

**Jungbunzlauer**

*From nature to ingredients®*



**Gluconates**

# Gluconates

## *Sustainable and versatile ingredients*

Jungbunzlauer Gluconates are versatile ingredients for food, personal care, pharmaceutical and technical applications. Naturally occurring in the human body, fruit, honey, kombucha and wine; they can also be produced by fermentation of renewable raw materials and are sustainable, readily biodegradable and safe products. The product group consists of the dry products sodium gluconate, glucono-delta-lactone (GdL), microencapsulated GdL (eGdL) and sub4salt®, and of the liquid products gluconic acid, NAGLUSOL® and EMF.

Product	Appearance	Types
Gluconic Acid	Colourless to light yellow liquid	50% solution
Glucono-delta-Lactone	White crystalline powder	Four different granulations F2500/F5010/F8025/G1225
Encapsulated Glucono-delta-Lactone (eGdL)	White, fat coated powder	Three different types S280H/S280T/S290T
Sodium Gluconate	White crystalline powder	Three different granulations Granular/Powder/Glucoset®
NAGLUSOL®	Colourless to light yellow liquid	60% solution of Gluconic Acid and Sodium Gluconate
Sodium Gluconate EMF 1240	Dark brown, nearly clear liquid	
sub4salt®	White crystalline powder	sub4salt® N1000, sub4salt® F3000; sub4salt® sea salt sub4salt® plus 50; sub4salt® cure 05 / 09

## Product characteristics

Glucono-delta-lactone (GdL) is a neutral cyclic ester of gluconic acid, produced by aerobic fermentation of the carbohydrate source glucose syrup derived from non-GMO corn. When added to an aqueous solution, GdL dissolves rapidly and hydrolyses progressively to gluconic acid, leading to a drop in pH-value. The taste changes from slightly sweet to mildly acidic. GdL's acidification and mild taste make it a great option for use in applications requiring a controlled decrease of pH and/or a neutral flavour profile.

For applications where a delayed release of GdL is needed, Jungbunzlauer offers a microencapsulated GdL grade (eGdL), using a vegetable oil as encapsulating agent.

Jungbunzlauer also provides gluconic acid as a colourless to light yellow 50% solution in water, for applications in which no progressive release of the acidic form is needed.

Sodium gluconate is the neutral sodium salt of gluconic acid. It is commercially available as a non-hygroscopic crystalline powder with high solubility in water and a sodium content of approximately 10.6%.

The Gluconates portfolio also includes the sub4salt® product range. sub4salt® is a mineral salt mixture based on rock salt or sea salt in combination with potassium chloride and, depending on the type, different gluconate salts. This allows either a 35% or a 50% sodium reduction, also in special curing salts for the meat industry. Sodium gluconate maintains familiar salty taste in sub4salt® by masking the metallic taste of potassium chloride.



## Sustainability

Sustainability is a keystone of Jungbunzlauer's strategy and value proposition. Jungbunzlauer ingredients are manufactured through natural fermentation from renewable raw materials. With a long history of calculating carbon footprints and implementing sustainability initiatives, Jungbunzlauer has set ambitious emissions reduction targets and committed to SBTi in 2021. This includes measuring environmental parameters such as greenhouse gas emissions and water consumption, which are also disclosed in the annual sustainability report.

For our range of Gluconates, we can obtain sustainably sourced glucose (SAI-certified) if desired. Enabling phosphate replacement, sodium reduction, natural chelating options and much more, our products provide sustainable solutions in a variety of applications as shown below.

# Jungbunzlauer Gluconates in food applications

## Bakery

The combination of GdL and a bicarbonate is a great alternative leavening system to traditional yeast fermentation. GdL belongs to the group of slow to intermediate leavening agents as the rising is based on the progressive hydrolysis of GdL to gluconic acid when water is added to the dough mix. The gluconic acid reacts with the bicarbonate for a continual release of carbon dioxide.

GdL is a sodium- and phosphate-free leavening agent, used to replace sodium acid pyrophosphate (SAPP). Simply replacing SAPP by GdL reduces the sodium content of muffins by approximately 30% and eliminates the phosphate and the soapy aftertaste caused by SAPP. GdL also makes it possible to adjust the pH in the baked product to prolong shelf-life.

Sodium content can further be reduced by the replacement of conventional salt with Jungbunzlauer's sub4salt®.

