Becoming Fluent in Gum Arabic

By Mary Lou Cunningham, Contributing Editor

Gum arabic, also known as gum acacia, is made from the sap of the exotic African acacia tree. It is one of the world's most-common gums and can boast the longest history. Yet, outside of the food world, gum arabic is a little-known ingredient that improves a range of foods, from making beverages more thirst-quenching to giving shell candies more crackle.

Learning about gum arabic

Gum arabic was used in ancient times as a tool in mummification and to make inks for hieroglyphics. Today, it is found in products ranging from beverages to baked goods to pan-coated candies. This stellar gum, however, can be difficult to source. It is harvested in the gum belt of Africa—Chad, Eritrea, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal and Sudan—but the region's volatile political climate can make harvesting acacia difficult.

The harvesting process also poses challenges, since the cultivation and harvesting of the gum has undergone few changes over the thousands of years it has been used. After extraction, the green gum goes through an initial drying, or curing, process that usually takes advantage of Africa's ambient warm temperatures and hot sunshine, rather than using specialized dryers. The aged, dried gum is then cleaned, dissolved in water and spray-dried to generate a uniform powdered product.

As with any natural product, agricultural differences occur in raw materials. Different Acacia species can produce exudates with different protein and uronic-acid contents, different amino-acid profiles, different molecular weights, and different fraction ratios, which can affect properties such as viscosity and emulsification ability. The effects of growing conditions are a bit more difficult to document.

Speaking arabic

Defined as a cold-water-soluble polysaccharide, gum arabic is a multifunctional hydrocolloid with a highly branched arabino-galactan-protein complex. The molecular weight of gum arabic is generally about 600,000 daltons, but it can vary. Overall, the highly branched gum is often described as globular in shape. This structure makes it only a moderately good film-former as hydrocolloids go; nonetheless, the unique quality of gum arabic films make them useful in applications such as hard-shell coatings and flavor-oil encapsulation.

Gum arabic is Newtonian up to about 40% concentration in water—its viscosity does not change with shear rate. Whether at rest or being sheared, its solution viscosity remains more or less the same. However, it thins out with temperature, a characteristic that is similar to corn syrups and other sugar syrups.

Gum arabic contains three fractions. One, known as the AGP (arabinogalactan protein) fraction, includes proteins responsible for the emulsification properties. Arabinogalactan provides most of the hydrophilic groups that orient to the water phase of an emulsion. The non-polar amino-acid side chains of the protein

orient to the oil. This makes it a natural emulsifier, allowing oil and water to be mixed together and stay together without separating. This property makes gum arabic useful in water-based beverages with oil-based flavor components, as it keeps flavor components well-mixed throughout the beverage rather than in an oil puddle on top. And, because it is natural, it is a much more “label-friendly" ingredient than many other emulsifiers.

Gum arabic also has unique film-forming properties. In pan-coated candies, for example, it is used to help give the right amount of crunch and hardness to the shell. Many flavor manufacturers also use gum arabic in their flavor encapsulation processes, since it offers protection against oxidation of the flavor without oversealing it, allowing the flavor to release as it should in the final application.

Like other hydrocolloids, natural gum arabic can be modified to change its properties. For example, TIC Gums’ modified gum arabic has been reacted with octenyl succinate anhydride (OSA) with an esterification reaction very similar to the one used to produce OSA-modified starch. This adds lipophilic groups to molecules, improving the emulsification properties of the gum. It is labeled as “modified gum arabic" and, unlike regular gum arabic, is not considered a natural product.

Supporting role

Gum arabic is a star performer that is mindful of its supporting role—it doesn’t overpower the product. Gums are often used to build viscosity, but sometimes too much is a bad thing. Gum arabic is often the perfect candidate for lower-viscosity applications. This means gum arabic is an excellent ingredient for coating cereal, confections and snack foods. And, in bakery products, the gum’s binding and emulsification abilities aid in the formulation of icings and frostings, as well as baked goods like cakes and muffins.

While gum arabic is limited in viscosity, it does provide mouthfeel, even at low usage. The perception of a polymer in the mouth is greatly influenced by the dose, and since gum arabic does not thicken the product, it can be used at a higher level. When compared with many other gums at the same usage, gum arabic can impart a perceivable, slick mouthfeel with little thickening. Even at usage of 0.1%, gum arabic can make alcoholic drinks slide down the throat more smoothly.

In addition to its functional properties, gum arabic plays an important dietary role. Its caloric value is 1.7 kcal/gram, and it is an excellent source of soluble dietary fiber (more than 85% on dry basis). Because of its low viscosity (300 cP maximum in a 1% solution), it can be used to boost fiber levels in a food or beverage without drastically altering the finished viscosity. Numerous published studies show that gum arabic boosts the growth of good bacteria in the colon. It is fermentable, producing the beneficial short-chain fatty acid butyric acid and, hence, a good prebiotic.

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