



ORGANICALLY-BOUND TRACE ELEMENTS

IPC[®]
INTERPHARMA

BASF
We create chemistry

SOMETIMES GOOD IDEAS COME IN PARTICLES.

TRACE ELEMENTS: ESSENTIAL AND INDISPENSABLE.

Trace elements are essential micronutrients required by all animals. Insufficient amounts in the feed can have severe consequences including lower feed intake, growth reduction, impaired immune function, and reduced fertility in the animal.

MANGANESE

Is essential for cartilage formation and the reproductive system. It protects against oxidation and is required for your animals' energy supply and wellbeing.

COPPER

Is important for the connective tissue. Which means that it plays an important role in the health of your animals' skin and cardiovascular health, but also in the process of egg shell production. Furthermore copper protects against oxidation and it is needed as a co-factor for various enzymes.

ZINC

Is important for collagen synthesis and keratin formation in hoof, skin, wool, hair and feathers. Zinc has also a barrier function and protects against oxidation. It has a regulatory role in cell turnover and repair of oxidative damage. Zinc is not only responsible for the reproductive and immune system, but also for proper growth according to your animals' full genetic potential. In total, zinc is a co-factor in more than 200 enzymes.

IRON

Is responsible for oxygen binding in blood cells. It is also the main ion in many enzymes and plays a central role in antioxidative processes. Lack of iron leads to exhaustion, reduced performance and insufficient generation of hemoglobin.

In the coming decades, the number of people living on our planet will increase. A larger population means an increased appetite for meat, fish, eggs and dairy products. To effectively feed the billions, we will need to produce more from less and we will need smart solutions for balanced growth. You can call it sustainability, we call it creating chemistry. With the right ideas, every aspect of animal nutrition can be improved, and become better and less exhaustive, both financially and environmentally. Trace elements play an essential part in animal husbandry, but getting them right has always been complicated.

- With BASF glycinate, you are getting trace elements in a form that is easy to handle, highly efficient and guaranteed to fulfill animal and customer requirements.



GOOD SOLUBILITY – FOR OPTIMAL ABSORPTION.

BASF glycinate show an excellent water solubility: Water solubility was measured according the OECD method of analysis no 105 with a water temperature 20°C, creation of saturation by stirring for 24 h. The following amounts of BASF glycinate can be solubilized without sedimentation:



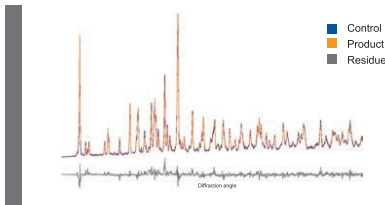
THE PERFECT BOND BETWEEN EFFICIENCY AND ANIMAL HEALTH.

- In the past, trace elements were added to the feed in the form of inorganic salts such as sulfates and oxides. Only a limited percentage was absorbed by the animal – the major part ended up in the manure. Quite a waste both financially and environmentally.
- Today, organically-bound trace elements such as glycinate are commonly used in animal feeds, since they show higher bioavailability. This results in increased animal performance and better animal vitality and productivity. BASF glycinate can be dissolved directly in water and do not need to be dissolved beforehand.
- Since they have less potential to build complexes with phytate a higher absorption rate by gut mucosa and even a higher efficiency from supplemented phytase can be expected.
- With glycinate, potentially smaller quantities are needed to supply the animals' net needs, and the environment benefits from less excreted trace elements. By using glycine, the smallest amino acid occurring in nature, it is possible to form the smallest amino acid trace element complex with the highest mineral content. Glycinate are therefore a great leap forward – but BASF leapt further.



COMPLEXATION IS THE WAY TO BETTER BIOAVAILABILITY.