Microencapsulated GdL (eGdL) provides great benefits in baking applications, like modulating the rate of reaction during dough preparation and additional stability during storage of baking powder.



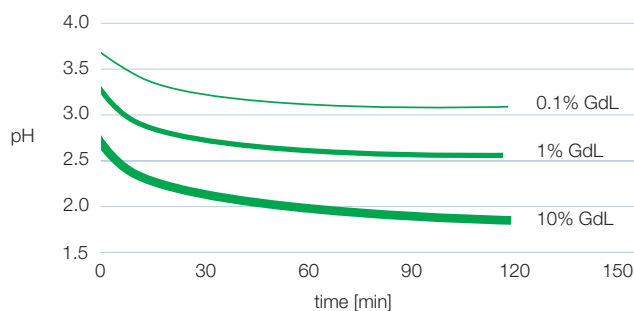
## Beverages

Thanks to their unique properties, gluconic acid, GdL and sodium gluconate are ideal choices as potent taste improvers for the beverage industry.

Compared to the intensive taste of standard acids such as citric, malic and lactic acid, gluconic acid has a slightly sweet, mild acid taste with a continual effect on the tongue. GdL, the dry form of gluconic acid, is also available. Its mild acidic taste harmonises well with ice tea, cola, citric and exotic fruit drinks.

Sodium gluconate reduces the bitterness of high-intensity sweeteners (HIS) like stevia, minerals and caffeine. It masks off-notes or aftertastes in plant-based proteins and artificial intense sweeteners like saccharin and aspartame, enabling them to be widely used in low- and mid-calorie soft, sport or energy drinks. The unique properties of sodium gluconate make it an excellent choice for healthier and better tasting beverages. Sodium gluconate is also approved as flavour ingredient with modifying properties by FEMA and can be labelled as natural flavour if the conditions for the declaration are met. Sodium gluconate has FEMA No. 4934.

Hydrolysis of GdL in water at 25°C – variation of pH with respect to time



When added to an aqueous solution, GdL dissolves rapidly and hydrolyses progressively to gluconic acid, leading to a drop in pH-value.

## Meat

Acidification is essential for the coagulation of meat proteins in production of raw sausages. Either food acids or starter cultures are used for this process. The main advantage of acidification using GdL is a fast, easily reproduced and well-controlled production process, resulting in a shorter ripening time.

From a sensory point of view, any acidic taste produced by GdL in raw sausages is easily masked by added spices. From a microbiological point of view, the combination of starter cultures and GdL leads to a safe product and suppresses existing pathogens like *Listeria* and spoilage bacteria.

Processed meat products are among the top 3 high sodium processed foods. While the natural sodium content of meat is low, salt is added during processes to help curing and prevent microbial spoilage. Curing salt is a combination of sodium chloride and sodium nitrate or sodium nitrite, which helps preserve the typical red colouring of meat products. Jungbunzlauer developed the sub4salt® cure that can be used as a 1:1 replacement, which allows for 35% sodium reduction in the end product without changing other physical or chemical properties.

Jungbunzlauer ingredients can also enhance colour development during the meat curing process.

Most cooked sausages are cured to develop the characteristic red colour. GdL promotes the reaction of nitrite with meat haemoglobin at a dosage level of as little as 0.1 to 0.2%, creating the stable red colour characteristic of cured meat products. By lowering the pH using GdL, the formation of nitrous acid is accelerated.

Sodium gluconate also acts as a stabiliser in meat products, especially in emulsion-type sausages such as frankfurters. It leads to an increase in the ionic strength and causes the muscle proteins to swell and unfold. As a result, the water-binding capacity increases, with a positive effect on firmness and sliceability.

Sodium gluconate is a good alternative to phosphates, which are increasingly controversial. Trials have shown that partial replacement of phosphates with sodium gluconate (up to 60%) improves perceived quality. No deficiency in terms of colour or taste were perceived when phosphates were partially replaced with sodium gluconate (up to 60%).



## Dairy

Many production processes in the dairy industry require a slow pH decrease during manufacturing. In contrast to microbiological acidification, GdL can be added to milk at almost any temperature and it allows excellent control and reproducibility of pH reduction.

Unlike other edible acids, GdL does not cause microflocculation of casein or organoleptic changes in dairy products.

