Selection Guide

The listed products are typical grades only and other grades are available. Appropriate products would be proposed after consultation.

Product Name: KIMILOID

Grade	Esterification Degree*	Viscosity (mPa·s)	Application
HV	High	High 150～250 (1% solution)	Texture improver for Bread, Noodle and Pasta
MV	High	High 100～150 (1% solution)	Texture improver for food (Stabilizer for Thickening, Emulsifying)
LV	High	High 60～100 (1% solution)	Texture improver for food (Stabilizer for Thickening, Emulsifying)
NLS-K	High	High 30～60 (1% solution)	Texture improver for food (Stabilizer for Thickening, Emulsifying)
LLV	High	High 15～35 (1% solution)	Texture improver for food (Stabilizer for Thickening, Emulsifying)
BF	High	High 50～200 (1% solution)	Foam Stabilizer for Beverages, Meringue
LVC	Low	High 70～170 (1% solution)	Texture improver for Noodle and Pasta / Thickening Stabilizer for Sauces
HVC	Low	High 300～600 (1% solution)	Oil Absorption Reduction, Egg White Substitute, Dressing

Product Name: KIMICA ALGIN

Grade	Ingredients	Application
M602	Propylene Glycol Alginate,Sodium Alginate	Texture Improver for Bread and Noodle

*Esterification Degree

"The properties of PGA solutions and their application suitability depend on the degree of esterification, which indicates the proportion of esterified carboxyl groups within the molecule. This 'esterification degree' is tailored to specific uses.

Propylene
Glycol
Alginate

KIMICA Corporation

KIMICA Marine Biopolymers Alginate
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2024.09

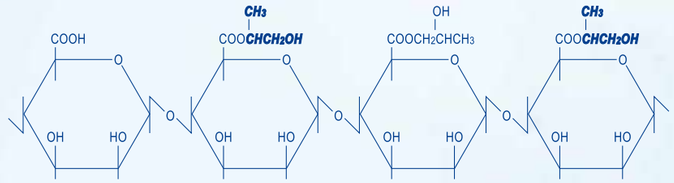
Introduction

Propylene Glycol Alginate

Propylene Glycol Alginate is a derivative of alginate, a natural dietary fiber extracted from seaweed, obtained by esterifying its carboxyl groups. It is commonly referred to as "PGA", an abbreviation derived from its formal name.

It has been widely used as a thickening agent and stabilizer in food, playing an essential role in improving the quality of products such as bread, noodles, sauces, dressings, and beverages.

Structure



PGA is formed by esterifying a portion of the carboxyl groups in alginate. By adjusting the degree of esterification, which indicates the percentage of carboxyl groups that have undergone esterification, it is possible to control properties such as viscosity and fluidity.

Safety

PGA has been used for over 60 years, with its safety confirmed by the United Nations, the FAO/WHO Joint Expert Committee on Food Additives (JECFA). The Acceptable Daily Intake (ADI) is set at 0-70mg/kg, meaning that a person weighing 60kg could safely consume up to 4,200mg daily throughout their lifetime.

Since the effective usage of PGA requires very small amounts (e.g., 0.1-0.2% against flour in bread), the likelihood of surpassing the daily ADI in a typical diet is limited and thus it is safe to use.

KIMICA's PGA is made from 100% natural seaweed, ensuring no concerns about genetic-modification, residual pesticides, or food allergies.

PGA and PG

The formal name of Propylene Glycol Alginate (PGA), closely resembles "Propylene Glycol (PG)." Consequently, there is potential for confusion between the two. However, PGA is a powder that forms a viscous paste when dissolved in water, whereas PG is a tasteless, odorless, and transparent liquid (organic solvent). Both substances are entirely distinct in terms of their characteristics, properties, and applications.

