NOVEL HYDROCOLLOIDS

# Gellan Gum: New Uses for a Novel Hydrocolloid

**Gellan gum networks can function as a great tool for consistent nutrient delivery. They give the formulator an easy tool to keep ingredients suspended, thus, delivering the nutrition consumers expect.**

by Wanda Jurlina

› *Two beverages with KELCOGEL gellan gum. One (left) contains beads, gelled with gellan gum, and the other contains suspended aloe pulp.*

Biotechnology – the use of living systems and organisms to develop or make useful products – is a modern term, but man has been reaping its benefits for thousands of years. Beer, wine, vinegar, yogurt and bread, all widely found across the globe, are products of ancient techniques that use bacteria or yeast to create the alcohol, acid or leavening. Today, biotechnology – using biological systems, living organisms or derivatives to make or modify products or processes for our use – is applied to many diverse food products, adding many features such as making them tastier and giving them a more stable shelf life. In the 1960s, Kelco Company (today part of CP Kelco), already successful in producing alginates, was looking for new ingredients that could thicken and gel water. The company discovered that the US Department of Agriculture had isolated a bacterium that produced a polysaccharide that thickened water – xanthan gum – and commercialized the technology. The rest is history: xanthan gum is a fermentation polysaccharide that changed the way people formulated many products such as salad dressings, cake mixes and sauces.

## Other Promising Hydrocolloids

With that success, a team of scientists was formed to see if they could identify other bacteria that produced polysaccharides. One result was a productive program that brought food formulators the versatile KELCOGEL gellan gum produced by the bacterium, *Sphingomonas elodea*, originally found in a lily pond in Pennsylvania. *Sphingomonas elodea* generates the polysaccharide named gellan gum that's used in producing highly efficient gels and extreme particle suspensions. The composition and structure of native gellan gum produced by commercial fermentation is identical to the naturally occurring polysaccharide.

The hydrocolloid was approved for use in food in Japan in 1988 and in the US in 1992. Today gellan gum continues to gain popularity in food and beverage products in countries around the world, and CP Kelco is an innovation leader in the production of polysaccharides by microbial fermentation.

Table 1: Comparison of Physical Properties of Example High Acyl and Low Acyl Gellan Gums from CP Kelco

| | KELCOGEL LT100 gellan gum (High Acyl) | KELCOGEL gellan gum (Low Acyl) |
|---|---|---|
| Molecular Weight | 1 - 2x106 Daltons | 2 - 3x105 Daltons (2) |
| Solubility | Hot water | Hot or cold water |
| Set Temperature | 70°-80°C (158°-176°F) | 30°-50°C (86°-122°F) |
| Thermo-Reversibility | Thermo-reversible | Heat stable |

## Commercialization: Early Applications

Gellan gum gained early popularity in Asian cuisine. Japanese epicureans with their passion for unique textures and eating experiences were the perfect market for the firm, brittle texture of low acyl gellan gum. Applications ranged from dessert gels to mitsumame cubes. Drinking jellies and dysphagia products with their unique requirements also created a market for gellan gum. In the US, bakery fillings emerged as a significant opportunity for gellan gum. For this application, low acyl gellan gum's compatibility with starch has led to many fillings, combining the two ingredients to give great flavor, good bake-stability and an easy-to-process, low-viscosity system with good fruit piece identity. Successes with gellan gum weren't limited to food applications. In pharmaceuticals, it is used effectively in drug delivery systems such as capsules. Non-food applications such as air freshener gels, cleaning products, personal care lotions, sprays and creams have all benefited from the unique properties of gellan gum.

## A Unique Ingredient

In the food industry, this multifunctional gelling agent can be used at low levels

in a wide variety of products that require gelling, texturizing, stabilizing, suspending, film-forming and structuring. Or, gellan gum can be combined with other thickening agents such as starch, guar gum, locust bean gum, cellulose derivatives or xanthan gum to produce a wide variety of interesting textures.

Gellan gum is currently available in two forms: low and high acyl. The low acyl product has a very high gel strength at low use levels with great clarity. The resulting gels are firm, cuttable and heat stable. While hydration of low acyl gellan gum is typically achieved through the use of heat and sequestrants, its low setting temperature can make it ideal for a variety of applications such as water gels and bakery fillings. High acyl gellan gum, by contrast, gives a soft, elastic gel. This gel network sets up at a relatively high temperature, making this ingredient ideal for suspension in hot fill applications as well as in aseptic fruit products.

