



Mineral Salts for Nutritional Supplements



Dr. Paul Lohmann®

High value mineral salts

www.lohmann-minerals.com

What are Nutritional Supplements?

A balanced diet is generally all healthy people need to satisfy their nutritional requirements. But sometimes, life circumstances make it impossible to take in the required quantity of nutrients through a normal diet alone. In cases like this, nutritional supplements can help to add certain required nutrients to people's diet and keep them in good health.¹

Nutritional supplements are foodstuffs used to improve people's usual diet with vitamins, minerals, amino acids, dietary fiber and phytochemicals. They contain nutritionally highly effective nutrients in a concentrated form and certain dosage.

Market trends in nutritional supplements

Growing awareness of health, the social status aspects of a healthy and active lifestyle and – last but not least – the demographic change contribute to the increasingly prominent role of nutritional supplements in industrialized nations.



Older people want to be healthy and active and are increasingly willing to take the necessary measures to achieve this in their diet as well.

The most important supplements in this case are Calcium, Magnesium and Iron. However, the demand for trace elements such as Chromium, Copper, Manganese, Selenium and Zinc is also on the rise.²

Tests have shown that the targeted intake of individual nutritional supplements reduces health risks and can therefore result in savings for the health care system.^{3,4}

Dosage forms

The nutritional supplement user group is extremely diverse. In order to satisfy the wishes of all consumers, products are available in various dosage forms, such as pills, effervescent tablets, sachets and drinking ampules. Because of the numerous dosage forms, nutritional supplement production faces an array of different challenges. For this, Dr. Paul Lohmann® offers the right product quality for the desired dosage form.



- ◆ Mineral salts for all dosage forms
- ◆ Available particle structures:
 - ◆ Micronized powder
 - ◆ Powder
 - ◆ Crystalline products
 - ◆ Granules

Dosage form	Product quality	Water solubility	Taste
Tablets	<ul style="list-style-type: none"> ◆ Powder ◆ Granules ◆ DC granules 	not applicable	not applicable
Effervescent tablets	<ul style="list-style-type: none"> ◆ Powder ◆ Granules ◆ DC granules 	good, rapid solubility	neutral or sweet/sour taste
Sachets	<ul style="list-style-type: none"> ◆ Micronized powder ◆ Fine powder ◆ Powder ◆ Crystalline products ◆ Granules 	good, rapid solubility	neutral or sweet/sour taste
Powder sticks for direct consumption	<ul style="list-style-type: none"> ◆ Micronized powder ◆ Fine powder ◆ Powder ◆ Crystalline products ◆ Granules 	not applicable	neutral or sweet/sour taste
Soft gelatin capsules	<ul style="list-style-type: none"> ◆ Micronized powder ◆ Fine powder ◆ High metal content ◆ High density 	not applicable	not applicable
Hard gelatin capsules	<ul style="list-style-type: none"> ◆ All qualities ◆ High metal content ◆ High density 	not applicable	not applicable
Liquids <ul style="list-style-type: none"> ◆ Syrup ◆ Drops ◆ Liquid sticks ◆ Drinking ampules 	<ul style="list-style-type: none"> ◆ All qualities 	good, rapid solubility	neutral or sweet/sour taste

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Calcium

Calcium is of key physiological importance. 99 % of the body's total calcium is located in bones and teeth in the form of undissolved Calcium Phosphate. Numerous neuronal and biochemical processes are based on calcium. Free Calcium plays an important part in the blood clotting system, and in normal muscle and nerve function. Moreover, Calcium regulates the secretion of hormones and neurotransmitters.⁵ A slight calcium deficiency can manifest in tingling or minor cramping in the hands, for example.

Iron

Iron is the most common essential trace element in the human body.⁵ Its primary function is to bind itself to hemoglobin and transport oxygen from the lungs into the tissue. Iron is also a component in numerous heme and non-heme enzymes, and is therefore of huge importance in our metabolism.⁶ Examples of possible symptoms of a slight iron deficiency are reduced mental and physical capacity.⁵ Divalent Iron has far greater bioavailability than trivalent iron.