Because it ensures a shorter total production time, constant quality of the final product, higher yields and a prolonged shelf-life, GdL F5010 has become a preferred acidifier in the manufacturing of feta-type cheeses, cottage cheese, mozzarella and the Indian paneer cheese. Other uses include standardisation of the pH of milk used for cheese production and in acidified milk drinks.

## Tofu

GdL is the preferred coagulant in silken tofu, a tofu with a smooth texture similar to yoghurt and a high water content. The coagulation process with GdL takes place in individual selling-size containers, i.e. directly in the packaging and leads, comparably to other coagulants, to a better firmness, breaking strength and to less whey separation.

For a silken tofu with a firmer texture, the combined use of GdL with Nigari, the traditional Japanese coagulant (which contains mainly magnesium chloride), calcium sulphate or calcium chloride is possible.



## Sea food

GdL helps inhibit enzymatic browning in seafood by chelating metal ions which enzymes need for their activation, replacing sulphite as antioxidant. Combining GdL with sulphites in the pre-freezing dip for frozen shrimps or in the blanching brine of canned shrimps makes it possible to substitute EDTA and reduce the sulphite level by 50-90%. GdL is used in the canning brine of canned shrimps both as a mild acidulant, and asorbate or benzoate preservative agent enhancer. It allows further reduction of salt level in the canning brine by 60-80% with no loss in shrimp firmness. The shrimps are healthier and have an improved clean shrimp flavour, closer to that of the fresh product.

Replacing up to 90% of the acetic acid content of marinated fish products like rollmops or Matjes herring with an amount of GdL that achieves the same pH as with vinegar alone improves taste while maintaining microbiological stability.

## Convenience food

The preparation of pasta and rice in a solution containing GdL not only potentially extends the shelf-life of the products by lowering the pH, it also improves appearance and minimises carbohydrate loss during cooking.

## Sauces and dressings

Gluconic acid (or GdL as dry form) is a multifunctional substance that can replace up to three ingredients of salads, dressings and sauces: the acidifier, the chelating agent and, to some extent, the preservative. It adds value and safety to these products by improving their taste, extending their shelf-life and reducing the use of preservative agents. Gluconic acid is a metal chelating agent for  $Fe^{3+}$  and  $Cu^{2+}$  ions which can prevent oxidation of fatty acids in emulsions.

## Table top salt replacer and topical applications

Jungbunzlauer's sub4salt® blends offer a sodium reduction in table top salt applications, with 35-50% sodium reduced compared to conventional table salt, while saltiness, taste and usage levels are comparable. For topical applications like for snacks or French fries, two different granulations of sub4salt® are available.



# Jungbunzlauer Gluconates in non-food applications



## Personal Care

GdL is a skin conditioning agent that can be used for skin or hair care formulations. With multiple hydroxyl groups present within its organic acid structure, it is a polyhydroxy acid and hence demonstrates milder exfoliating properties than alpha-hydroxy acids or beta-hydroxy acids, allowing its use as an exfoliant, while reducing potential side effects, like irritation or sun sensitivity.

Sodium gluconate belongs to the salts of gluconic acid. Beside its buffering properties, it is used as a chelating agent in various cosmetic products thanks to its excellent complexing ability, especially in alkaline media. Fully biodegradable and non-toxic, it is an environment friendly alternative to the common chelating agents used in cosmetics such as EDTA.

Both GdL and sodium gluconate are COSMOS ECOCERT and NATRUE approved.

## Home Care

Sodium gluconate is very good at sequestering trace metals like copper, it has the capacity to boost stain removal and prolong the shelf-life of formulations in the cleaners and detergents field. With pH values in the higher range, its building capacity is comparable to, or even greater than commonly used chelating agents, like EDTA, making it the perfect solution for an effective, biodegradable, and therefore environmental friendly alternative for home care products. Sodium gluconate is ECOCERT approved as raw material of 100% natural origin for use in detergents.

## Construction

In construction, sodium gluconate can significantly delay the start of concrete setting and the end of the clotting time, an important advantage in difficult conditions such as long hauling times, hot summer days or tropical weather. Besides its wide use as a highly efficient set retarder, it also performs as a water reducer and allows a better workability of concrete mixes.



