Xanthan Gum

Jungbunzlauer

Xanthan Gum

A hydrocolloid with outstanding properties

Xanthan gum is a natural polysaccharide. It was discovered in the late fifties in the research laboratories of the US Department of Agriculture during research work into the industrial applications of microbial biopolymers. Extensive research revealed that the bacterium Xanthomonas campestris found on cabbage plants produces a high molecular weight polysaccharide which protects the bacterium. This polysaccharide, called xanthan gum, proved to have technically and economically interesting properties.
The industrial importance of xanthan gum is based upon its exceptional qualities as a rheology control agent in aqueous systems and as a stabiliser for emulsions and suspensions.

$(C_{35}H_{49}O_{29})_n$

Regulatory Status

Detailed investigations with respect to toxicology and safety have shown that xanthan gum is a safe food additive. It was cleared by the FDA (the US Food and Drug Administration) in 1969 and is registered in the Code of Federal Regulations. In 1980 the EC approved xanthan gum under the number E 415. In 1988 the ADI (acceptable daily intake) of xanthan gum was changed to "not specified" confirming its status as a safe food additive.

Jungbunzlauer xanthan gum food grade fully meets the standards and the purity criteria issued in the latest versions of USP-NF (United States Pharmacopeia-National Formulary), Ph. Eur (European Pharmacopoeia), FCC (Food Chemicals Codex) and the respective EC directive.

Properties

Xanthan gum is a white to cream-coloured free flowing powder soluble both in hot and cold water, but insoluble in most organic solvents. Even at low concentrations xanthan gum solutions show a high degree of viscosity in comparison with other polysaccharide solutions. This property makes it a very effective thickener and stabiliser (Fig. 1).

Xanthan gum solutions are highly pseudoplastic but not thixotropic, i.e. even after high shear rates the initial viscosity is rebuilt instantaneously.

Xanthan gum is more pseudoplastic than most other hydrocolloids (Fig. 2). This pseudoplasticity enhances sensory qualities (flavour release, mouth feel) in final products, eases processing (mixing and pumping) and guarantees a good pourability.

Xanthan gum solutions are very resistant to pH-variations, i.e. they are stable in both alkaline and acidic conditions.

The thermal stability of xanthan gum is usually superior to most other water-soluble polysaccharides (Fig. 3).

Fig. 1: Viscosity versus Concentration
in standardized tap water, Brookfield LVT, 60 rpm, 25 °C

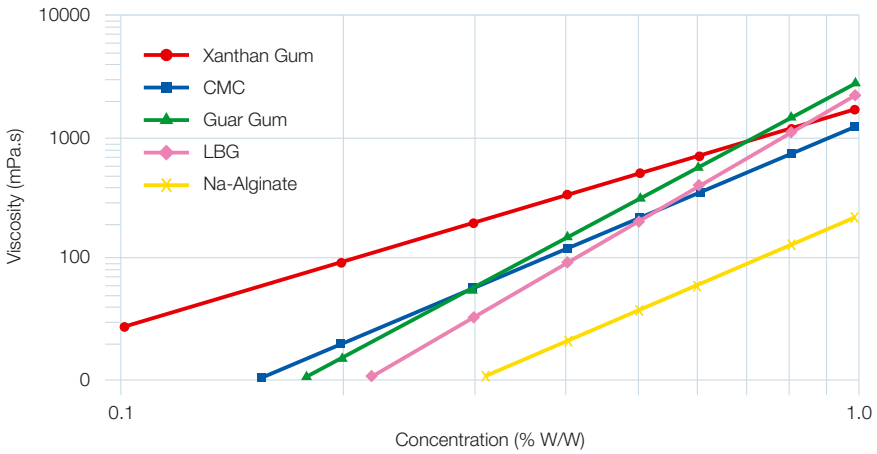


Fig. 2: Viscosity versus Shear Rate
0.25 % solutions in standardized tap water, Haake RV30-M5/NV, 25 °C

