BASF
The Chemical Company

Organically-bound trace elements

AT BASF, WE KNOW OUR TRACE ELEMENTS TO THE DETAIL.

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 ecology, 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 glycinates, you are getting trace elements in a form that is easy to handle, highly efficient and guaranteed to fulfill animal and customer requirements.

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.

COPPER
is important for the connective tissue. Which means that it plays an important part 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.

IRON
is responsible for oxygen binding in blood cells. It is also the main ion in many enzymes and plays a central role in anti-oxidative processes. Lack of iron leads to exhaustion and reduced performance.

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

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.

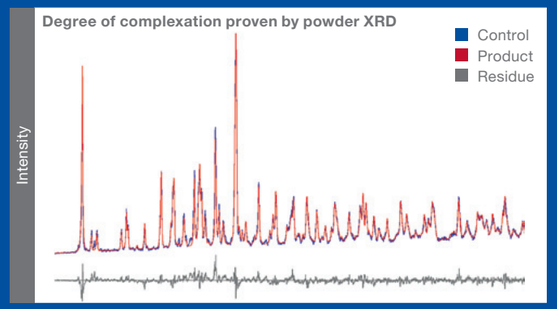
THE PERFECT BOND BETWEEN EFFICIENCY AND ANIMAL HEALTH IS ORGANIC.

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 glycinates are commonly used in animal feeds, since they show higher bioavailability. This results in increased animal performance and better animal vitality and productivity. BASF glycinates 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 glycinates, 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. Glycinates are therefore a great leap forward – but BASF leapt further.

SOMETIMES GOOD IDEAS COME IN PARTICLES.



Cu	Fe	Mn	Zn
>95 %	>90 %	>95 %	>95 %

Source: BASF

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

THERE IS MORE THAN ONE BEST GLYCINATE.

	COPPER GLYCINATE	IRON GLYCINATE	MANGANESE GLYCINATE	ZINC GLYCINATE
	blue to turquoise, free flowing, dust-free and odorless micro-particle	beige to brownish, free flowing, dust-free and odorless micro-particle	white to light rose, free flowing, dust-free and odorless micro-particle	white to beige, free flowing, dust-free and odorless micro-particle
Mineral content	min. 24 %	min. 22 %	min. 21 %	min. 26 %
Mineral complexed	>95 %	>90 %	>95 %	>95 %
Residual moisture	<8 %	<8 %	<3 %	<3 %
Density	800–1100 kg/m^3	750–1000 kg/m^3	600–1000 kg/m^3	800–1100 kg/m^3
Solubility	highly soluble in water	highly soluble in water	highly soluble in water	highly soluble in water
Shelf life	24 months	24 months	24 months	24 months
Packaging	25 kg bag	25 kg bag	25 kg bag	25 kg bag
Article number	50351985	50351987	50351989	50349107

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

BASF glycinates 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 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 regulation EC No 1334/2003 and 2112/2003:*

COPPER

Ovine:	15
Pigs:	
• piglets up to 12 weeks:	170
• other pigs:	25
Bovine:	
bovine before the start of rumination:	
• milk replacers:	15
• other compl. feedingstuffs:	15
• other bovine:	35
Fish:	25
Crustaceans:	50
Other species:	25

IRON

Ovine:	500
Pigs:	
• piglets up to 1 week before weaning (mg/day):	250
• other pigs:	750
Pets:	1,250
Other species:	750

MANGANESE

Fish:	100
Other species:	150

ZINC

Milk replacers:	200
Pets:	250
Fish:	200
Other species:	150

*Please note that the dosage must be calculated on an element equivalent basis.

THE FACTS ABOUT GLYCINATES ARE VERY EASY TO DIGEST.

PIGLETS

The superiority of glycinates versus other forms of trace elements was tested in a feeding trial. Animals were fed 53 % barley (heat treated), 37.4 % skim milk powder, 3 % corn starch.

Depletion took place on days 24–37 followed by repletion on days 37–44. The results clearly show highest apparent digestibility for glycinates.

Control: 24.6 mg Zn, 15.3 mg Mn, 45.0 mg Fe & 3.8 mg Cu per kg feed
Sulfate: 43.1 mg Zn, 26.9 mg Mn, 69.7 mg Fe & 5.9 mg Cu per kg feed
Proteinate: 42.6 mg Zn, 25.6 mg Mn, 72.9 mg Fe & 5.7 mg Cu per kg feed
Glycinate: 44.4 mg Zn, 27.5 mg Mn, 68.2 mg Fe & 6.2 mg Cu per kg feed

a, b, c values with different superscripts in the same trace element block differed significantly ($p < 0.05$). Calculated relative difference of Fe, Mn, Zn, Cu digestibility from glycinates: +22 %, +25 %, +24 %, +49 % versus sulfates +4 %, +3 %, +9 %, +23 % versus protein chelates.