Properties

The Advantages of PGA over Alginates

Acid & Calcium Tolerance

While many substances referred to as "alginate" function as thickening and gelling agents, they are typically "Sodium Alginate". The aqueous solution of Sodium Alginate exhibits very smooth fluidity. However, under acidic conditions or with an increase in the concentration of divalent ions such as calcium, it undergoes gelation (or precipitation) through ion exchange reactions. Consequently, Sodium Alginate is unsuitable for acidic foods (such as fruit juices, dressings, fermented foods) or foods rich in calcium (e.g., dairy products).

The role of PGA addresses the limitations of Sodium Alginate. PGA dissolves well in acidic foods, providing thickening and stabilizing effects. It does not undergo gelation upon contact with calcium, making it suitable for dairy products rich in calcium. Furthermore, it exhibits superior resistance to high salt concentrations and high alcohol content in foods compared to Sodium Alginate.

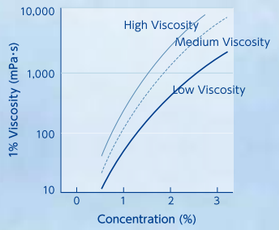
Emulsion Stability

PGA has a structure that imparts surfactant properties by combining hydrophilic alginate molecules with hydrophobic propylene glycol groups. This unique feature, absent in other alginate salts, is utilized as a stabilizer in salad dressings.

Properties

Solution Properties

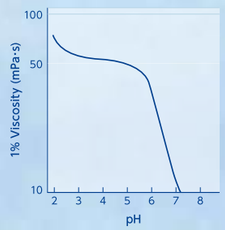
Concentration and Viscosity



- It dissolves in cold and warm water, exhibiting high viscosity.
- The pH of a 1% aqueous solution ranges from 3 to 4, indicating acidity.
- Due to its high hydrophilicity, caution is required during dissolution to prevent lumping.

Acid Resistance

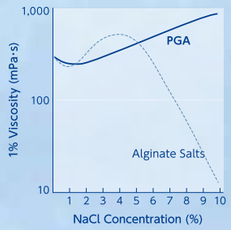
pH and Viscosity



- In the pH range of 3 to 5, it exhibits stable viscosity, making it highly effective for thickening and stabilizing acidic foods.

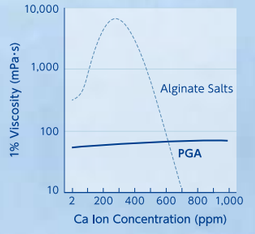
Salt Tolerance

Effect of Monovalent Electrolytes



- While Alginate molecules may contract and eventually precipitate when high concentrations of inorganic electrolytes such as table salt are added to their aqueous solutions, PGA remains stable even in concentrated electrolyte solutions.

Effect of Multivalent Cations



- Even in the presence of multivalent cations, PGA exhibits thickening and stabilizing effects without gelation.

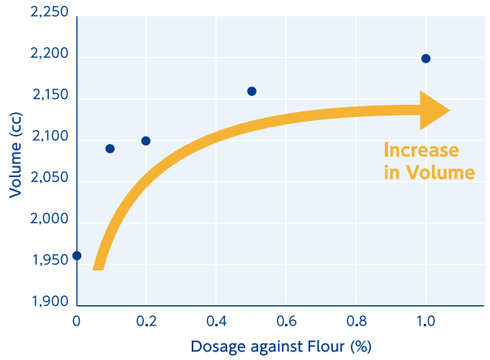
What PGA can do

Elevate Volume

Recommended Grade : **HV, M602**

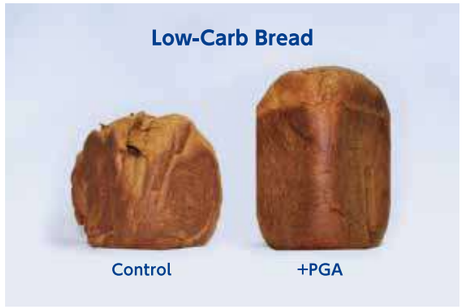
Recommended Dosage : **0.1~0.5% against Flour**

When adding PGA at a ratio of 0.1-0.2% against flour, the water retention capacity of the dough improves, influencing the proteins in the wheat flour to strengthen the structure of the bread. It rises firmly from the bottom, expands uniformly without forming a flat bottom, enhancing the overall volume of the bread. As a result, sandwich bread becomes fluffy and large, while buns and pastry bread gain improved texture.