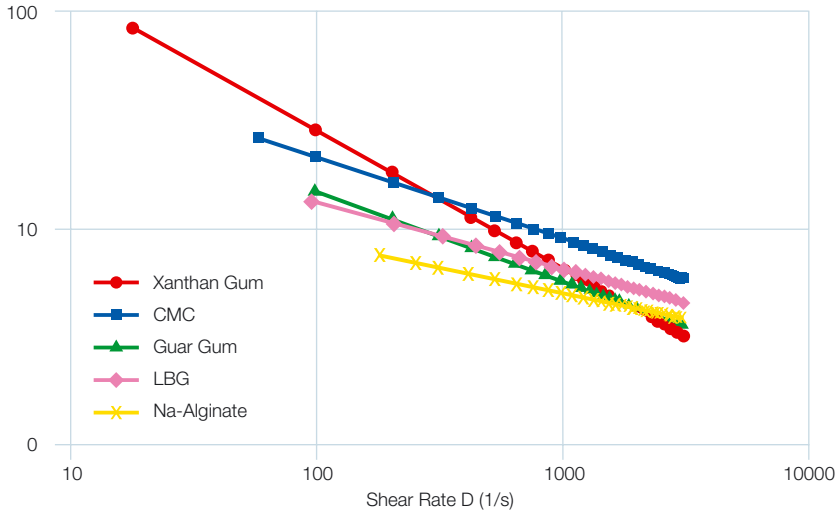
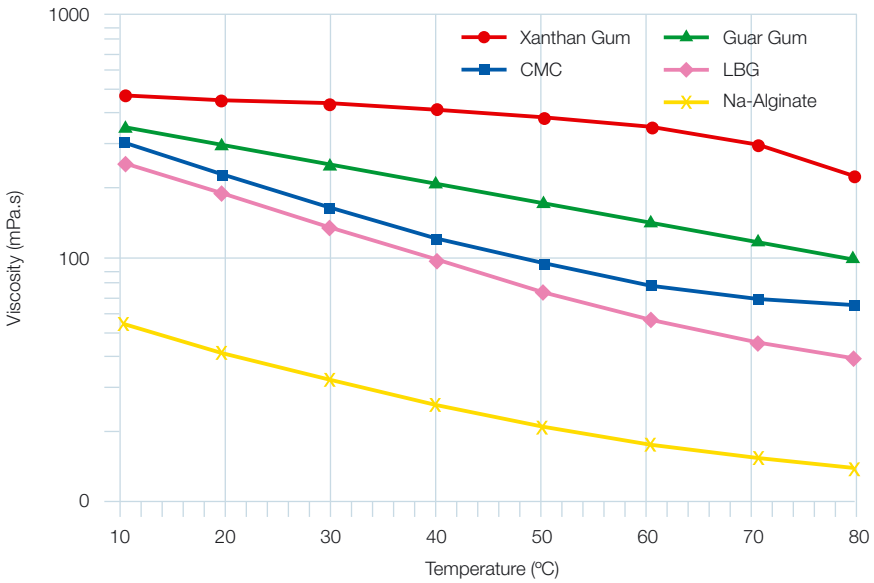


Fig. 3: Viscosity versus Temperature
0.5 % solutions in standardized tap water, Brookfield LVT, spindle 2, 60 rpm



The viscosity of xanthan gum solutions is completely recovered after heat treatment steps during food processing e.g. sterilisation. The rheological properties of the final products thus remain stable, irrespective of being kept in a refrigerator, stored at room temperature or heated. Xanthan gum also improves the freeze / thaw stability of frozen foods.