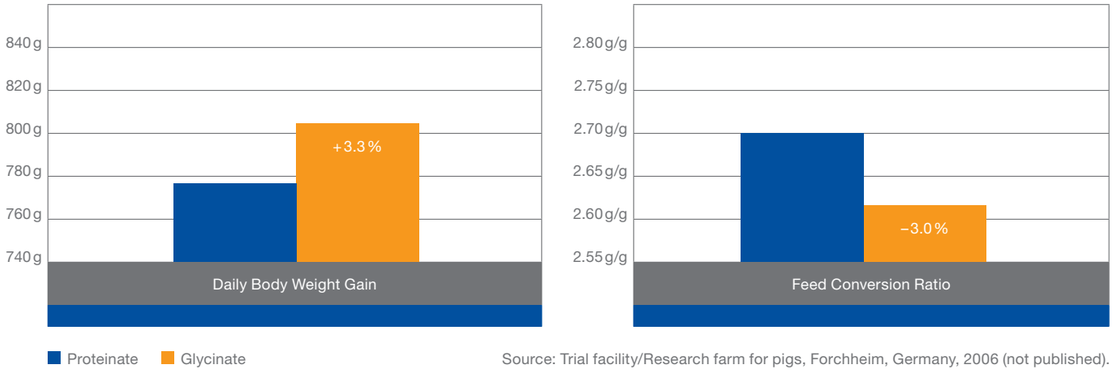
Source: Männer et al. 2008, in: "Trace elements in animal production systems", p. 182–186, Wageningen Academic Publishers, eds Schlegel, Durosoy, Jongbloed.

FATTENING PIGS

In fattening pigs, the effects of glycinates versus proteinates on animal performance were studied. The pigs received a standard diet during the fattening period (30–105 kg BW).

The results show a higher body weight gain and better feed conversion ratio when glycinates were used.

Proteinate: 160 mg Cu, 160 mg Mn & 660 mg Zn per kg mineral feed
Glycinate: 160 mg Cu, 160 mg Mn & 660 mg Zn per kg mineral feed



Source: Trial facility/Research farm for pigs, Forchheim, Germany, 2006 (not published).

PIG PRODUCTION

In gestating, lactating sows and their offsprings in the piglet and fattening pig period, inorganic trace element sources were compared with 2 sources of organically-bound trace elements. The following tables show the superiority of the glycinates compared to the other trace element sources that have been tested in the present study.

TRACE ELEMENT SUPPLEMENTATION

	GESTATING SOW		LACTATING SOW		PRESTARTER, STARTER I & II		GROWER, FINISHER	
(mg/kg FM)	inorganic	organic*	inorganic	organic*	inorganic	organic*	inorganic	organic*
Cu	11	8 (50%)	15	8 (50%)	160	16 (50%)	17	5 (100%)
Fe	53	75 (0%)	73	51 (0%)	120	32 (50%)	68	24 (0%)
Mn	60	50 (50%)	80	50 (50%)	88	20 (50%)	83	5 (100%)
Zn	83	83 (50%)	110	80 (50%)	110	40 (50%)	108	20 (100%)

PIG PERFORMANCE FROM WEANING UNTIL SLAUGHTER

PARAMETER	STANDARD	CHELATE with hydrolyzed soy protein	GLYCINATE
Overall FI (g/d)	1,787	1,857	1,880
Overall BWG (g/d)	661	709	735
Overall FCR	2.70	2.62	2.56

*Organic sources provided either through chelate or glycinate sources (two treatments); Values in brackets: part as organic.

SOW AND OFFSPRING PERFORMANCE FROM FARROWING TO WEANING

PARAMETER	STANDARD	CHELATE with hydrolyzed soy protein	GLYCINATE
Nº sows	10	10	10
BW loss during lactation (kg)	42	37	33
Insemination success (%)*	70[b]	80[a]	90[a]
Live born piglets/litter	11.0	11.3	11.5
Dead born piglets/litter	0.4	0.4	0.0
Removed piglets (%)	11.8[b]	9.7[a]	8.7[a]
Weaned piglets/litter	9.9	10.2	10.5
BW day 2 (kg)	1.47[b]	1.55[a]	1.62[a]
BW at weaning day 21 (kg)	5.94	6.49	6.69
BWG day 2 to day 21 (g/d)	235	260	267

*Insermination success following the lactation on study.

a, b values with different superscripts differed significantly, ($p < 0.05$).

