MINOR ingredients produce MAJOR results

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Focusing on the 2% of beverage ingredients that drive quality and innovation

The Food and Drug Administration provides the option for food and beverage companies to identify ingredients that account for 2% or less of a formulation. These minor ingredients are often colors, flavors and high-intensity sweeteners, as well as performance ingredients, which are additives the consumer cannot characterize and, if omitted, would render the product inferior.

All ingredients are listed on the label in descending order of predominance by weight. The exception is for the 2% rule. These ingredients are listed in no particular order at the end of the ingredient statement following an appropriate quantifying statement, e.g., "Contains xx percent or less of" or "Less than xx percent of." The blank percentage may be filled in with a threshold level of 2 or less, as appropriate.

All types of beverages benefit from minor ingredients, especially the growing array of protein drinks and plant-based dairy alternatives. The appearance and mouthfeel of the beverages may be improved with the addition of a stabilizer, which helps reduce or eliminate sedimentation that may occur from the protein, minerals, and cocoa, if the beverage is flavored chocolate.

"In neutral-pH beverages containing protein and electrolytes, 0.01% to 0.05% carrageenan can stabilize proteins and provide properties such as thickness, viscosity and creaminess," said Iliana Nava, senior technical service specialist-hydrocolloids, Cargill, Minneapolis. "Because of its charge density, carrageenan helps keep particles such as potassium, calcium, magnesium and proteins in suspension. These same electrostatic interactions enable carrageenan to entrap insoluble particles such as cocoa, or calcium salts used to fortify dairy or non-dairy beverages, as well as lower density constituents, such as fat globules."

Gellan gum is another common option. If suspension is the only goal, use levels are low, in the 0.03% to 0.05% range.

"When properly dispersed and activated by heat, gellan gum forms a strong network that provides excellent stability with minimal impact on viscosity," said Ariel Beverly, application specialist-beverages, DuPont Nutrition & Biosciences, St. Louis, a business of DuPont. "As a product of microbial fermentation, gellan gum is widely considered natural and can be used in organic beverage applications."

If some viscosity is desired, gellan gum may be used with other hydrocolloids.

"Gellan gum contributes the strong network to provide suspension, while xanthan gum and locust bean gum — two hydrocolloids commonly paired with gellan — allow formulators to build viscosity to target their desired mouthfeel," Ms. Beverly said.

Formulating with proteins can lead to grittiness and unpleasant texture, said Eugenia Erlij, vice president of marketing and communications, Innophos, Cranbury, NJ.

"To increase creaminess and ensure a smooth mouthfeel, pyrophosphates are an excellent solution," Ms. Erlij said. "They function similar to hydrocolloids but with a different mechanism of action, as phosphates modify the viscosity of the protein directly rather than the liquid in the formula."

The high acidity of juice-based protein drinks also may cause sedimentation. The lower pH requires a different approach to stabilization.

"Pectin is great for stabilizing acidic beverages, where other hydrocolloids may not be as effective," Ms. Beverly said. "It's highly effective at low pH and keeps proteins and other ingredients suspended in the beverage throughout shelf life. Typical

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usage levels are 0.10% to 0.40%."

Ms. Nava said, "The pH of acidified dairy beverages is usually close to casein's isoelectric point, which can cause the protein to aggregate if it's not protected. For this reason, pectin is used as a protective colloid. Without it, proteins will stick together, forming large clumps. The clumps settle to the bottom of the container, resulting in a gritty, unappealing texture. For optimum stability, we recommend high methoxyl pectin."

When you reduce the sugar in acidic beverages, viscosity is noticeably impacted. The loss of sugar solids results in a thin, watered-down texture.

"Sugar helps keep everything in suspension, so when formulators cut the sugar in beverage formulations, they need to replace it with hydrocolloids," Ms. Nava said. "The same principle applies to reduced-sugar fruit juices. Orange juice is actually a combination of water and orange oil, pulp and protein all in suspension. In a full-sugar orange juice, those components stay together because of the liquid's density. Reduce the sugar, and the pulp and protein precipitate out, leaving the water on top."

The system does not have the body to keep the components in suspension. Adding a small amount of pectin (0.05% to 0.4%) helps everything stay in homogenous suspension, Ms. Nava said.