Gluten-Free & Low-Carb Bread

Gluten-Free Bread (Rice flour Bread) is known for its higher water absorption and lack of gluten compared to wheat flour, making it challenging to rise well. Similarly, bread made with soybean or bran as the main ingredients to reduce carbohydrates tends to have difficulty rising and may result in uneven shapes. However, by using PGA, these breads can achieve a pleasing shape and a light, fluffy texture even without wheat flour.



Cake Flour Bakery

When PGA is added to sponge cake made with cake flour, it ensures uniform incorporation of air bubbles, resulting in a firm rise from the bottom and increased volume. Additionally, it reduces the generation of crumbs during cutting and enhances the resistance to cracking or breaking when rolled.

What PGA can do

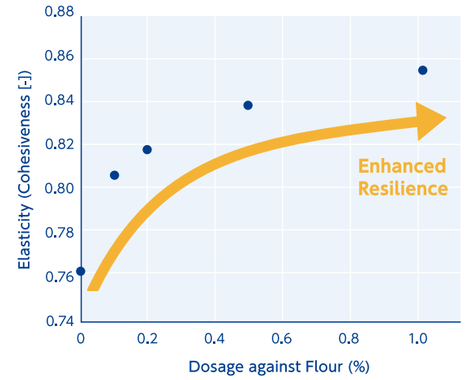
Enhance Elasticity

Recommended Grade : **HV, M602**

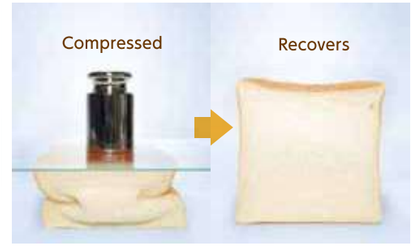
Recommended Dosage : **0.1~0.5% against Flour**

PGA strengthens the structure of bread, improving its elasticity. As a result, the bread's resilience (ability to return to its original shape after being compressed) increases, providing a soft and fluffy texture.

A notable example where this effect can be readily experienced is in convenience store or supermarket sandwiches. Bread distributed through chilled channels is processed to maintain softness even when refrigerated, addressing the previous drawback of being easily compressed and resulting in a chewy texture when bitten. By incorporating PGA, the bread retains its original shape even if compressed during distribution, achieving a pleasant, firm texture without the chewiness.



Pressing the bread leaves no hand imprint



PGA also prevents caving. Even in soft bread with abundant ingredients like raisin bread, adding PGA results in a fluffy texture without caving after baked.

PGA imparts elasticity to the skin of Chinese buns. It provides a pleasant firmness to the steamed buns, enhancing their texture.

Improve Workability

Recommended Dosage : **0.2% against Flour**

Increasing the amount of water in dough can reduce workability due to stickiness. However, by adding PGA, the dough becomes less sticky even with added water, leading to improved workability. This not only contributes to the reduction of labor time but also minimizes material waste, allowing for cost savings.

- Does not stick to mixers even with high water content
- Easier to cut, enabling time-saving during the process
- Reduces bread crumbs accumulating in the slicer by over 80%
- Dough remains stable even with overmixing

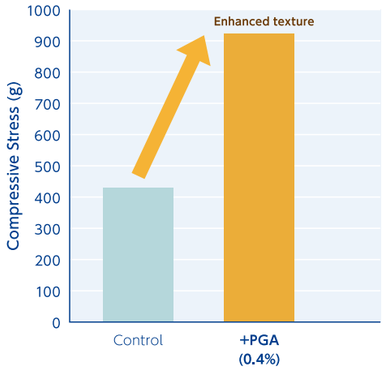
*Increase the water content by 1% against 0.1% of PGA.

