

Hydrocolloid Heroes Boost Wellness in Confectionery

Crafting sugar-reduced, plant-based, and functional confections with gelling systems.

by Nesha Zalesny

Sweet is one of the four basic tastes along with sour, bitter, and salty. For much of the population (myself included), the other three basic tastes (four if you count umami) are just interesting ways to make “sweet” even better.

Confectioners are on a constant mission to develop products that combine the basic flavors in unique ways. Alongside taste, healthy indulgence and personalized nutrition have been top trends for the past five years. Consumers want to indulge in sweets without completely derailing their health goals.

The confectionery industry has stepped up to deliver products that satisfy these needs. From sugar-reduced gelled confections to plant-based candies fortified with active ingredients, hydrocolloids can help develop new products and novel confections.

Traditional Sugar Reduction

Reducing sugar consumption has been a nearly global concern for many years. Eating too much sugar has well-known side effects. Unfortunately, hard candies and gum- mies derive much of their texture

from various forms of crystalline sucrose. Removing sugar from a confection removes the functionality of sucrose as well as the flavor. Early efforts to remove sugar included sugar-free candies that were usually hard candies created with a combination of sugar alcohols such as sorbitol, maltitol, and xylitol. But eating too many of these sugar alcohols can also have side effects. Specifically, some are not well tolerated in human digestion systems.

The early entrants into the sugar-free market also had some flavor issues. Xylitol has a negative heat of solution, which means that it will draw warmth from its surroundings to hydrate. This results in a cooling sensation in the mouth. This cooling effect makes it particularly effective in mint products. But this refreshing cooling effect is not needed for fruit or caramel flavored systems.

Latest Sweetener Systems

A newer systems approach for sugar reduction includes blends of ingredients such as erythritol, allulose, and soluble corn fiber. These ingredients are available in high solids syrups which makes them relatively easy for confectioners to drop into their manufacturing sites. These ingredients are also better tolerated by the human gut, and make effective matrixes for confections.

Erythritol and allulose are nearly as sweet as sugar. In fact, several manufacturers are using these ingredients without added high-intensity sweeteners. However, to reach the sweetness of sugar, these systems benefit from a small amount of high-intensity sweetener. Monk fruit and stevia are newer naturally derived alternatives to the stand-by high-intensity sweeteners such as sucralose, aspartame, or acesulfame K.

Better-for-You Gummies

Gelatin is a simple and effective gelling agent that can be easily used within traditional sugar gummies and sugar-free gummies. Gelatin is protein-based, unlike any of the other hydrocolloids. It is also compatible with sugar alcohols and other ingredients used to make sugar-free confections. Gelatin is a foam-former and stabilizer which makes it possible to create aerated sugar-free confections as well.

For plant-based alternatives, pectin, agar, carrageenan, and low acyl gellan are also compatible with these newer sugar-free matrixes.



Project 7 Low Sugar Apple Ring Gummies contain only 3 g sugar per bag/serving. The confection contains pectin which has a nice soft gel texture.

Table 1: The cost in use of hydrocolloids in gummy applications using their typical use levels at current (Q1 2022) pricing

Hydrocolloid	Cost In Use
Agar	0.09
Acacia gum	1.22
Carrageenan	0.07
Gelatin	0.16
Low acyl gellan gum	0.08
HM Pectin	0.07

High methoxyl (HM) pectin requires a total solids level higher than 55% to be able to gel and a pH between 2.9 and 3.3. Sucrose is usually what is meant when talking about solids, but they can also be in the form of sugar alcohols or other ingredients such as soluble corn fiber.

Pectin Peculiarities

Most confections have a very high solids level, 75% or higher as well as a low pH for flavor. Pectin creates a softer, almost creamier gel matrix when compared with gelatin or agar. Also, the high solids/low pH systems common with confections are ideal for pectin gelation, which means that the pectin will want to set quickly in this environment.

This can lead to gelation during processing. When this happens, the pectin begins to set while still being mixed. This will create a broken gel that may have microgels mixed in a soft, partially gelled matrix. Use slower-setting, buffered pectin for these systems to avoid pre-gelation. This will extend processing time; however, selection of the correct pectin is essential for success with pectin in high solids confections.

Vegan Gummies

Other hydrocolloids can also be used to create sugar-free gummy textures. Agar has a lower set temperature than many other hydrocolloids, such as carrageenan. It will form a gel at approximately 30°C, whereas carrageenan will form a gel at 38°C, and low acyl gellan will set around 42°C. These hydrocolloids have set temperatures that are influenced by the presence of ions such as potassium (especially for carrageenan) and calcium. These ions can be used to create customized textures. The use levels for these hydrocolloids are very low, between 0.2%–0.6%.

Acacia Insights

Acacia gum can also be used, but it has a higher use level, between 28%–37%. There are two grades of acacia gum: senegal and seyal types. They are from different cultivars of the acacia tree and differ by protein level. The senegal type

has a higher protein content and has emulsifying properties which make it useful as a delivery excipient for oil-based flavors. The senegal type has also been studied for use in gummy applications, both in full-sugar and sugar-free formulations.

The US Food and Drug Administration (FDA) has recently added acacia gum back onto the list of approved fibers, so these gummies also have the added benefit of being fiber-fortified without an additional ingredient being added to the label.

Prices on the Rise

Prices and shipping costs of almost every food ingredient are increasing. Making matters worse, increasing demand, labor, and energy costs are putting uncommon pressure on the supply chain. Calculating cost in use for each ingredient is therefore increasingly important (See table on next page).

