Functional magnesium carbonate – a classic with potential

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The well-established and innovative Magnesium Carbonates of Dr. Paul Lohmann® are a good example of the versatility of this raw material. It can be used in many different application areas and, as a Magnesium source, is of particular interest to the food and food supplement industry. The individual adaption to the needs of many different customers in all areas of food and food supplement production is the greatest strength of the raw material.

All-rounder in the food sector with technological and nutritional benefits

Magnesium Carbonate has remarkable properties and is therefore particularly valued as a raw material in the food and food supplement industry. The applications are as varied as the product itself.

Magnesium Carbonate as acidity regulator

In the beverage industry Magnesium Carbonate is used as an acidity regulator. This use has sensory and also nutritional advantages:

– optimized flavor
  - positive influence on the sour/sweet taste
– healthy
  - no additional entry of sodium by sodium citrate
  - increased magnesium content in the beverage

Application Area	Usage in	Function
Food	Baked goods Beverages Milk and dairy products Infant formula and follow-on formula	Magnesium fortification Anti-caking agent Acidity regulator
Food supplements	Effervescent tablets Chewing tablets Powder	Magnesium source Anti-caking agent
Pharmaceutical preparations	Tablets Capsules Sachets	Functional active ingredient (API) Highly efficient auxiliary and carrier material Antacids Laxatives Phosphate Binders

The acidic taste of a beverage is not only influenced by the pH-value, but also by the amount of organic acid in the beverage. Magnesium Carbonate has, in contrast to the Sodium Citrate that is usually used, a significantly higher buffer capacity. This enables beverage manufacturers to use larger amounts of acid (e.g. citric acid) in their products and thus enhance the acidic taste of the beverage. The pH-value of the beverage is not reduced to an unacceptably low value. This leads to another advantage: in order to achieve a certain pH-value with a precisely defined amount of acid, significantly less Magnesium Carbonate has to be used in relation to Sodium Citrate (Fig. 1).

Buffer Capacity of Sodium Citrate and Magnesium Carbonate

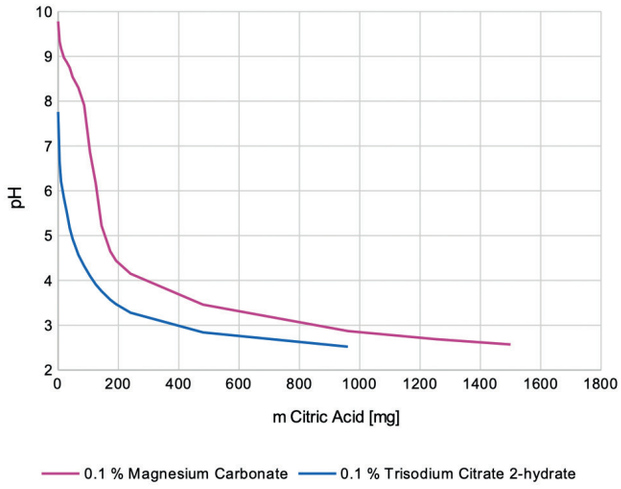

Fig. 1: Comparison of the buffer capacity of the acidity regulators Sodium Citrate and Magnesium Carbonate. Titration curves of the two acidity regulators at different concentrations in 100 ml sugar solution (11%) with citric acid. Photo©: Dr. Paul Lohmann®

Magnesium Carbonate as anti-caking agent

Due to hygroscopic properties of some foods or ingredients, the addition of anti-caking agents or free-flowing agents can control, reduce or prevent lumping. For this purpose, additives (anti-caking agents) are used, which are highly efficient, especially in very low concentrations.

Some additives, especially nanoscale particles, are a very controversial and emotional topic of discussion. Silicon Dioxide (SiO_2, declared as E 551 or often as silica) has been used for years as a harmless additive. However, due to its structure it should be replaced in many food applications.

An alternative is Magnesium Carbonate, which is harmless to health and can be used without hesitation in products such as instant coffee, sliced or grated cheese, spices, packet soups, table salt or food supplements and baby food products.

Potassium Chloride is a product with a very strong tendency to lump. It is used as a matrix in experiments to test the suitability of flow aids. The results with Magnesium Carbonate as a flow aid are very promising. Magnesium Carbonate from Dr. Paul Lohmann® shows excellent functionality in direct comparison to Silicon Dioxide. Figure 2 shows that over a storage period of 360 days the sample with Magnesium Carbonate shows a constant flowability, whereas the flowability of the sample with silica deteriorated over the storage period. The sample flows more slowly.

Due to the defined particle structure, light qualities are suitable for dosages as low as 0.1 %. The bulk density is approx. 120 grams per liter, is loose and can be distributed excellently. Heavy Magnesium Carbonate with a bulk density of approx. 500 g/l is suitable at a concentration of 0.5 % and scores points for its reduced dust formation.