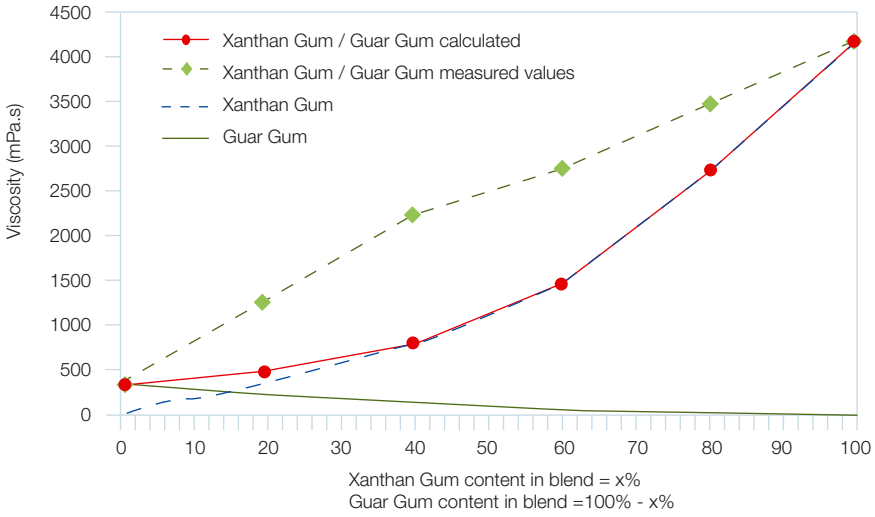
Xanthan gum is tasteless and does not affect the taste of other food ingredients. The caloric value of xanthan gum is very low (0.6 kcal/g).

Compatibility

Xanthan gum is compatible with most food, cosmetic and pharmaceutical ingredients. Xanthan gum has an excellent stability in the presence of acids.

It can be dissolved directly in many acid solutions. To achieve best results it is recommended to add the acid after the preparation of the gum solution. Xanthan gum solutions have unusually good compatibility and stability in the presence of most salts. The addition of electrolytes, such as sodium and potassium chloride, increases the viscosity and stability. Divalent salts like calcium or magnesium have a similar effect on viscosity. Optimum viscosity is reached at salt concentrations above approximately 0.1 %. Higher salt concentration levels do not increase stability any further, nor do they affect the rheological properties of xanthan gum solutions. Most food systems, though, contain the appropriate amount of salts. Even at high concentrations xanthan gum is compatible with most salts. Only at high pH-levels (pH > 10) xanthan gum tends to form gels in the presence of high concentrations of divalent cations. Trivalent cations such as aluminium or iron form gels at acid or neutral pH-levels. Gelling may be prevented by high levels of monovalent metal salts.

Fig. 4: Synergy with Guar Gum
0.5% Xanthan Gum / Guar Gum blend in 1% NaCl solution
Brookfield LVT, 3rpm, 20C



Jungbunzlauer xanthan gum is compatible with most of the commercially available thickeners such as cellulose derivatives, starch, pectin, gelatine, dextrin, alginates, carrageenan, etc. Combinations of xanthan gum with galactomannans show a synergistic viscosity increase, i.e. the observed viscosity is higher than the sum of viscosities of either gum alone. Such combinations also show improved rheological properties, better texture and mouthfeel in comparison to pure locust bean gum or guar gum solutions. Fig. 4 shows the synergistic effect of a xanthan gum/guar gum solution.

The synergism with locust bean gum (LBG) is even stronger than with guar gum and concentrations up to approximately 0.2 % show very high viscosity values. Above this level solutions of xanthan gum and LBG will form thermally reversible gels when heated to above 85 °C and subsequently cooled. Maximum gel strength is attained at a 50/50 ratio of xanthan gum / LBG and is influenced by the pH and the electrolyte content of the solution.

By blending different gums with xanthan gum, varying the ratio and the concentration of the combination, very specific characteristics of the end product may be obtained, e.g. viscosity, pseudoplasticity, texture and mouthfeel.

Xanthan gum is highly resistant to enzymatic degradation due to the nature of the sugar linkages as well as to the side chain substituents on the polysaccharide backbone. Pure xanthan gum can therefore be safely used in the presence of most enzymes commonly occurring such as galactomannanases, cellulases, amylases, pectinases, proteases etc. Xanthan gum is not directly soluble in most organic solvents. Up to 40 - 50 % of common solvents such as isopropanol, methanol, ethanol or acetone can be added to aqueous solutions of xanthan gum without precipitation of the gum.

Applications

Due to the extraordinary properties as stabiliser and thickener xanthan gum is used in the food, cosmetic and pharmaceutical industry.

Also, xanthan gum is used in various industrial applications and for oil drilling.

In all these areas xanthan gum is accepted as an excellent stabiliser and a useful processing aid.