DEGREE OF COMPLEXATION PROVEN BY POWDER XRD*



Thanks to the superior production process at BASF, you can rely on

- constant content of trace elements
- uniform particles
- excellent flowability
- no dust or lumps, extremely easy to handle
- perfect miscibility and water solubility
- no odor

And thanks to constant BASF analysis via powder XRD, we can guarantee

- controlled production
- highest feasible degree of complexation
- less metals in the manure
- a reliable and transparent content of trace elements up to the last particle

X-Ray Diffraction

THE WAY TO YOUR ANIMALS' VITALITY IS THROUGH THEIR GUT.

BASF glycinate are suitable for all types of premixes, mineral and mixed feeds. The flowability and mixing behavior of the product is excellent and eases homogeneous distribution in all types of feed.

The EU maximum contents are given per kg of feed based on the assumption that the animals are fed mainly with complete feed. If a supplementary feed is given in addition to the basic ration, the amount of trace elements contained has to be taken into account.

Total maximum content of the element in mg/kg of the complete feed in accordance to EU regulations EC No 479/2006 and 1095/2016: **

At 9th August 2016, EFSA has proposed modification to the maximum levels of copper in complete feed. For piglets it should not exceed 25 mg per kg. For dairy cows and cattle it should be reduced from 35 mg/kg of feed to 30 mg/kg (<https://www.efsa.europa.eu/en/press/news/160809a>).

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BROILER IN SITU TRIAL (2010)

In 2010 Yu et al. published very interesting results of Yu's study on "Effects of zinc source and phytate on absorption by in situ ligated intestinal loops of broilers". After feeding a Zn deficient semisynthetic corn starch/casein-based diet from day 21-28 of life, defined segments of the broiler's duo- denum, jejunum and ileum were isolated and perfused with the same amounts of solubilized Zn from different sources (sulfate, glycinate, methionate). Yu concluded from his research results that the most efficient Zn absorption seems to occur in the broiler's ileum. The results also indicate the highest absorption rate for Zn-glycinate in the duodenal and jejunal segment. No difference in absorption between Zn- sources was found in the ileal segment. This leads to the speculation that the involvement of amino acid carriers in the duodenum and jejunum might be responsible for the higher bioavailability of organically bound trace elements.

ABSORPTION PERCENTAGES (%) OF ZN WERE DETERMINED IN EACH SEGMENT.

	ZN-SULFATE	ZN-GLYCINATE	ZN-METHIONATE
Duodenum	26.6 ^{b,B}	42.0 ^{a,B}	38.8 ^{a,B}
Jejunum	27.6 ^{c,B}	44.2 ^{a,B}	35.6 ^{b,B}
Ileumw	62.5 ^A	68.1 ^A	68.2 ^A

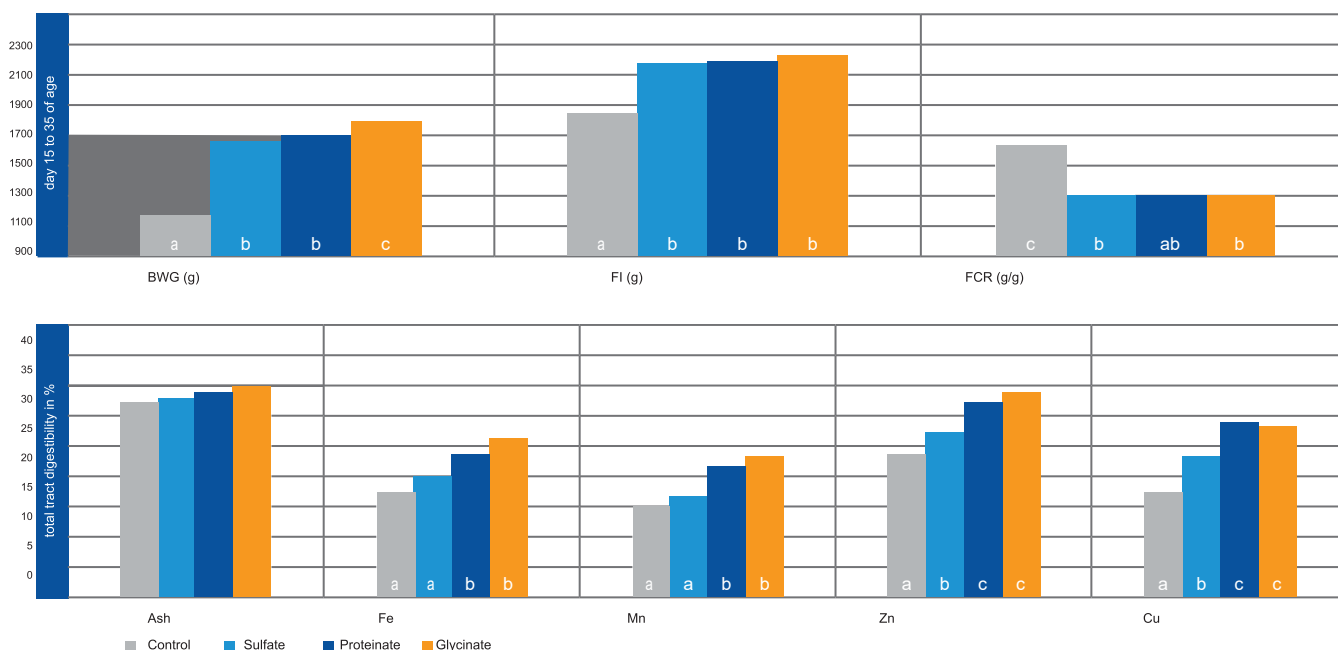
a,b,c different superscripts mean a significant difference between Zn-sources, p≤0.05

