When sodium is the associated cation with the Carrageenans, the gelling phenomenon is not observed. However, in some cases an increase in viscosity is noted.

Secondary, tertiary, and quaternary structure association can affect the functional properties. In all of the Carrageenans, except Lambda Carrageenan, the gel structure is achieved through double-helix junction zones.

Carrageenans are stable throughout a wide range of pH conditions and will adapt to most food systems. A Carrageenan gel will start losing some of its strength at pH values below 4–5 and above 10.

Temperature
Carrageenans generally require heat to become solubilized. Kappa and Iota Carrageenan, depending upon salt addition, will solubilize at about 75° Celsius and should be heated to this point in order to achieve a gel structure upon cooling. Gel formation takes place from 45°–65°, again depending upon associated salts. Generally, the greater the addition of potassium or calcium, the higher the gel-set temperature. Kappa and Iota Carrageenan gels are thermo-reversible. Thermo-reversibility usually occurs 10–15° Celsius above gel-set temperature.

Solubility
All Carrageenans are soluble in water above their gelling points. This is usually about 45–70° Celsius. The Carrageenans associated with sodium salts are soluble in cold as well as hot water. Carrageenans are generally insoluble in alcohol and oils, which makes these good media for dispersing the Carrageenans into solutions. A high concentration of sugar will also prevent solubility below gel temperature. High amounts of alcohol might precipitate Carrageenans out of solution.

Protein Reactivity
One of the unique properties of Carrageenans is their ability to react with proteins. Carrageenan is a negatively charged polymer and as such is capable of ion-ion reactions with the positively charged polycation protein. Calcium-sensitive milk proteins can also form weak complexes with the calcium ion present in calcium-associated Carrageenans. This ability to react with proteins makes Carrageenans particularly useful in the dairy industry. Stabilizers for ice cream, chocolate-milk drinks, puddings, whipping creams, and cheeses, for example, are built around protein-reactive Carrageenans. In these cases, the Carrageenans are usually used at very low levels, around 50–300 ppm.

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Carrageenans

SOURCE

A cell-wall hydrocolloid extracted from certain species of seaweeds belonging to red algae.

QUALITIES

- Uniform Gelling
- Thickening
- Texturizing Agent

USES

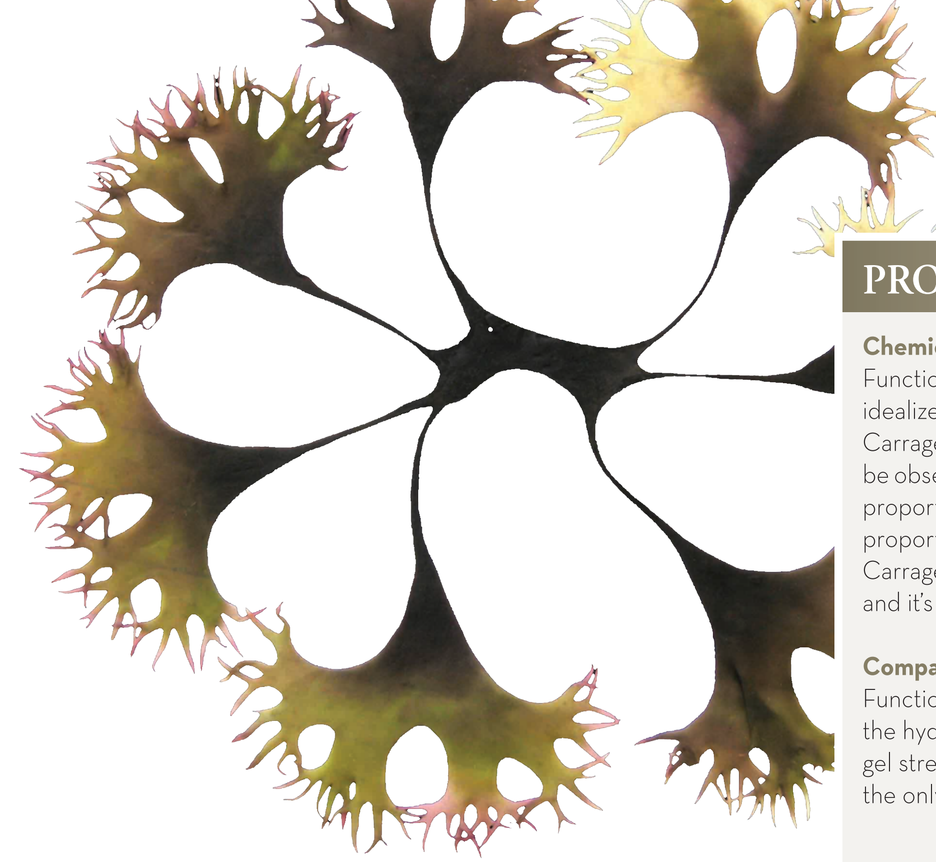
- Dairy
- Beverage
- Salad Dressing
- Pharmaceutical
- Cosmetic
- Paint