The heat of ultra-high temperature pasteurization and retort processing also impacts protein stability. The heat denatures the proteins, resulting in a sandy or gritty texture.

"Milk proteins are especially susceptible to heat during processing," Ms. Nava said. "Hydrocolloids like pectin and carrageenan can coat and protect the protein and, at the same time, help create the thick, creamy texture consumers expect from dairy beverages."

Ms. Beverly suggested using cellulose gel and cellulose gum in retort beverages.

"They work together to keep the proteins separated throughout the matrix, which inhibits the aggregation, resulting in a smooth, homogenous product," she said. "This combo of stabilizers also allows faster heat penetration, which reduces the amount of time needed to retort the product. Typical usage ranges from 0.20% to 0.60%."

Ms. Erlij said high-heat thermal processes may impact product pH. Orthophosphates, such as disodium and dipotassium phosphates, function as buffers, helping maintain pH over shelf life.

"Phosphates also help sequester metal ions," Ms. Erlij said. "By preventing metal ions from interacting with other ingredients, they protect color and texture.

"Including polyphosphates in beverages such as smoothies and shakes improves texture and stability of the foam."

Manufacturers of dairy-based beverages increasingly are adding lactase enzyme to formulations to break down milk's inherent sugar into a form that does not cause gastrointestinal issues in consumers with lactose sensitivities.

"A highly purified lactase enzyme will break down the lactose and will not cause any undesired interactions with the other ingredients in the formula, resulting in a clean taste with boosted sweetness," Ms. Beverly said. "The lactase can be added before or after the final heat treatment of the beverage."

Enzymes also may assist with improving the mouthfeel of oat-based beverages, where the high starch content can create considerable viscosity.

"Alpha-amylases are commonly used to reduce the viscosity of grain flours, and gluco-amylases provide sweetness," Ms. Beverly said. "These enzymes are typically considered processing aids and are added to a grain flour and water slurry and allowed to incubate from 30 minutes to a couple hours."

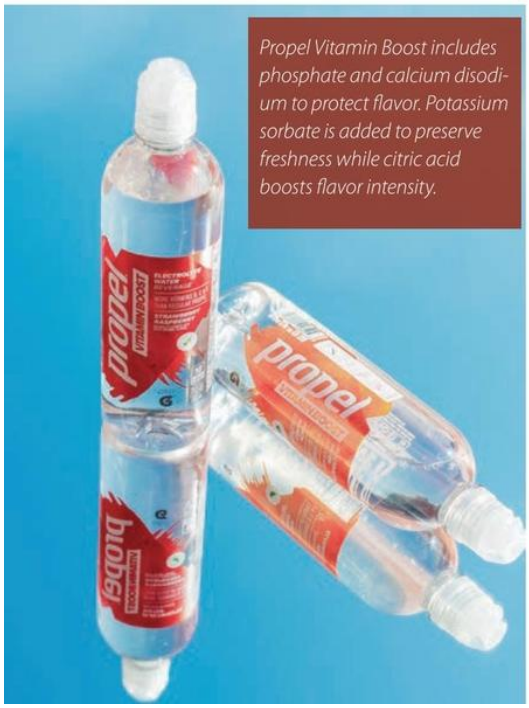
Drinkable yogurt, kefir and plant-based fermented beverages promoting live and active cultures are produced by adding the cultures after the heat treatment. Fruit and other flavorful additives are then added after fermentation and may be a source of yeast or mold contamination.

"Cultured dextrose is a fermentate produced by bacteria, which inhibits yeast, mold and gram-negative bacteria in ready-to-drink beverages, thus extending shelf life," Ms. Beverly said. "These types of fermentation products are well suited for the clean label market because they can be listed simply as 'cultured dextrose' and are available organic.