A, B different superscripts mean a significant difference between intestinal segments, p≤0.05

BROILER TRIAL (2016)

Effects of supplemented organic (BASF glycinate, chelated proteinates) and inorganic (sulfates) trace minerals on apparent total tract digestibility in growing chicken were tested.

Iron, manganese, zinc and copper (Fe, Mn, Zn, and Cu) were supplemented to a basal diet (corn, soybean meal) to meet the recommended dietary levels (Fe: 80 ppm; Mn: 60 ppm; Zn: 40 ppm; Cu: 8 ppm) for broiler chickens with a 21 d repletion period (d 15 to d 35 of age) after a preceding 14 d depletion period (d 01 to d 14 of age). Body weight gain was significantly increased when diets were supplemented in comparison to birds fed the deficient diet. BASF glycinate tended to be numerically more efficient than chelated pro- teinates (partly significant) and significantly more efficient than sulfates (p≤0.05 significant). The effects on total-tract digestibility of the tested mineral sources was significantly positive for diets containing organically bound trace minerals in the form of BASF glycinate, followed by the diets supplemented with chelated proteinates



ORGANICALLY-BOUND TRACE ELEMENTS

Glycinates

Essential for health and performance

Small quantities – big impact: Glycinates with organically bound copper, iron, manganese or zinc.

- Better absorption and bioavailability
- Essential nutrients for metabolism
- Excellent flowability and mixing behaviour
- Perfect combination of efficiency and animal performance