Magnesium

Magnesium is involved in hundreds of enzymatic reactions in the body and is an important constituent of bones and teeth, which contain 60 –70 % of total body Magnesium. Magnesium plays a vital role in cellular and muscle metabolism. Particular examples in this case are muscle contraction and neuromuscular nerve impulse conduction.^{5,6} Moreover, magnesium helps to keep bones healthy in elderly people. A magnesium deficiency can manifest in muscle cramps and fatigue, for example.

Zinc

Zinc is involved in more than 300 different enzymatic reactions in the human body, as varied as breaking down alcohol, processes involved in the visual system, and spermatogenesis. When the body has a sufficient intake of Zinc Salts, the resulting support for the immune system can considerably shorten the duration and severity of colds and flu.⁷ Therefore, an adequate and, above all, continuous supply of Zinc is indispensable, because only limited quantities are stored in the organism.

Potassium

Potassium's most important function is to maintain intracellular osmotic pressure. It acts as an antagonist to sodium and therefore helps to regulate blood pressure. Potassium and Sodium are of major importance in nerve impulse conduction and muscle contraction. Potassium is indispensable for contracting the cardiac muscle, in particular. A shift in the trans-tubular Potassium gradient can lead to life-threatening conditions.⁶


Copper

Copper is an important trace element and essential component of numerous metalloenzymes, especially oxidases and hydroxylases. Because of this, copper is involved in the formation of connective tissue and protection against oxidation.⁶

Manganese

Manganese is an essential trace element and is especially in demand in many enzymatic processes, such as gluconeogenesis and insulin production. The metabolism of fat and blood coagulation also depend on Manganese.⁸



- 
- ◆ Extensive product range
 - ◆ Bulk and trace elements for nutritional supplements
 - ◆ Over 70 approved EFSA Health Claims

Iodine

Iodine is a vital constituent of the thyroid hormone (iodothyronine). For its part, this hormone controls numerous essential metabolic processes, as well as people's growth and cognitive development.⁸

Selenium

Selenium performs important antioxidative functions in the body. In addition, Selenium stimulates the immune system and inhibits the growth of tumors.^{9,10}

Fluoride

Hard teeth and dense, resistant bones are largely due to sufficient supplies of Fluoride in the body. Fluoride salts have therefore been incorporated in oral and dental care products for many decades.⁸

Chromium
































































































Chromium potentiates the efficiency of insulin and is therefore a vital factor in the metabolism of glucose. The body's levels of cholesterol and triglycerides is dependent on an adequate intake of Chromium.⁸

Molybdenum































































































Molybdenum is an important cofactor in a range of enzymatic breakdown processes. For instance, it is responsible for breaking down purines and various amino acids.⁸