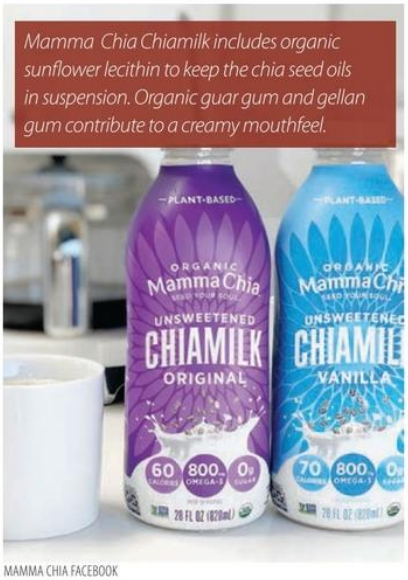
"If an oil layer is observed at the top of any beverage, this indicates the beverage wasn't properly emulsified. For beverages with lower fat levels (<5%), soy or sunflower lecithin provides excellent emulsification and a creamy mouthfeel. For beverages with very high fat levels, you may need to use mono- and di-gylcerides to emulsify all of the fats and oils in the beverage."

Food-grade acidulants allow beverage developers to manipulate flavors. Some acids boost sweet perception while others influence sour and tart notes. Acidulants are particularly useful in beverages made with fruit flavors, such as the growing number of flavored carbonated waters in the marketplace. Even beverages made with fruit juice are prone to flavor challenges. Most whole fruits contain 0.5% to 2.0% total acid, which contributes to their familiar flavor. Some of the acid is lost during juice processing and pulp removal. Adding back acids makes the fruit profile more authentic.

"Fruit-flavored beverages may deliver flavors that fall flat or dissipate prematurely," said Mohammad Emami, senior product manager, Bartek Ingredients, Stoney Creek, Ont. "Citric acid is often top-of-mind when acidulants are used in beverages. The fruit flavor of beverages with citric acid alone appears



Propel Vitamin Boost includes phosphate and calcium disodium to protect flavor. Potassium sorbate is added to preserve freshness while citric acid boosts flavor intensity.



Mamma Chia Chiamilk includes organic sunflower lecithin to keep the chia seed oils in suspension. Organic guar gum and gellan gum contribute to a creamy mouthfeel.

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one dimensional, whereas using it in combination with malic acid and fumaric acid makes it more complex and more 'true-to-fruit.' Overall, malic and fumaric acid can intensify fruit flavors, creating a smoother, more natural flavor profile and prolonged flavor release."

Citric, malic and tartaric acids are all very soluble in water. Fumaric acid often needs extra time for it to properly dissolve in a water solution. The ingredient also happens to be one of the strongest (lowest pH) of the acidulants often added to beverages and is said to have a higher relative sourness. Malic acid has a higher relative sourness than citric acid, even though its pH is higher. The higher relative sourness is because of malic acid's more prolonged sour sensation in the mouth versus citric acid. It is this sourness and contribution to tart taste that has many beverage formulators exploring how acidulants allow for flavor innovation and modification. FBN

Donna Berry
editor@sosland.com
The author is a contributing editor for Food Business News *and a principal in the firm Dairy and Food Communications, Inc. Her website address is www.berryondairy.com.*

Functions and applications for MINOR ingredients

Minor Ingredient	Examples	Functions	Applications
Acids	Citric, malic, phosphoric	Reduce pH to help microbial stability; enhance fruit flavors	Juice-based, soda, sports drinks
Antioxidants	Rosemary extract, tocopherols (vitamin E)	Slow oxidation to prolong desired taste of oil-based flavors and functional ingredients	Concentrates, low-pH beverages
Buffers	Potassium phosphate, sodium citrate	Maintain pH to increase product stability over time	Coffee lattes, creamers, protein shakes
Bulking Agents	Erythritol, maltodextrin	Add mouthfeel and some sweetness without increasing added sugars	Low-calorie beverages, protein shakes
Emulsifiers	Gum arabic, sunflower lecithin	Suspend fats, oil-based flavor compounds and other oil-soluble components	Citrus-flavored drinks, protein shakes, sports drinks
Preservatives	Potassium sorbate, sodium benzoate	Inhibit microbial growth; extend shelf-life	Juice-based, liquid water enhancers, soda
Stabilizers	Carrageenan, gellan gum, guar gum, locust bean gum, pectin, xanthan gum	Stabilize proteins, fats and other less-soluble functional ingredients; add mouthfeel and viscosity	Dairy alternatives, functional beverages, protein shakes
Weighting Agents	Brominated vegetable oil, ester gum, sucrose acetate isobutyrate	Increase density of oil-based ingredients to ensure stability in beverage	Juice-based, citrus-flavored drinks, sports drinks

Source: Joe Farinella, vice president of research and development, Imbibe, Niles, Ill.

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