The science of sustainable feed that succeeds

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animal-nutrition.basf.com

Superior bioavailability and optimal supply of trace elements

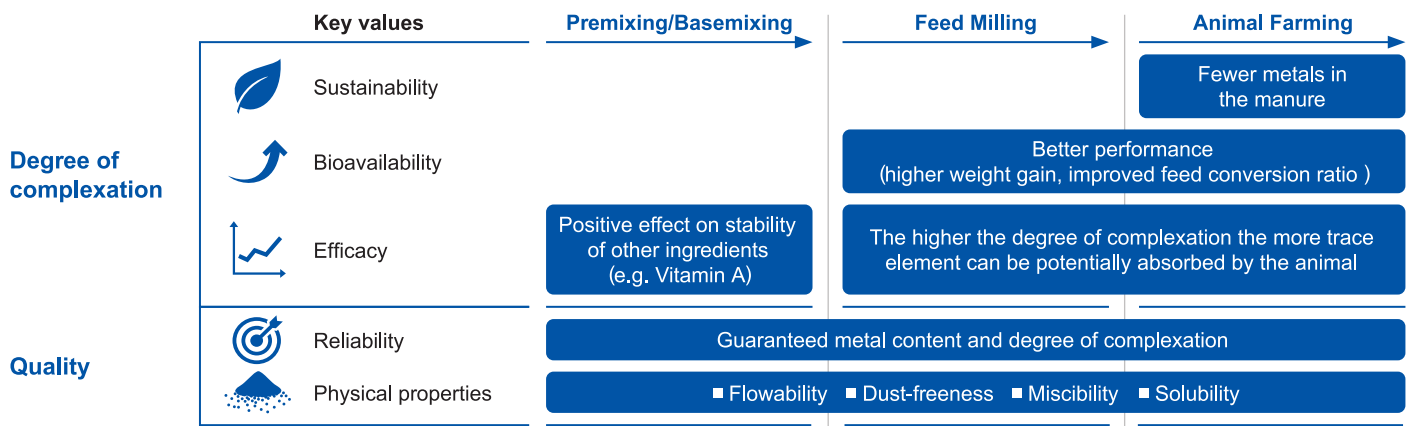
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BASF glycinates are very easy to digest with excellent solubility for optimal absorption.

Nutritional effect:

- Feeding livestock with higher amounts of energy and amino acids requires adjustment of trace element levels to ensure a balance of the nutrient supply.
- Insufficient trace elements cause deficiency diseases or malnutrition symptoms, especially for young animals, like:
 - lower feed intake and growth reduction
 - impaired immune function
 - susceptibility to diseases
 - reduced fertility

◆ Gain value with degree of complexation and quality



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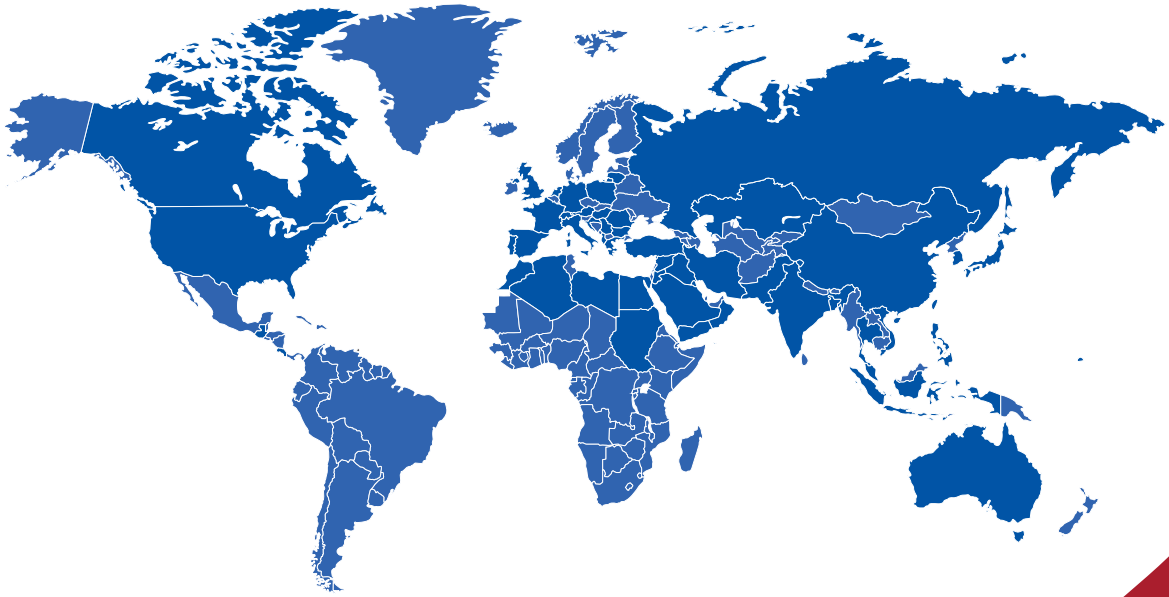
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COMMENTS

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