Carrageenans

SOURCE & PROCESSING

Carrageenan is a cell-wall hydrocolloid found in certain species of seaweeds belonging to red algae (class: Rhodophyceae). Carrageenans, extracted from seaweeds harvested throughout the world, have established their position within the food, household, and personal-care industries as uniform gelling, thickening, and texturizing agents of high quality. High-productivity sites are the waters off the coasts of Chile, Mexico, Spain, Philippines, and Japan.

After harvesting the seaweed, the Carrageenans are extracted and simultaneously upgraded through the use of various cationic alkalis. After extraction and purification, the Carrageenan is either alcohol precipitated or drum dried. Alcohol precipitation is considered the best method, since less thermal shock occurs, and the indigenous salts are left behind in the alcohol. All Colony Gums Carrageenans are alcohol precipitated.



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PROPERTIES

Chemical Characteristics

Functional properties may be predicted based on the primary idealized repeating unit structures for Kappa Carrageenan, Lambda Carrageenan, and Iota Carrageenan. One major generalization can be observed based on sulfate content. Viscosity increases proportionately with the increase in sulfur, while gel strength proportionately decreases. The idealized structure of Lambda Carrageenan is the only structure void of a 3,6-anhydro unit, and it's the only non-gelling Carrageenan.

Compatibility and Functional Properties

Functional properties can be manipulated through the association of the hydrocolloid with cations. Potassium ion generally increases the gel strength of Kappa and Iota Carrageenans. The Iota Carrageenan is the only reported Carrageenan that gels upon the addition of calcium.

(Continued on back)

USES

Dairy

Carrageenans are widely used in the dairy industry for their water-binding and -suspending properties. The unique capabilities of Carrageenans to complex with proteins helps prevent wheying off in such products as cottage cheese and yogurt. The gelling properties of Carrageenans are used in cheeses and parfait-style yogurts. Carrageenans are the main component of ice-cream stabilizers. The ability to prevent wheying off and crystallization are Carrageenans' functions with these products. When chocolate milk or milk drinks are bottled, the cocoa or carob particles have a tendency to fall out of solution. The gel structures that Carrageenans set up help keep the cocoa particles in suspension without adding much viscosity. Additionally, a mouth feel approximating a creamy texture is imparted by the use of Carrageenans in this situation. Most anywhere that a dairy protein exists—for example, whipped cream, soft-serve ice cream, custards, and so on—Carrageenans can be used as a stabilizer.

Beverage

Besides the already mentioned dairy beverages, Carrageenans can be useful in pulp suspension in fruit drinks. Syrups can be thickened and stabilized with Carrageenans. Another unique application of Carrageenans is in wine and beer clarification. Dry powdered mixes often incorporate Carrageenans for mouth feel and viscosity.

Salad Dressing

Carrageenans fit in with several types of popular dressings. First, Carrageenans are used to help stabilize regular standard-of-identity salad dressings. Second, dry-mix dressings depend on Carrageenans to help aid in particle suspension and to quickly increase viscosity. A new application of Carrageenans is in oil-less salad dressings. Here, the Carrageenans are used to impart an oily mouth feel and to increase viscosity; they can also be used to make "permanently suspended solids" in no-oil dressings.

Other Food Items

Carrageenans are put to use whenever a gel system is required. Water dessert gels can be made without gelatin by using Carrageenans as the gelling agent. An advantage of this is that prepared gels can have a very long shelf life and are stable at fairly high temperatures. Fish gels and aspics can be made quickly and inexpensively using Carrageenans. Many gel-type candies formerly made with Agar are now using Carrageenans as a total or partial replacement for Agar.

At low usage levels, Carrageenans can form a very slight gel for use in relishes and food toppings. Marmalades and jellies, condensed products, and pet-food gels and binders are still other possible uses.

Pharmaceutical

Carrageenans have been used as binders in tableting as well as tablet disintegrators. Syrups can be thickened using Carrageenans. Other applications are as viscosity agents in enemas, as gelling agents in prepared cold packs, and as binders and absorbing agents in sanitary napkins and tampons.

Cosmetics and Personal Care

Toothpastes, especially gel types, have a Carrageenans base. Carrageenans are also used in shampoos, as thickeners, in facial and hand lotions, and facial masks. Solid gel deodorants use Carrageenans as the base for their gel structure.

Paints

Water-based paints incorporate Carrageenans as a thickening agent and to help the paint spread evenly.