commitment to providing comprehensive solutions that address brands' formulation needs today and for years to come.

See how Cargill expertise can help you find the right solution for reduced-sugar sweetness.

Learn more at cargill.com.

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