Gellan gum offers the unique ability of suspension while contributing minimal viscosity via the formation of a distinctive functioning fluid gel solution with a weak gel structure. Fluid gels exhibit an apparent yield stress, i.e., a finite stress which must be exceeded before the system will flow. These systems are very good at suspending particulate matter, provided the stress exerted by the action of gravity on the particles is less than the yield stress.

Other important properties of gellan gum fluid gels are the setting temperature, degree of structure and thermal stability. As with normal unsheared gels, all of these properties are dependent upon the concentration of gellan gum and the type and concentration of gelling ions.

## Applications of Tomorrow

When gellan gum was commercialized more than 20 years ago, it seemed like its future growth would be driven by the unmatched gel textures that could be created with this ingredient. These textures have been important to many formulators, but the truly unique properties of gellan gum are demonstrated in their "fluid gel" networks. These "fluid gels" have revolutionized what can be done with beverages today. They behave as a gel at rest, but become fluid when the beverage is moved, poured or consumed. The result is a thin beverage with excellent suspension.

As companies look for new ways to deliver the nutrients necessary for life in easy-to-consume products, fortification in food systems has never been more important. Beverages are a great option, but for ingredients like insoluble fiber or minerals, they can be difficult for consistent nutrient delivery. Hard-packing of minerals in the bottom of packages may never redistribute when shaken by the consumer, a key issue for calcium fortification in aseptic products with long shelf life. Gellan gum networks give the formulator an easy tool to keep ingredients like ground calcium carbonate or bamboo fiber suspended, thus, delivering the nutrition consumers expect.

## The Need for Uniformity

Flavor and appearance in a beverage rely on uniformity. Delivering the same amount of cocoa from the first sip to the last is crucial to a consistently flavorful product. While carrageenan has historically been used to suspend cocoa in chocolate milk, creating a similar suspension in non-dairy systems can be tricky. Gellan gum networks, being more independent of proteins, can create suspension in a variety of products ranging from dairy-based drinks to milk alternatives and fruit-based systems. In each of these products, uniformity is the goal. In nut milks, in addition to suspending the calcium, stabilizing the tiny nut particles is critical to a smooth, uniform product. For fruit-based systems, formulators no longer have to accept all of the pulp settling out of the product; now it can be easily suspended with gellan gum.

Beyond fortification and uniformity is food fun. The potential for gellan gum suspension systems in beverages is limitless, driven only by the formulator's imagination. Early offerings include aloe vera pieces or gelled gellan gum beads suspended in thin, easy-to-consume beverages. Basil seeds with swollen, amoeba-like seed coats offer adventurous consumers a different experience when suspended in a drink. In recent years, producers of alcohol-containing beverages have created products with suspended ingredients ranging from cocoa to coconut to gold and silver flakes.

Low pH protein drinks, long popular in Asia and Latin America, offer a new beverage category for gellan gum growth. These systems rely heavily on the excellent protein stabilization properties of pectin and cellulose gum to prevent protein aggregation, but these hydrocolloids cannot suspend any particulates, calcium, fruit pulp or fibers. Blends of gellan gum with other hydrocolloids can do the job.

While beverage opportunities for gellan gum will continue to grow, additional applications are already drawing interest in the industry. One area of expected strong growth is fruit preps. Used extensively in the dairy industry for yogurt and ice cream products, these fruit systems have distinctive requirements such as easy-to-pump texture, great syneresis control and fruit float prevention, for which high acyl gellan gum is the ideal solution. Producers of aseptic fruit preparations find that moving to gellan gum eliminates processing steps and generates a product that's easy to make and easy to re-work when needed. Low use levels also make the application of gellan gum cost-effective when compared with alternative systems.

**For more information: CP Kelco**
**www.cpkelco.com**

### › The Gellan Gum Technical Advantage

- **Is effective at low concentrations, ensuring no flavor masking.**
- **Gels on cooling.**
- **Is created by fermentation, so its quality is consistent and supply is reliable.**
- **Offers a wide range of textures from brittle to elastic.**

### › Typical Food Applications of Gellan Gum

- **Beverages: Fruit-based, milk-based, alternative protein and carbonated drinks**
- **Bakery Fillings and Puddings: Fruit-based, milk-based**
- **Water-Based Gels: Dessert gels, aspic**
- **Confectionery: Starch jellies, pectin jellies, fillings, marshmallows**
- **Jams and Jellies: Reduced-calorie jams, imitation jams, bakery fillings, jellies**
- **Fabricated Foods: Fabricated fruits, vegetables, meats**
- **Icings, Frostings and Glazes: Bakery icings, canned frostings**
- **Dairy Products: Ice cream, gelled milk, yogurt, milkshakes, low fat spreads, dips**
- **Films/Coatings: Batters, breadings, coatings, adhesion systems**