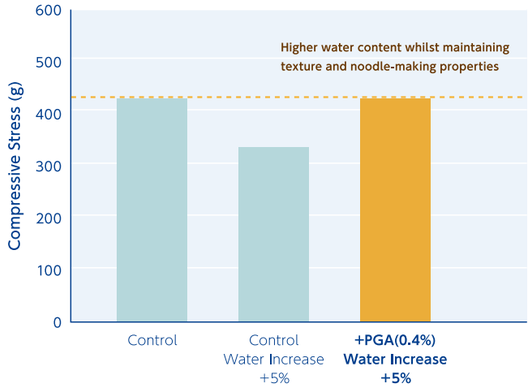
What PGA can do

Improve Texture

Recommended Grade : **HV, HVC, LVC, M602**
Recommended Dosage : **0.1～0.5%**

PGA imparts firmness and elasticity to the structure of wheat flour, improving the texture of noodles. Widely adopted by major manufacturers in Japan for long-standing popular products such as instant noodles and chilled noodles, it is increasingly utilized in cases involving dry noodles, low-carb noodles, gluten-free noodles, and more. Increasing the water content also improves yield.





Instant Noodles

Instant noodles have a long shelf life after being heat-treated in the factory. However, during this period, starch aging may occur, leading to a tendency for the noodles to become soft after rehydration. PGA increases the firmness of the noodles, improving the texture after rehydration. It is also said to enhance the smoothness and mouthfeel, making it a popular choice for many successful products.

Chilled Noodles

Chilled noodles displayed in convenience stores and supermarkets face the challenge of maintaining their texture due to the extended time between heating and consumption. The texture of chilled noodles is improved using only a small addition of PGA.

Dried Noodles

PGA enhances the texture of dry noodles such as soba noodles and pasta, improving the chewiness after boiling. Machine-made pasta, which tends to have a soft texture after boiling, can achieve a hand-stretched texture and chewiness when formulated with PGA. It prevents the noodles from softening even with a longer boiling time and provides resistance against boiling elongation.

Functional Noodles

(Low-Calorie/Low-Carb/High-Protein/Gluten-Free Noodles)

Creating noodles without wheat allows for low-calorie, low-carbohydrate, high-protein, and gluten-free options. PGA enables the processing of unconventional ingredients, such as soy, rice flour, and seaweed, into noodle-like forms, providing a moderate chewiness and smoothness.

Rice Flour Noodles

Rice flour noodles tend to disintegrate into small pieces and cannot maintain the integrity of their noodle strands when boiled.

The boiling water becomes heavily turbid due to the dissolved rice flour.

Rice flour noodles result in well-cohesive strands, creating a glossy and desirable texture.

The leaching into the boiling water is controlled, and the turbidity of the cooking water is reduced.

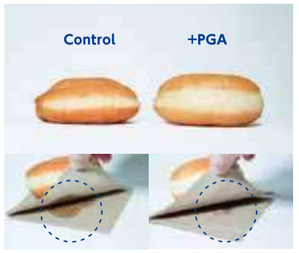
What PGA can do

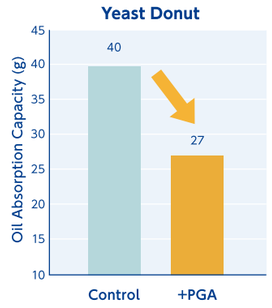
Reduce Oil Absorption

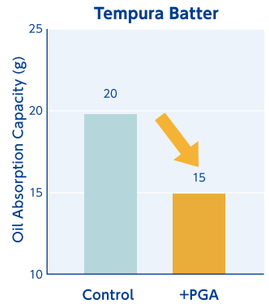
Recommended Grade : **HVC**
Recommended Dosage : **0.1～0.5%**

Adding PGA into dough for donuts improves oil drainage after frying, resulting in reduced greasiness. By suppressing surface oiliness, it eliminates the need for excessive powdered sugar or toppings, preventing visual deterioration.