## Legal aspects and certifications

Gluconic acid, GdL and sodium gluconate are permitted as *quantum satis* food additives in Europe and have been affirmed as GRAS (generally recognised as safe) substances in the USA. They meet the purity requirements of the European Union and of the Food Chemicals Codex (FCC), and are certified Kosher and Halal. All Gluconates are suitable for vegetarian and vegan diets. Since they contain no gluten they are suitable for gluten-free products.

Jungbunzlauer Gluconates are produced in a state-of-the-art, ISO 9001 and FSSC 22000 certified factory in Marckolsheim, France.

The mineral salt blend of sub4salt® is patented and can be added to all foodstuffs under the *quantum satis* principle. sub4salt® has to be labelled as a blend of food additives with salt. The additives correspond with purity requirements of Commission Regulation (EU) No 231/2012. It is marketable and fit for human consumption according to the conditions of use laid down in Regulation (EC) No 1333/2008.

### Certificates/approvals

- ✓ GRAS

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- ✓ Purity requirements of EU and FCC

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- ✓ Kosher

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- ✓ Halal

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- ✓ Gluten-free

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- ✓ Vegan

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- ✓ COSMOS ECOCERT

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- ✓ NATRUE

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### Overview of major food applications of Gluconates

	Beverage	Dairy	Tofu	Bakery	Meat	Sea food	Sauces and dressings	Convenience food	Table Top
<b>Sodium Gluconate</b>	Bitterness inhibitor, off-taste masking	Off-taste masking, particularly for dairy alternatives			Phosphate replacement, stabiliser				
<b>Glucono-delta-Lactone</b>	Taste/acid profile	Acidifier, coagulant, replacement of starter cultures	Coagulant	Leavening agent	Curing agent, replacement of starter cultures	Replacement of sulphates, acidifier, preservation	Acidifier, chelating agent, preservation	Preservation, lowering pH	
<b>Gluconic Acid</b>	Taste/acid profile					Acidifier, preservation, mild taste		Lowering pH, preservation, mild taste	
<b>sub4salt®</b>		Sodium reduction	Sodium reduction	Sodium reduction	Sodium reduction, curing agent	Sodium reduction	Sodium reduction	Sodium reduction	Sodium reduction

### Overview of major non-food applications of Gluconates

	Personal Care	Cleaners & Detergents	Industrial applications	Agriculture	Feed and pet food	Healthcare
<b>Sodium Gluconate</b>	Chelating agent, pH buffer	Chelating agent	Set retarder, plasticiser, water reducer, metal surface cleaning	Chelating agent in fertilisers	pH buffer	Excipient
<b>Glucono-delta-Lactone</b>	Moisturiser, exfoliant, chelating agent, preservative booster					Excipient
<b>Gluconic Acid</b>	Preservative booster	Chelating agent	Set retarder, metal surface cleaning	Chelating agent in fertilisers	Acidifier	Starting material
<b>NAGLUSOL®</b>		Chelating agent, scale remover	Set retarder, water reducer			

# Jungbunzlauer Group

Jungbunzlauer is represented in all major markets. Our global network of sales companies and distributors covers more than 130 countries.

## North America

## Europe (incl. Africa and Middle East)



- SALES OFFICE
- PRODUCTION SITE

- PRODUCTION SITE / SALES OFFICE
- APPLICATION TECHNOLOGY CENTER

Jungbunzlauer is a world leading producers of biodegradable ingredients of natural origin. The Swiss-based, international company's roots date back to 1867. Today, Jungbunzlauer specialises in citric acid, biogums, gluconates, lactics, specialties, special salts and sweeteners for the food, beverage, pharmaceutical and cosmetic industry as well as for various other industrial applications.

Jungbunzlauer's products are manufactured using natural fermentation processes, based on renewable raw materials.

All our products can be used, transported and disposed of in a secure and ecologically safe way. The Group operates manufacturing plants in Austria, Canada, France and Germany.

A worldwide network of sales companies and distributors with a thorough understanding of target markets and client requirements underlies Jungbunzlauer's strong market and customer focus. Committed to its rigorous quality standards, Jungbunzlauer guarantees for the excellence and sustainability of its products and services.

## Headquarters Jungbunzlauer Suisse AG

4002 Basel · Switzerland · Phone +41 61 295 51 00 · [headquarters@jungbunzlauer.com](mailto:headquarters@jungbunzlauer.com) · [www.jungbunzlauer.com](http://www.jungbunzlauer.com)

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