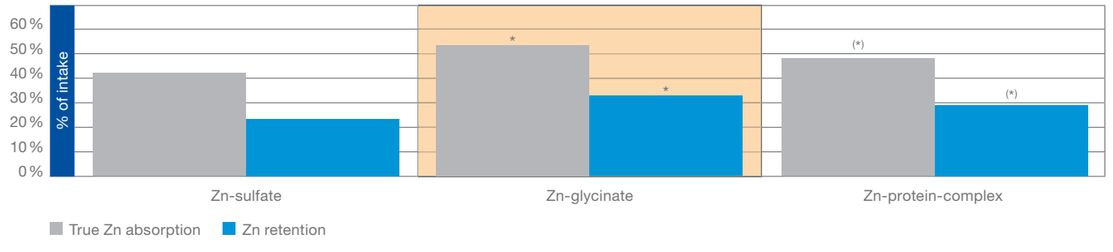
PROTEIN AND UREA CONTENTS IN SOW PLASMA AND MILK

	STANDARD	CHELATE with hydrolyzed soy protein	GLYCINATE
Plasma contents in gestating sows			
Protein (g/l)	66.3	69.6	69.8
Albumin (g/l)	29.0[b]	28.8[b]	34.9[a]
Urea (g/l)	6.2[b]	5.4[a]	5.2[a]
Plasma contents in lactating sows			
Protein (g/l)	68.8	74.6	80.8
Albumin (g/l)	29.9	28.3	30.9
Urea (g/l)	6.7[b]	6.0[a]	5.5[a]
Plasma contents sow milk			
Protein (g/l)	22.62[b]	24.32[b]	33.15[a]
Albumin (g/l)	3.25[b]	4.72[b]	6.81[a]

Source: Fuchs et al. 2008.

RATS

In rats, different bound trace elements were tested by Windisch and Ettle; the results show that organically-bound trace elements as such have a better absorption and retention rate than the inorganic. Glycinates show the highest retention and absorption.



Level of significant difference to Zn-sulfate group * $p < 0.05$; (*) $p < 0.1$. Calculated relative difference of Zn retention from Zn-glycinate group +30 % versus Zn-sulfate and +15 % versus Zn-protein-complex.

Source: Windisch & Ettle 2008, in: "Trace elements in animal production systems", p. 187–201, Wageningen Academic Publishers, eds Schlegel, Durosoy, Jongbloed.

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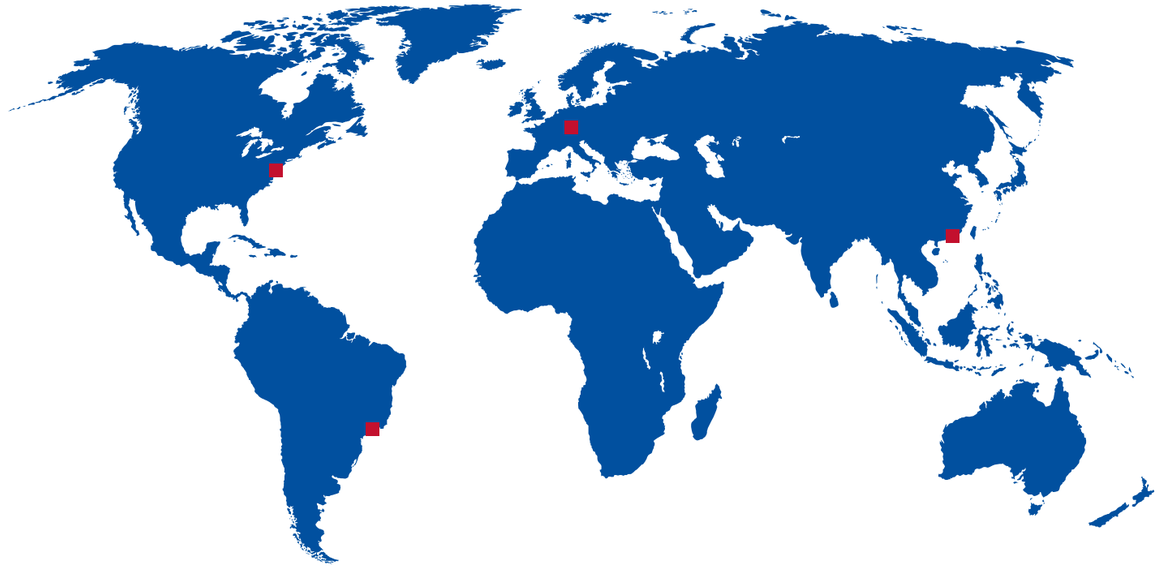

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Note: National regulations may vary and need to be considered prior to product use.

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