

Trace elements: Consider the source of these essential nutrients

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Trace elements such as copper, zinc and manganese are of great importance for optimal animal health and performance. As the name indicates, only very small amounts of these compounds are required in feed. It is therefore important that the animal can absorb these small amounts to fulfil their essential role in the animal's physiology.

Different sources of trace elements are available to supplement feed. To guarantee an optimal and safe trace mineral supply, it is vital to choose a high-quality source.

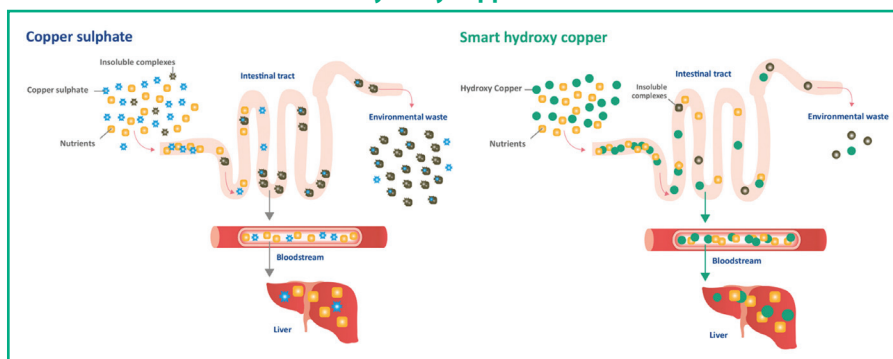
Sources of trace elements

High-quality trace elements must firstly be released at the right place and at the right time. Since the animal cannot absorb solid particles, it is necessary for trace element sources to be soluble. The solubility of oxides is rather low, and the absorption of this trace mineral source is therefore also lower.

When it comes to dissolving in a watery environment, there are two types of trace element sources, depending on the bonds.

Ionic bonds are very weak and easily broken by the attractive force of water molecules. When these ionic bonds are broken (also called dissociation), trace

Figure 1: Higher reactivity with weak ionic bonds in copper sulphate leads to the formation of insoluble complexes and lower absorption efficiency compared to low reactive covalent bonds in smart hydroxy copper.



element ions are released. An example of trace element sources with this type of ionic bonds is sulphates. Released metal ions are highly reactive and cause oxidation reactions (e.g. fat oxidation). High reactivity in feed is detrimental to the stability of other nutrients and leads to enzyme activity and vitamin level degradation.

Reactive trace elements will also interact with other compounds, leading to the formation of insoluble and thus non-absorbable complexes.

The second type are covalent bonds. These bonds are much stronger and can stay intact in water. There is also no risk of harmful reactivity or formation of insoluble

complexes. Covalent bonds are ideal to release trace elements at the right place and the right time. Most of the organic trace element sources have covalent bonds, but the newest generation of inorganic hydroxy trace minerals are also characterised by this type of bonds.

Product quality

The quality of the trace element sources is essential. This includes the purity or concentration of the mineral in the product, contamination with heavy metals and with dioxins, and the handling properties of the product.

Producers of trace element sources need to follow quality standards such as

Table 1: Total volatile fatty acid production, and percentual composition of the different acids, during an in vitro fermentation trial where a negative control fermentation substrate was supplemented with five different sources of trace elements (P<0,05 for different superscripts).

Additives	Control	Hydroxy	Sulphate	Glycinate	AA	Proteinate
TVFA, mmol/ℓ	102,0 ^a	99,8 ^a	40,5 ^b	41,7 ^b	42,3 ^b	42,1 ^b
HAc, % of TVFA	65,31 ^a	64,98 ^a	67,00 ^b	67,26 ^b	67,69 ^b	67,52 ^b
HPr, % of TVFA	20,35 ^a	20,72 ^b	18,80 ^c	18,64 ^{cd}	18,44 ^d	18,53 ^{cd}
HBu, % of TVFA	9,90 ^a	9,84 ^a	11,17 ^b	11,02 ^b	10,93 ^b	10,95 ^b
BCVFA, % of TVFA	2,87 ^a	2,85 ^a	1,86 ^b	1,90 ^b	1,80 ^b	1,81 ^b
Ac:Pr ratio	3,21 ^a	3,14 ^a	3,56 ^b	3,61 ^{bc}	3,67 ^c	3,64 ^{bc}

GMP+ or FAMI-QS. Implementing strict monitoring programmes and regular analysis of the products is the best way to ensure high-quality and safe products.

Smart hydroxy trace minerals

Orffa's smart hydroxy trace minerals are inorganic sources of trace elements with a stable molecular structure and unique covalent bonds. These smart bonds release the trace elements at the right place and the right time and prevent problems with reactivity and complex formation, leading to optimal availability for the animal.

For ruminants, trace elements with low reactivity in the rumen is required for excellent fibre fermentation and volatile fatty acid production by the rumen microbiota. In vitro trials, the low reactivity of Orffa's Excential smart hydroxy trace minerals was demonstrated. In a simulation of rumen fermentation, the influence of different sources of copper and zinc were tested.

As presented in *Table 1*, the hydroxy trace elements were the only source that did not influence total volatile fatty acid (TVFA) production during fermentation. For the sulphate and three tested organic sources (glycinate, amino acid complex,

and proteinate), a significant decrease in TVFA production was observed compared to the non-supplemented control, indicating inhibition of fermentation by trace element reactivity.

Supporting rumen fermentation

Under practical circumstances, impaired efficacy of the rumen microbiota by toxic antimicrobial effects of soluble, reactive copper and zinc will result in lower ruminal fibre fermentation, as well as lower animal performance and health.

As demonstrated in this trial, smart hydroxy trace minerals are the safest trace mineral choice for excellent rumen fermentation. The low reactivity of this trace element source was not only evident in the unaffected TVFA production, but also in the stable VFA composition. For the level of acetic (HAc), butyric (HBu) and branched chain volatile fatty acids (BCVFA), no differences could be observed between the control or hydroxy trace mineral-supplemented group.

The level of propionic acid (HPr) showed a very small increase when hydroxy trace elements were supplemented during fermentation. This can be considered beneficial,

as propionic acid is a precursor for gluconeogenesis.

A superior product for the market

Low reactivity is the first key feature of smart hydroxy trace elements. The slow release of active elements also contributes to optimal availability. As a result, hydroxy trace minerals show higher rumen fermentation, dry matter digestibility, milk production, health (especially in terms of claws) and fertility in cows.

Purity and safety are the second key quality feature distinguishing smart hydroxy trace minerals from other common organic and inorganic trace mineral sources. The purity or concentration of minerals in the range of smart hydroxy products is above 50% for copper, zinc and manganese (each batch is analysed). The level of heavy metal and dioxin contamination remains far below legal limits, and a low dust level also assures the high-quality handling properties of the product.

When supplementing feed with trace elements, it is vital to choose a high-quality trace mineral source to guarantee the best supply of these essential nutrients for the animal. Smart hydroxy trace minerals provide these nutrients to animals in a safe and optimal way.



EXCENTIAL SMART TRACE MINERALS

High bio-available hydroxy trace minerals for optimal health and performance



SMART TRACE MINERALS

"The smart bonds in hydroxy trace elements provide a release of Cu, Zn and Mn, at the right place, at the right time."

- No in-feed interactions
- Safe for rumen microbiota

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