Our Approved Product Portfolio for Nutritio

Product	Key features	Suitable dosage form*	Product modification**
Calcium			
Calcium Acetate	good solubility	  	G M
Calcium Bisglycinate	good bioavailability	 	
Calcium Carbonate	use in effervescent tablets: forms CO ₂ with acid, high calcium content, neutral taste	 	G M
Calcium Chloride	good solubility	 	
Calcium Citrate	good bioavailability, low reactivity, neutral taste	 	G M
Calcium Citrate Malate	good bioavailability, combination of two organic acids	 	G
Calcium Gluconate	good solubility, neutral taste	 	
Calcium Glycerophosphate	source of phosphate, neutral taste	 	G
Calcium Hydroxide	high calcium content	 	
Calcium Lactate	neutral taste	 	G
Calcium Malate	neutral taste	 	
Calcium Phosphate	source of phosphate, neutral taste	 	G M
Calcium Sulfate		 	G
Chromium			
Chromium(III) Chloride		 	T
Copper			
Copper(II) Bisglycinate	good bioavailability	  	
Copper(II) Carbonate		  	
Copper(II) Citrate		  	
Copper(II) Gluconate		 	E
Copper(II) Sulfate		 	M E
Iodine			
Potassium Iodate		 	T
Potassium Iodide		 	T
Iron			
Ferric Ammonium Citrate, brown	good solubility	 	
Ferric Ammonium Citrate, green	good solubility	 	
Ferrous Bisglycinate	good bioavailability, low reactivity	 	G
Ferrous Carbonate with sugar	neutral taste (mildly sweet)	  	M
Ferrous Citrate		 	G M
Ferrous Fumarate	high iron content	 	G M E
Ferrous Gluconate	good solubility	  	G M
Ferrous Lactate	good solubility	  	
Ferric Diphosphate (Ferric Pyrophosphate)	low reactivity, neutral taste (slightly acidic)	 	G M E
Ferrous Phosphate	good solubility	 	
Ferric Saccharate	good solubility, low reactivity		
Ferric Sodium EDTA	low reactivity, complexed product	  	
Ferric Sodium Diphosphate		 	
Ferrous Sulfate	good bioavailability, high iron content	  	M E
Magnesium			
Magnesium Acetate	good solubility	 	
Magnesium L-Ascorbate	source of vitamin C, neutral taste		G
Magnesium Bisglycinate	good bioavailability		
Magnesium Carbonate	use in effervescent tablets: forms CO ₂ with acid, high magnesium content, neutral taste		G
Magnesium Chloride	good solubility		G
Magnesium Citrate	good bioavailability, good solubility	  	G
Magnesium Citrate, acidic	good bioavailability	  	
Magnesium Hydrogen Citrate	good bioavailability	  	G
Magnesium Citrate Malate	high solubility, stable in solution	 	

nal Supplements¹¹

Product	Key features	Suitable dosage form*	Product modification**
Magnesium			
Trimagnesium Dicitrate, anhydrous	good bioavailability	  	G M
Trimagnesium Dicitrate 9-hydrate	good bioavailability	 	G M
Trimagnesium Dicitrate 14-hydrate	good bioavailability	 	
Magnesium Gluconate	good solubility	 	
Magnesium Glycerophosphate	good solubility, good bioavailability, source of phosphate, neutral taste	  	G M
Magnesium Hydroxide	high magnesium content, neutral taste		G
Magnesium Lactate		  	G M
Magnesium Malate			
Magnesium Oxide	high magnesium content, neutral taste	 	M E
Magnesium Potassium Citrate	source of potassium, neutral taste	 	
Magnesium Phosphate	source of phosphate, neutral taste	 	M
Magnesium Sulfate	good solubility	 	
Magnesium Taurate	source of taurine		
Manganese			
Manganese(II) Bisglycinate	good bioavailability	  	
Manganese(II) Carbonate		 	
Manganese(II) Citrate			
Manganese(II) Gluconate			
Manganese(II) Glycerophosphate	source of phosphate	  	
Manganese(II) Sulfate		 	E
Molybdenum			
Sodium Molybdate		 	T
Potassium			
Potassium Bicarbonate	use in effervescent tablets: forms CO ₂ with acid	 	
Potassium Carbonate	use in effervescent tablets: forms CO ₂ with acid	 	G
Potassium Chloride	good solubility	 	
Potassium Citrate	good bioavailability	 	M
Potassium Gluconate			
Potassium Glycerophosphate		  	
Potassium Lactate			
Potassium Magnesium Citrate	source of magnesium, neutral taste	 	
Potassium Malate			
Potassium Phosphate	source of phosphate	 	
Potassium Sulfate	good solubility	  	
Selenium			
Sodium Selenite			T
Sodium			
Sodium Bicarbonate	use in effervescent tablets: forms CO ₂ with acid	 	M
Sodium Carbonate	use in effervescent tablets: forms CO ₂ with acid	  	G M
Sodium Citrate	good solubility	 	G M
Sodium Gluconate		 	
Sodium Lactate			
Sodium Phosphate	source of phosphate	 	
Sodium Sulfate		 	
Zinc			
Zinc Acetate	high zinc content	 	
Zinc L-Ascorbate	good solubility, source of vitamin C		
Zinc L-Aspartate	good bioavailability		
Zinc Bisglycinate	good bioavailability		
Zinc Carbonate		 	
Zinc Citrate	good bioavailability, low reactivity, neutral taste	 	M E
Zinc Gluconate	good solubility, neutral taste		G
Zinc Lactate		 	
Zinc Malate	neutral taste	  	
Zinc Oxide	high zinc content, neutral taste		E
Zinc Sulfate	good solubility	 	M

