

innovations

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**Jungbunzlauer presents: Calcium Lactate Gluconate
– the innovative solution for extra calcium**

Calcium Lactate Gluconate – the innovative solution for extra calcium

Along with current developments of the overall functional food market, the use of minerals and especially calcium salts is expected to exhibit strong growth rates. The increase in demand for mineral supplements and food fortified with minerals is forecasted at around 4% per annum, reaching a turnover of more than USD 450 Mio in Europe, the US and Japan by 2005. Future trends include growing consumer concern regarding osteoporosis and bone health, leading to increased sales of calcium salts¹.

Jungbunzlauer ranks among the world's leading producers of citric acid and gluconic acid and has also become an important supplier of organic calcium derivatives. Besides its calcium products tricalcium citrate and calcium gluconate, Jungbunzlauer has recently introduced calcium lactate gluconate with unique characteristics for food and beverage fortification.

Calcium Lactate Gluconate characteristics

Calcium Lactate Gluconate, also known as calcium lactogluconate (CLG) is a relatively new product for calcium fortification in food and beverages. It is a mixture of the commonly used calcium sources calcium lactate and calcium gluconate and so far it has served mainly as a pharmaceutical calcium source such as in the well-known effervescent tablets Calcium-Sandoz® (a registered trademark of the Novartis AG). The outstanding characteristics of CLG, combining high solubility and neutral taste lead to new applications in a wide range of premium products.

Solubility. CLG has the highest solubility of all commonly used calcium salts, which is the main functional advantage of this product (Table 1). Its solubility is synergetically enhanced to approx. 400g/L water and well beyond that of the relatively well soluble single components calcium lactate (66g/L) and calcium gluconate (35g/L). The reason for this phenomenon of extremely high solubility is

believed to be the ability of mixtures of lactate and gluconate ions to form metastable complexes with calcium ions in solution, which provides additional stability benefits in food and beverage applications.

Taste. CLG provides a neutral taste, even at high concentrations.

This is especially important for food applications, where high calcium levels must be obtained without negative influence on taste properties of the fortified product. Calcium lactate for example tends to impart a bitter taste at high concentrations comparable to the negative characteristics found for calcium chloride². As bitterness can be attributed to free calcium ions concentration, the high complexing power from the combination of lactate and gluconate ions does not only increase the solubility, but also helps to shield the reactive

free calcium ions. Technical University Munich-Weihenstephan has performed detailed studies on taste properties of Jungbunzlauer CLG³. Triangle taste panels with trained students and scientists have detected and evaluated differences between fortified and non-fortified samples at different CLG concentrations (Table 2). Total calcium levels, where CLG addition could be significantly detected ranged between 120 and 200 mg/100 mL for mineral water and whole milk (3.5% fat), respectively. Interestingly, CLG fortification could not be detected in apple juice with up to 150 mg/ 100 mL added calcium. Accordingly, without any further modification to the apple juice no unusual/negative taste characteristics could be found at relevant calcium RDA levels between 15 to 18.7% per 100 mL. Therefore it makes sense that for example in near-to-water drinks, a slight fruity taste can help to prevent the detection of added CLG as found in plain mineral water in the Weihenstephan



Table 1. Properties of Jungbunzlauer Calcium Lactate Gluconate compared to commonly used soluble organic calcium salts (in water at room temperature).

Product	Calcium content	Solubility [g/L water]	Solubility [g Ca/L water]	% of RDA in 100 mL*
Calcium lactate gluconate	13 %	400	52	650 %
Calcium lactate pentahydrate	13 %	66	9	107 %
Calcium gluconate	9 %	35	3	41 %

* RDA (Recommended Daily Allowances) of calcium equals 800 mg per day in the EU.

studies.

Calcium content. Due to the fact, that CLG is a mixture of calcium gluconate and calcium lactate, the calcium content is dependent on the ratio of these two substances and on the final water content of the mixture. Jungbunzlauer CLG contains approx. 13% calcium, which is very high compared to other forms of CLG, where the calcium content can be as low as 10%. The improved formulation of 13% calcium has a considerable impact on the raw material cost, when the price of added calcium is calculated for the product to be fortified.