The reduction in retained oil not only facilitates calorie reduction and cost savings (due to decreased oil consumption) but also imparts a crispy and crunchy texture. This effect extends beyond baked goods, finding applications in various fried dishes like fried chicken, tempura, and more.

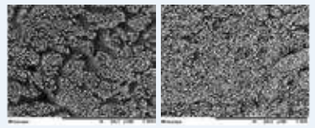






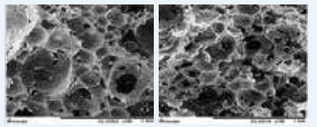
Mechanism of Oil Absorption Reduction

Surface of a Donut
(Electron Micrograph Image)



Donuts without PGA have noticeable raised oil particles, visible as dark gray bands, while those with PGA show no floating oil on the surface.
It is believed that this contributes to the elimination of stickiness and imparts a refreshing texture.

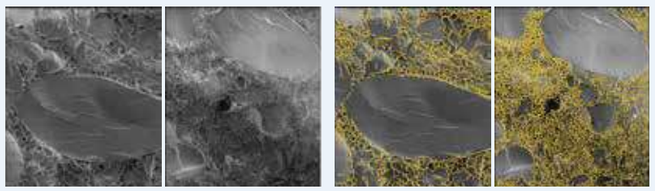
Internal Structure of a Donut
(Electron Micrograph Image)



Donuts without PGA have coarse, uneven air bubbles and thicker dough walls, while adding PGA creates finer, more uniform bubbles with thinner walls.* This effect plays a role in reducing the absorption of oil by the dough.

Mechanism of Elasticity Improvement

Network density
(The right side emphasizes the network structure highlighted in yellow)



PGA interacts with the proteins in flour, creating a uniform and dense network structure of gluten in the dough. It is believed that this dense gluten network effectively supports the structure of bread and layers, enhancing elasticity and texture.

What PGA can do

Improve Stability

Fruit Juice

Recommended Grade : **HV, LLV** | Recommended Dosage : **0.1～1.0%**

PGA imparts a moderate mouthfeel and richness to fruit juice beverages. It also helps to minimize the settling of solid components, such as pulp derived from raw materials, that may be suspended in the drink.

Lactic Acid Beverage

Recommended Grade : **LLV** | Recommended Dosage : **0.1～0.8%**

When added to lactic acid beverages, PGA binds to acidic milk protein particles, reducing electrostatic repulsion. Its high molecular structure creates a barrier that prevents the proteins from coagulating and settling, thus maintaining a stable dispersion for longer periods with only half the usual amount of pectin.

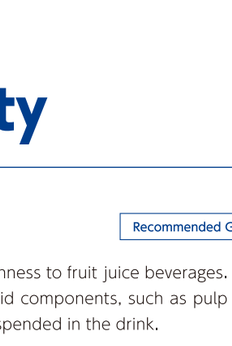
Observation

After settling at room temperature for two weeks

Maintains a dispersed state, preventing the sedimentation of milk proteins.

State of Milk Proteins

Microscopic observation after homogenization



PGA prevents the aggregation of milk proteins, ensuring homogeneous dispersion.

Effects on Acidic Protein Stability

PGA exhibits stabilizing effects at lower addition levels compared to other stabilizers.

Dressings

Recommended Grade : **HVC, LVC** | Recommended Dosage : **0.1～0.5%**

PGA functions by adhering to the surface of oil droplets, preventing the fusion of oil particles and inhibiting the growth of oil droplets, thereby stabilizing the emulsification of dressings. It easily dissolves even under high salt concentration and acidic conditions, exhibiting viscosity. This improves the fluidity and texture of the dressing, reduces the movement of oil droplets, and enhances the stability of the emulsion. It prevents the precipitation of seasoning components and food materials.