What a cost-in-use analysis cannot factor in, however, is the ease of use for manufacturers or consumer acceptance. Whether in full-sugar or sugar-free gummy applications, hydrocolloids can give tailored tex-

tures. Sugar-free matrixes can be different in terms of ionic environments; working closely with a hydrocolloid supplier to develop new sugar-free confection formulations is strongly recommended.

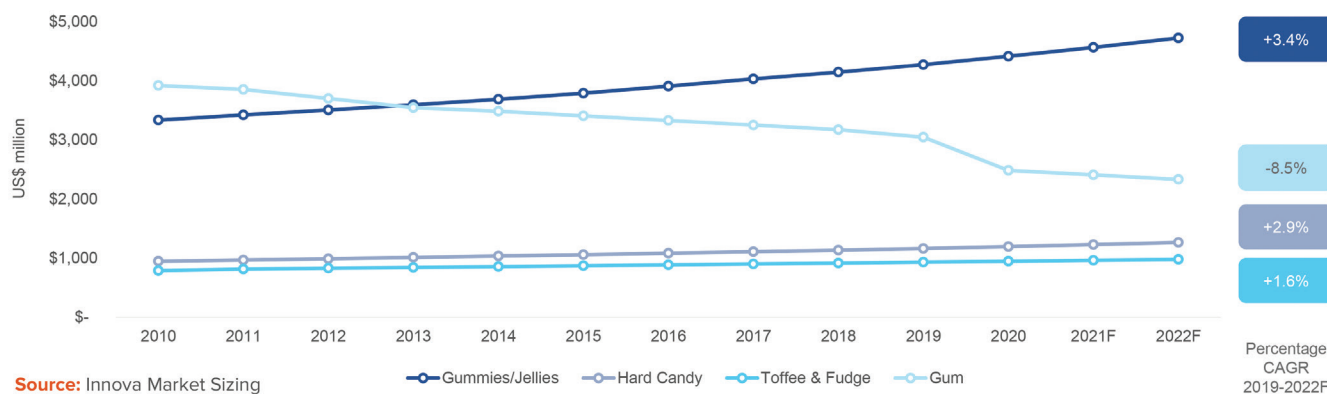
Protecting Chocolate

The chocolate segment is the largest application segment of the confectionery market. Generally, chocolate contains little to no water, so hydrocolloids are not typically added to the chocolate itself. The gelling hydrocolloids are used in enrobed gummy centers. Film-

Strongest Performance for Gummies & Jellies in Sugar Confectionery

- Gummies and jellies show the strongest growth (3.4% CAGR 2019-2022F), followed by hard candy (2.9%) and toffee and fudge (1.6%) within the sugar confectionery category in the North American market.
- Sales of gum are declining (-8.5%), with a big drop in 2020 following years of steady declines. Canada's growth of 1.9% (2019-2022F CAGR) was able to slightly offset US declines (-10.4%).

North America Sugar Confectionery: Market value by subcategory (selected subcategories only) (retail value, US\$ million) (2010-2022F)



forming hydrocolloids are also used to prevent moisture or fat migration between the chocolate coating and whatever the chocolate is wrapped around, such as a gummy center or a nut. They are also used as a barrier between chocolate and a hard candy shell.

One of the most cost-effective hydrocolloids for this is acacia gum. For this application, a 30% solution of seyal type of acacia is created with water. The gummy or nut is coated with this solution and dried. This creates a barrier between the

chocolate and center, which helps prevent both fat migration from the chocolate to the center and moisture migration from the center to the chocolate. The first would alter the eating quality of the candy; the second may cause bloom on the chocolate and alter the appearance. Both reduce the experience of eating the chocolate.

This same 30% seyal solution can also be used as a barrier between a chocolate center and a hard candy outer shell. It is used to create a smooth surface to which the hard

candy shell can adhere. That candy shell would not remain hard if fat migration was allowed to occur. It is also used on the outside of chocolate candy as part of a two-step polishing process to create a shiny appearance. The first step is coating the chocolate with the acacia solution and drying. The second step is polishing with an edible wax or shellac for a shiny finish.

Preserving Functional Actives

Increasingly, candies are used as delicious delivery formats for active supplement ingredients. These include vitamins, minerals, and oils such as DHA or CBD. However, many of these ingredients are not heat stable or stable in low pH systems. Encapsulation technology utilizes edible waxes, solid fats, or hydrocolloids along different encapsulation techniques to stabilize these ingredients during processing and eating.

Vitamins used to fortify candies need to be heat stable to 100°C or higher, and most are not in their native form. To increase heat and acid stability, solvent coating microencapsulation is used.

Hydroxy ethyl cellulose (HEC) is one of the primary ingredients used for this technology. Unlike

most other hydrocolloids, it is soluble in alcohol. For this process, HEC is dissolved in alcohol and then blended with the vitamin or oil. Once the mixture is homogeneous, usually via a high-pressure homogenizer, the alcohol is evaporated off. The finished product is a powdered vitamin or oil that is heat and pH stable. This technology can also help keep off-flavored ingredients from affecting the finished product. Not many people would willingly eat a fish-flavored fruity gummy, which is what would happen with an unstabilized DHA.

The world of confections is expanding with new textures and new active ingredients. There are many hydrocolloid combinations possible, and with new fibers and sugar alternatives, the possibilities are nearly endless. Active ingredients such as vitamins or nutritional supplemental oils such as CBD can add next-level benefits to the confectionery market. ▼

Nesha Zalesny is a hydrocolloids consultant and co-author of *The Quarterly Review of Food Hydrocolloids* produced by IMR International since 1991.



- Xylitol draws warmth from its surroundings to hydrate, resulting in a cooling sensation in the mouth. Orbit Refreshers sugar-free gum contains xylitol as its first ingredient.