Maximum fortification level. When fortifying food or beverages, the individual

Table 2. Triangle taste panel results for Jungbunzlauer Calcium Lactate Gluconate (13 % Calcium) added to milk, apple juice and mineral water

Matrix	Ca added (mg/100 mL)	Total Ca (mg/100 mL)	% RDA (100 mL)	Addition detected	Taste evaluation
Whole milk ^a	150	270	34	Yes*	⊗
	120	240	30	Yes*	⊗
	80	200	25	Yes**	⊗
	40	160	20	No	☺
Apple juice	150	150	19	No	☺
	144	144	18	No	☺
	136	136	17	No	☺
	128	128	16	No	☺
	120	120	15	No	☺
Mineral water	144	144	18	Yes*	⊗
	136	136	17	Yes*	⊗
	128	128	16	Yes*	⊗
	120	120	15	Yes*	⊗

^a Whole milk naturally contains 120 mg of calcium
*Significance P = 95 %; **Significance P = 99 %

characteristics of the different calcium salts (e.g. solubility, taste at high concentrations) limit their application as well as the maximum concentration for each product. However, high calcium contents are needed to claim “calcium” on the label. As shown in Table 1, the high solubility of CLG in water allows for concentrations, which could theoretically reach a maximum fortification level of more than 6 times of the Recommended Daily Allowances (RDA) of calcium. This excellent solubility and complexing power of CLG is an

concentrated solutions³. As shown in Table 3, concentrations of up to 50% could be reached within minutes without negative consequences on colour or odour and only slight influence on pH. In storage stability tests, solutions with concentrations of 5, 10 and 30 % of CLG remained stable at room temperature for at least one week (data not shown). These characteristics significantly reduce the time needed for adding calcium during processing. High dissolubility and stability can also be deciding factors as to

Applications. CLG is primarily used in applications where solubility and clarity is important, such as

- fortified clear beverages
- concentrated preparations and pre-blends
- instant preparations.

Due to better stability of beverages fortified via CLG, clear beverages can be fortified without the addition of chelating agents⁴. Higher calcium concentrations can be reached, even in critical applications such as grape and cranberry juice, tea beverages and also concentrated pre-blends.

Conclusions

The challenge for food manufacturers is to provide a product having high calcium content but without sacrificing quality for the added health value. Commonly used calcium salts might have negative effects on taste and stability of the final product. Jungbunzlauer Calcium Lactate Gluconate has been formulated to solve these problems because it displays high solubility and stability, combined with a neutral taste profile. The introduction of mixed calcium salts displaying optimised characteristics can help to overcome existing problems in applications and is an important prerequisite to explore innovative concepts for food fortification.

References

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Table 3. Dissolution characteristics of Jungbunzlauer Calcium Lactate Gluconate (CLG) with 13 % calcium

g CLG/ 100 mL	Calcium Content (g/100 mL)	Dissolution Speed (min)	Colour	Odour	pH value
5	0.7	3	clear	neutral	6.8
10	1.3	3	clear	neutral	6.7
30	3.9	4	clear	neutral	6.4
40	5.2	8	clear	neutral	6.4
50	6.5	10	clear	neutral	6.3

additional safety aspect to avoid negative consequences, such as sedimentation (e.g. forming of insoluble complexes with other ingredients) or bitter taste in the final product. Thus, higher calcium fortification levels of food and beverages are now possible. With CLG, required fortification levels can generally be achieved without the need of modifications to the salt such as micronisation to increase dispersability or the addition of sequestering agents.

Dissolubility. High dissolubility of a calcium salt can have various benefits for its use in food processing. At Technical University Munich-Weihenstephan CLG was tested for important processing parameters such as dissolution characteristics of highly

when CLG is used in concentrations or instant preparations.

Bioavailability. Any nutrient's effectiveness depends on its bioavailability, which means how well the human body absorbs and utilises it. On average, only about 10 to 30 % of calcium is absorbed from a mixed diet by healthy adults⁵. Several different factors influence this level, one being the type of salt providing the calcium. Various scientific studies have shown that organic calcium salts outperform inorganic calcium sources such as calcium carbonate and calcium phosphate with regard to their relative bioavailability. CLG belongs to the group of highly-bioavailable organic sources, proven by extensive human and animal studies⁶.

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