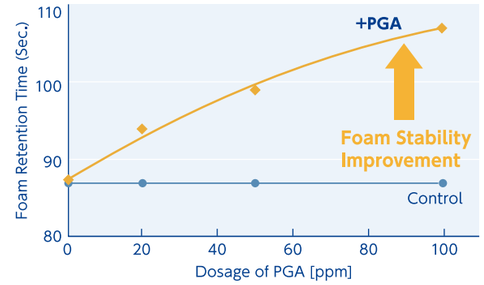
What PGA can do

Improve Foam Stability

Beer

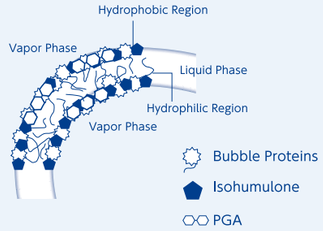
Recommended Grade : **BF** | Recommended Dosage : **40～80 ppm**

PGA acts on foaming proteins, reinforcing the film of the foam, and slowing down the liquid flow rate to extend the retention time of the foam. Due to its excellent effects in extremely small quantities (several tens of ppm), it has been utilized for many years, particularly in breweries in Europe and South America.



Mechanism of Foam Stability

The foam in beer is composed of a complex formed by the bubble proteins from malt and the bitterness component (isohumulone) from hops. This complex orients itself differently on the inside and outside due to differing affinities with water, forming a double membrane and resulting in the formation of foam. When PGA binds to this complex, the strength of the membrane increases, contributing to the stability of the foam.



Meringue

Recommended Grade : **BF** | Recommended Dosage : **0.1～0.5% of Egg White**

PGA acts on the proteins in egg whites, strengthening the film of the foam and creating fine, long-lasting bubbles. This not only reduces the stirring time required for meringue to foam but also maintains a creamy, smooth texture with well-defined peaks.

Foamy Soy Sauce

Recommended Grade : **BF** | Recommended Dosage : **0.1～0.5% of the Total Amount**

Transforming condiments like soy sauce into a foamy texture enhances the flavor. By maintaining the shape of foamy condiments with PGA, the diversity and creativity of dishes are elevated.

Stable Supply

KIMICA produces PGA in Japan, Chile, and China. Additionally, we maintain a constant and ample inventory with logistics hubs in the United States and Germany. This is to fulfill the responsibility of ensuring stable supply, During the Great East Japan Earthquake in 2011, we collaborated with our overseas facilities to maintain an uninterrupted supply.

High Quality

KIMICA has been dedicated to alginate for over 80 years, continuously refining its quality culture. As a result, we have become the world's top manufacturer of alginate in the food and pharmaceutical fields, with its quality. Not only do we comply with ISO9001 and FSSC22000, but also deliver KIMICA-quality products through our unique quality culture developed over 80 years.

Technical Support

We have multiple Ph.D. holders from various fields such as chemistry, engineering, pharmacy, and agriculture, all working together to address the needs of the times through research and development. The expertise accumulated in this way is built and polished from scratch distinct from "know-how acquired from others" or "purchased knowledge." Our Food Application Laboratory, equipped with professional-grade cooking facilities, is also available to develop and validate solutions to meet our customers' needs.

How to dissolve Alginate

PGA is available in powder form. It is typically dissolved in water before being added to food, but if a water solution is unsuitable, the powder can be added directly to the ingredients.

When using as a water solution

PGA, like other water-soluble polymers, can form lumps when mixed with water. To avoid this, use a special dissolving tool or mix PGA with something like sugar before adding it to water.

When incorporating as a powder

PGA exhibits sufficient effects at a concentration of 0.1-0.2%. For example, in bread making, where only 25-50g is added per 25kg of wheat flour, simply adding it may result in uneven distribution. It is necessary to take a portion of the wheat flour in advance, premix it with PGA, and then thoroughly mix it back into the entire mixture to ensure uniform distribution throughout the raw material.

How to dissolve Alginate in movie

Storage

In environments exceeding 30˚C, ester degradation progresses, leading to a deterioration in quality (insolubilization). For long-term storage, please keep it in powder form in a cool, dark place at or below 20˚C.