Flowability of Potassium Chloride with Silicon Dioxide or Magnesium Carbonate as free-flowing agent

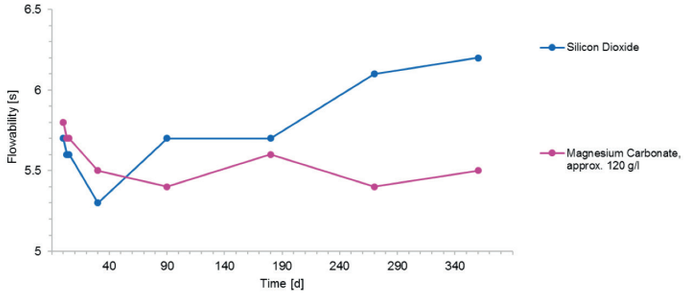

Fig. 2: Comparison of the flowability of Potassium Chloride with Silicon Dioxide and Magnesium Carbonate as free-flowing agent in a stainless steel funnel with Ø 10 mm. The method according to Ph.Eur. (2.9.16) was measured three times at room temperature. Photo©: Dr. Paul Lohmann®

However, an excess of flow aid can reverse the positive effect and reduce the good flowability (Fig. 3).

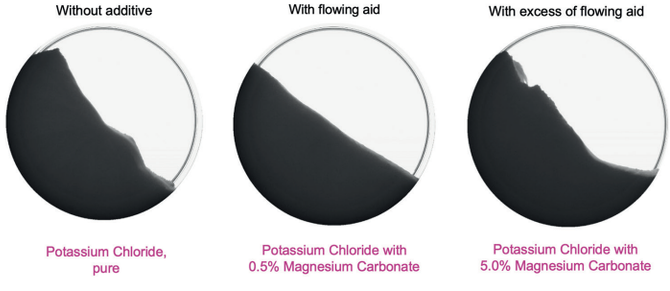

Fig. 3: Images from a powder rheometer of Potassium Chloride and Magnesium Carbonate as flow aid, Photo©: Dr. Paul Lohmann®

Infant formula and follow-on formula

The market for infant nutrition is growing and Magnesium is an essential ingredient of formulations. With a very fine particle structure, Magnesium Carbonate enhances powdered infant formula and follow-on formula in a safe and healthy way. Magnesium Carbonate is also ideal for ready-to-use infant milk as well as cereals and cookies for smaller children. Dr. Paul Lohmann® Magnesium Carbonate combines nutritional benefits with ease of processing and makes it easy to develop innovative and comprehensive solutions for infant and children's nutrition.

The high-purity of Magnesium Carbonate allows to meet the demanding quality criteria for baby food in terms of product safety and purity. For example, very low Aluminum, Lead and Cadmium contents can be met.

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Magnesium Carbonate as DC Granules

A special development of Dr. Paul Lohmann® are the “DC Granules” (Direct Compression). These are formed by adding a liquid solution (water with binder) to the powder. During the subsequent drying process, agglomerates with permanent bonds are formed. The granulation process increases the particle size and converts fine or coarse powders into physically solid and larger granules with a uniform shape, good flowability and optimized compression properties.

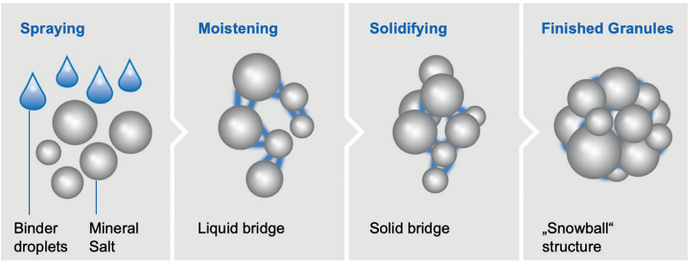

Fig. 4: Wet granulation process, Photo©: Dr. Paul Lohmann®

Due to their composition, these directly compressible Magnesium Carbonates have a slightly reduced Magnesium content due to the addition of a binder, but are characterized by significant advantages. They simplify many manufacturing steps in the production process, as a previously performed granulation process is no longer necessary. There are advantages in terms of production capability and costs[1]. The coarse, porous particles offer easy, dust-free handling and optimized flow properties. In combination with directly compressible active ingredients, these DC granules are also ideally suited as carriers.

Magnesium Carbonate is also preferably used as an ingredient in tablets such as chewable and effervescent tablets because of its high Magnesium content. In effervescent tablets, it also serves as a source of carbon dioxide to produce the effervescent effect. The tablet strength can be influenced by the variation of the binder.

Magnesium Carbonate DC – Designed for Direct Compression:
- Magnesium Carbonate DC 90S with 10 % corn starch
- Magnesium Carbonate DC 90S/C with 10 % corn starch
- Magnesium Carbonate DC 90S/F with 10 % corn starch
- Magnesium Carbonate DC 97GA with 3 % gum arabic

S – Starch
S/C – Starch/coarse
S/F – Starch/fine
GA – Gum Arabic

Reference

[1]Agrawal, R., & Naveen, Y. (2011). Pharmaceutical processing–A review on wet granulation technology. International journal of pharmaceutical frontier research, 1(1), 65-83.

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