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Solutions for the fortification of food with mineral salts

The fortification of foods and beverages with minerals and micronutrients has been practiced for a long time. The supply with a sufficient amount of minerals and vitamins via a normal diet is in certain life stages and living conditions not possible. Particularly an unbalanced diet poor in nutrients, various diseases or the need for extra nutrients such as in pregnancy can lead to symptoms of deficiency. For that reason, fortified foods and food supplements became part of the daily food to avoid deficiencies.

Fortifying food

The easiest possible way to fortify foods or beverages with minerals, like Calcium, Iron, Magnesium or Zinc, is the simply addition of the fortifying agent. Flour, for example, can be fortified with Iron by adding ferric pyrophosphate.

However, simply blending foods with minerals is not always feasible. Interactions between food ingredients and added mineral salts can also take place. This is mainly due to the complex structure of food.

Influencing factors of a mineral salt regarding its feasibility to fortify foods are e.g. solubility, reactivity, taste, metal content and the particle size. To overcome these obstacles, Dr. Paul Lohmann® offers several techniques and products with improved product properties. This includes the adaptation of chemical and physical parameters such as bulk density, solubility, particle size, purity or pH-value.

Enhanced solubility

The solubility of a mineral salt is a basic requirement for the fortification of liquid or instant powder products.

Magnesium Citrate Malate, a new development of Dr. Paul Lohmann®, is a fully reacted mineral, which is permitted for the use in food supplements in Europe since spring 2021. The combination of Magnesium with two organic acids, citric acid and malic acid, leads to a mineral salt with excellent solubility. This innovative mineral salt is clear soluble and stable in solution. Comparable products are not stable in solution over storage time or are even insoluble.

Micronization



Micronized mineral salts are suitable for use in foods as well as in food supplements. Mineral salts with a long history of use are made suitable for new applications due to the change in their morphology. Due to the extra fine particle size, micronized minerals improve the sensory properties and provide a higher relative surface, which may lead to an enhanced absorption of the active minerals. The micronization step of a mineral salt has several advantages, such as improved dispersibility or less sedimentation.

Sedimentation

The use of insoluble mineral salts can offer some advantages, e.g. a lower reactivity or a better taste profile. Micronized, insoluble mineral salts can be used in solid foods as well as in a suspension of liquid products. Water-insoluble minerals in relatively large particles easily form sediments in a suspension, whereas micronized particles remain dispersed in low viscous liquids without any sedimentation. This, for example, is important for an optimal homogeneity of a fortifying agent in fruit and vegetable juices, milk and dairy products or dips and sauces. Fruit juices or infant formula can be fortified with micronized, water-insoluble Ferric Pyrophosphate.

Sensory properties

Beginning with a particle size of about 50 µm, the human mouth senses a suspended powder as being “rough”¹. In order to avoid

an unpleasant mouthfeel, the use of additives with a small particle size is essential. For example, the fortification of cream cheese with micronized Tricalcium Citrate leads to a very creamy product without any negative side effects.

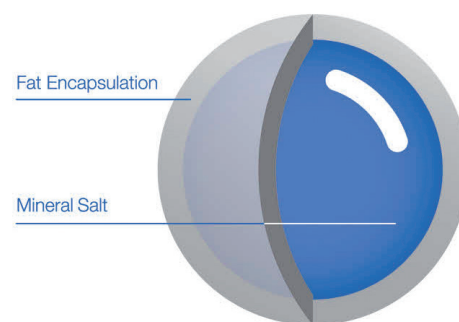
Bioavailability

The bioavailability of mineral salts is influenced by several factors like the anion, the solubility, and the particle size. Studies have shown that smaller particle sizes increase the bioavailability of Ferric Pyrophosphate².

Microencapsulation

In a micro-encapsulated mineral, every single particle of the product is coated with a thin layer of vegetable fat. Dr. Paul Lohmann® offers coatings with sunflower oil, rapeseed oil or palm oil. This coating is achieved by a uniquely developed procedure, and provides a nearly complete and secure separation of the encapsulated active ingredient and the surrounding food or beverage.

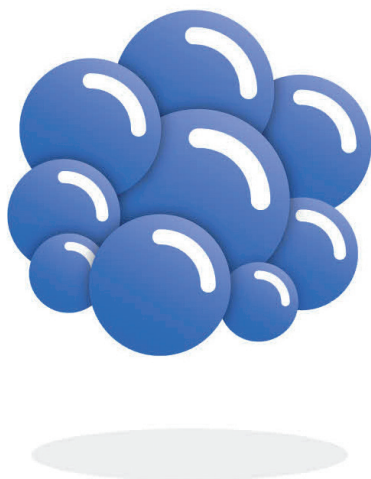
This enables manufacturers to fortify foods and food supplements with minerals, which would otherwise affect the quality of the product. Many Iron salts, for example, have a strong and unpleasantly metallic taste by nature and lead to lipid oxidation of unsaturated fatty acids. The surrounding coating layer of the micro-encapsulated mineral salts provides an excellent taste masking effect, protects against fat oxidation and discoloration. Using a micro-encapsulated Iron salt, e.g. Ferrous Sulfate, offers the opportunity to manufacture Iron-enriched products without any impairment in taste or quality.



Granulation

Granulated mineral salts enhance many manufacturing steps in the fortification of foods and food supplements. The granulation process enlarges the particle size by converting fine or coarse powders into physically strong and larger granules with uniform shape, good flow property, less dustiness as well as good compression characteristics. Granules are formed by adding a liquid solution (water with or without binding agent) to powders. Binding agents of the product line are maltodextrin, starch, PVP, citric acid and gum arabic.

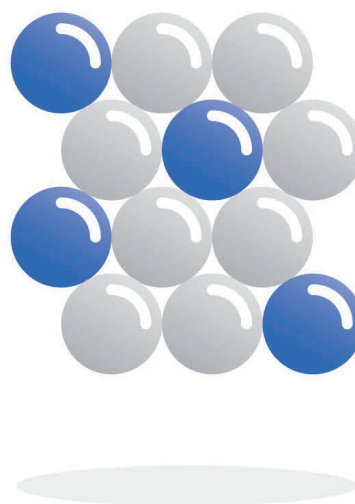
The special DC (direct compressible) Granules product line developed by Dr. Paul Lohmann® covers Calcium, Magnesium, Iron and



Zinc Salts offering lots of application benefits. From a production point of view, DC grades offer excellent tableting properties. Granulated DC grades solve challenges during the tableting process due to the physical modification. The use of directly compressible granulated minerals for the tableting process eliminates the need of an in-house granulation process, and offers vast advantages in terms of production capability and cost.

Triturations

Trace elements like Selenium, Molybdenum or Iodine are used in very low dosages for the fortification of foods and beverages, as well as in food supplements. In order to ensure safe handling, a precise dosage and a homogeneous dispersion in the final product, Dr. Paul Lohmann® offers triturations of trace elements (Selenium, Iodine, Chromium and Molybdenum) diluted in inert carrier materials such as Calcium Carbonate or Maltodextrin.



References

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- ²Wegmüller R., Zimmermann M.B., Moretti D., Arnold M., Langhans W., Hurrell R.F.: Particle size reduction and encapsulation affect the bioavailability of ferric pyrophosphate in rats. J Nutr. 2004 Dec;134(12):3301-4.

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