** G Granules/granules, directly compressible (DC)

M Micronization

E Microencapsulation

T Trituration

You can find our complete portfolio in the product catalog.

Areas of Application for Minerals

Area of application	Minerals
Blood formation, blood coagulation, blood function	<ul style="list-style-type: none"> ◆ Calcium ◆ Iron
Blood pressure	<ul style="list-style-type: none"> ◆ Potassium
Glucose metabolism	<ul style="list-style-type: none"> ◆ Chromium
Healthy hair/ healthy skin	<ul style="list-style-type: none"> ◆ Iodine ◆ Copper ◆ Selenium ◆ Zinc
Healthy bones	<ul style="list-style-type: none"> ◆ Calcium ◆ Fluoride ◆ Magnesium ◆ Manganese ◆ Phosphate ◆ Zinc
Immune system	<ul style="list-style-type: none"> ◆ Iron ◆ Copper ◆ Selenium ◆ Zinc
Muscle function	<ul style="list-style-type: none"> ◆ Calcium ◆ Potassium ◆ Magnesium
Nervous system/ mental & cognitive health	<ul style="list-style-type: none"> ◆ Calcium ◆ Iron ◆ Iodine ◆ Magnesium ◆ Manganese ◆ Selenium ◆ Zinc
Sexuality/hormone balance for men	<ul style="list-style-type: none"> ◆ Zinc
Thyroid function	<ul style="list-style-type: none"> ◆ Iodine

- ◆ Modification of chemical and physical product characteristics
- ◆ Tailor-made, innovative solutions according to customer requirements
- ◆ Joint product and application development in collaboration with customers

Tailor-made Solutions for state-of- the-art Applications



Modification of chemical properties

- ◆ Solubility
- ◆ pH-value
- ◆ Concentration
- ◆ Assay
- ◆ Color
- ◆ Water content
- ◆ Flowability
- ◆ Purity



Microencapsulation

- ◆ Avoidance of interaction with other ingredients, e.g. fat oxidation
- ◆ Excellent flavor-masking properties
- ◆ Optimum flow characteristics and dosability
- ◆ Micro2 = micronized + microencapsulated mineral salts



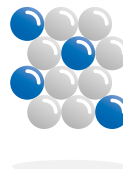
Particle size engineering

Granules

- ◆ Excellent flowability
- ◆ Reduced dust
- ◆ Minimized material agglomeration

Granules for Direct Compression (DC)

- ◆ Optimum tablet compression characteristics
- ◆ Improved dosage
- ◆ Only small amounts of binders are necessary



Triturations

- ◆ Easy dosage
- ◆ Safe handling
- ◆ Homogeneous distribution of trace elements
- ◆ Reduced toxicity
- ◆ Inert carriers



Premixes

- ◆ Simple and safe handling in the process
- ◆ Homogeneous mixture
- ◆ Defined mixing ratio



Micronization

- ◆ Improved dispersion behavior in suspensions, resulting in improved homogeneity
- ◆ Reduced sedimentation
- ◆ Improved mouthfeel
- ◆ Potential increase in bioavailability



Bulk density variation

- ◆ Optimized ratio between weight and volume
- ◆ Ultralight to heavy qualities available



Solutions

- ◆ Energy and resource efficient
- ◆ Organic solvent-free – water based
- ◆ Easier processing

Legal Aspects



Nutritional supplements are foodstuffs. They are therefore subject to the extensive legal provisions that apply to all food. Specific rules can be found in European Directive (EC) No. 2002/46.¹¹ Approved minerals are contained in a positive list in the Annex to this Directive.