Food Application	**Usage in %**	**Function**
Salad Dressings	0.1 - 0.5	provides easy pourability and good cling; suspends spices
Bakery Products	0.05 - 0.3	binds water; improves texture
Beverages	0.05 - 0.2	enhances mouthfeel; suspends fruit pulp
Instant Products	0.05 - 0.2	contributes body; quick viscosity build up in cold and hot water
Prepared Foods	0.1 - 0.3	stabilises; avoids syneresis
Soups, Sauces and Gravies	0.05 - 0.5	gives good temperature stability; prevents separation
Frozen Food	0.05 - 0.2	provides good freeze/thaw stability; contributes smooth texture
Dairy Products	0.05 - 0.2	inhibits syneresis; stabilises emulsions
Toppings	0.05 - 0.3	stabilises foams and emulsions; provides good flow and cling
Meat Products	0.2 - 0.5	binds water; inhibits syneresis
Low-calorie Products	0.1 - 0.5	improves texture; stabilises

Personal Care Application	**Usage in %**	**Function**
Toothpaste	0.7 - 1.0	provides easy pumpability and gives good stand on the brush
Creams and Lotions	0.2 - 0.5	stabilises emulsions; gives creamy consistency
Shampoos	0.2 - 0.5	controls rheology; suspends insolubles

Industrial Applications	**Usage in %**	**Function**
Agricultural Chemicals	0.1 - 0.3	suspends active ingredients; controls drift and cling
Cleaners	0.2 - 0.7	provides good pH-stability; extends contact time
Polishes	0.2 - 0.7	suspends abrasive components
Water Based Paints	0.1 - 0.3	controls rheology; stabilises pigments
Textile and Carpet Printing	0.2 - 0.5	improves processing; controls colour migration
Adhesives	0.1 - 0.3	controls rheology and penetration
Paper Industry	0.1 - 0.2	acts as suspension aid and rheology control
Ceramic Glazes	0.3 - 0.5	suspends solids effectively
Oil Drilling	0.1 - 0.4	provides good stability against salt, temperature and shear
Enhanced Oil Recovery	0.05 - 0.2	functions as mobility control agent

Animal Feed	**Usage in %**	**Function**
Liquid Milk Replacers	0.05 - 0.2	stabilises water insoluble ingredients
Pet Food	0.1 - 0.4	prevents syneresis; contributes body to gravy

Pharmaceuticals	**Usage in %**	**Function**
Suspensions and Emulsions	0.1 - 0.5	provides excellent stability and good flow
Tablets	1.0 - 3.0	retards drug release
Lozenges	0.3 - 1.0	prolongs contact time of active ingredients

Additional Information

Grades
Jungbunzlauer offers a number of different xanthan gum types, mostly for food, pharmaceutical and personal care applications but also for industrial use:

- Xanthan gum in various particle sizes
- Xanthan gum in different viscosity ranges
- Dust free xanthan gum
- Salt tolerant xanthan gum
- Xanthan gum with reduced pseudoplasticity
- Easily dispersible xanthan gum
- Clear solution xanthan gum
- Xanthan gum with delayed hydration for industrial applications

Please do not hesitate to ask for additional information and samples of our broad product range.

Quality
Jungbunzlauer xanthan gum food grade fully meets the purity and identification criteria of US, EC and WHO regulations and is acceptable for use in Kosher or HALAL foods.

The Xanthan gum production facility Pernhofen is ISO and responsible care certified.

Preparation of Solutions
Xanthan gum is a hydrophilic biopolymer readily soluble in cold and hot water. Rapid dissolution requires even dispersion of xanthan gum particles in the aqueous medium. For that reason, intense agitation of the solution is necessary when introducing xanthan gum. Insufficient dispersion will cause lumps. Preblending xanthan gum with other dry ingredients or presuspending it in oil or alcohol facilitates the preparation of xanthan gum solutions.

Storage and Stability
In its powder form xanthan gum can be easily and safely stored over several years. Xanthan gum solutions, however, although more resistant to microbial attack than most other water soluble polymers, should be protected by adequate preservatives when storage time shall exceed 24 hours. Xanthan gum is compatible with most commonly used preservatives.

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