When bringing nutritional supplements onto the market, it is essential to inform users not to exceed the recommended daily intake, that nutritional supplements are no substitute for a balanced diet, and that products must be kept out of reach of young children.

Purity grades

The quality requirements for vitamins and minerals and related safety aspects are defined by statutory provisions governing their purity and characteristics. In Europe, the requirements defined in Commission Regulation (EU) No. 231/2012¹², which lays down specifications for additives, apply. Furthermore, generally recognized purity criteria that are recommended by international bodies may also be applied.

This enables the use of pharmaceutical qualities, such as Ph.Eur.

To ensure the constantly high purity of nutritional supplements, the European Commission has decreed maximum levels for the concentration of contaminants such as heavy metals in Commission Regulation (EU) 2023/915¹³. Maximum levels are 3.0 mg/kg for lead, 1.0 mg/kg for cadmium and 0.10 mg/kg for mercury. Many mineral salts from Dr. Paul Lohmann® for use in nutritional supplements already satisfy the purity requirements for end products in their raw material state.

Health Claims

Nutritional supplements are sold over-the-counter and are advertised as such to consumers. However, advertising claims regarding the effects and health benefits are subject to strict restraints. The European Food Safety Authority (EFSA) is responsible for evaluating the scientific evidence of such claims. Regulation (EC) No. 1924/2006¹⁴ governs the requirements for health claims in detail.

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- ¹¹ Directive 2002/46/EC of the European Parliament and of the Council of 10 June 2002 on the approximation of the laws of the Member States relating to food supplements.
- ¹² Commission Regulation (EU) No. 231/2012 of 9 March 2012 laying down specifications for food additives listed in Annexes II and III to Regulation (EC) No. 1333/2008 of the European Parliament and of the Council.
- ¹³ Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006
- ¹⁴ Regulation (EC) No. 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods.

The information given in the document corresponds to our current knowledge. We warrant in the frame of our General Terms and Conditions of Sale that our products are manufactured in accordance with the specifications. However, we disclaim any liability with regard to the suitability of our products for a particular purpose or application or their compatibility with other substances. Tests have to be performed by the customer who also bears the risk in this respect. Nothing herein shall be construed as a recommendation to use our products in conflict with third parties' rights.



Dr. Paul Lohmann® – Your Partner for high value Mineral Salts

With over 135 years of producing Mineral Salts that meet the highest quality standards we have been established as the leading global supplier to the pharmaceutical, biopharmaceutical, nutritional supplement, food and personal care industries.

Our Expertise

- ◆ GMP and DIN EN ISO 9001 certified production sites
- ◆ FSSC 22000/ISO 22000 certified
- ◆ Processes according to HACCP
- ◆ Compliance and commitment with the FSMA (food safety modernization act)
- ◆ Tailor-made and innovative solutions according to customer requirements
- ◆ Highly qualified experts in R&D lab and application technology with long-term experience and a wide variety of possibilities to develop new products and applications
- ◆ Joint product and application development together with our customers
- ◆ Our manufactured products are exclusively Made in Germany
- ◆ A wide range of more than 400 different Mineral Salts
- ◆ Products in compliance with the most relevant pharmacopoeias (Ph.Eur., USP, BP), food codices (FCC, E-numbers, etc.) and customer specific requirements
- ◆ Regulatory documentation (CEP, ASMF, etc.)
- ◆ REACH compliance on request
- ◆ Wide range of production equipment
- ◆ Social and environmental standards (Sustainability report, EcoVadis, DIN EN ISO 50001, Sedex)
- ◆ High purities can be realized according to specific requirements

Modification

- ◆ Physical properties
- ◆ Chemical properties
- ◆ Packaging
- ◆ Labeling

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