



# The benefits of hydroxy trace minerals and L-selenomethionine in ruminant nutrition

## The role of trace minerals

Trace minerals are required in very small amounts, but perform several essential catalytic, physiological, structural, and regulatory functions in the body. Copper, zinc, manganese, and selenium are involved in gene transcription, the structural integrity of DNA and proteins, the functioning of the immune system, reproduction, the catalytic activity of enzymes, and has antioxidant properties. A specific range exists for the optimal dietary level of trace minerals. Dietary levels below this optimal range will lead to compromised health and performance of animals. In most cases, trace mineral deficiencies are subclinical, making them difficult to observe.

Common feed ingredients and pasture are natural sources of these trace minerals that could contribute to the dietary requirements of animals. However, the levels of trace minerals can vary between raw material sources, and their bioavailability may be negatively influenced by some plant constituents. Therefore, to avoid deficiencies, livestock feeds are mostly supplemented with trace minerals. Various sources of trace mineral supplements exist, differing in chemical composition and bioavailability to the animal.

## Hydroxy copper, zinc, and manganese for optimal bioavailability

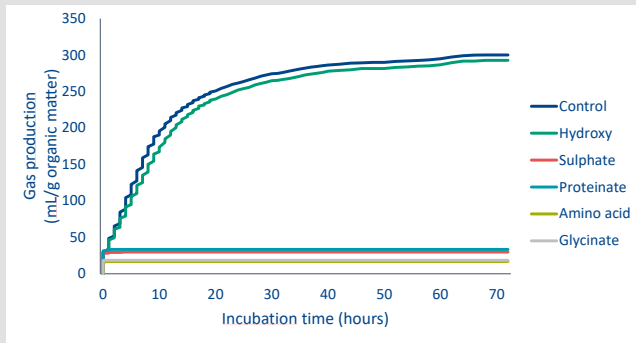
Hydroxy trace minerals, such as Orffa's Excential Smart range of copper, zinc, and manganese, are known for their low reactivity in the feed and upper intestinal tract (rumen). This is due to the strong covalent bonds between the metal ions and hydroxyl ligands. At a neutral pH,

the hydroxy trace minerals are insoluble and no reactivity in the feed with other nutrients or minerals occurs. As the pH decreases, the hydroxy trace minerals are gradually released, giving them an advantage in relative bioavailability compared to traditional inorganic sources (e.g. oxides, sulphates). Sulphate salts, for example, are easily dissolved in a watery environment, releasing free metal ions such as copper that can interact with microbes in the rumen or form complexes with other nutrients. Organic trace minerals consist of a metal bound to a carbon- or nitrogen containing ligand (e.g. proteinate, amino acids). While organic sources are more bioavailable than sulphates and oxides, they have a high relative cost and, due to the size of their ligand, they contain a lower concentration of the mineral element than inorganic sources.

## The effect of different copper and zinc sources on rumen health

In an *in vitro* simulation of rumen fermentation, the effect of different copper and zinc sources on rumen health was compared. Fiber fermentation by the rumen microbes was measured by means of gas production and total volatile fatty acid production. Under physiological optimal rumen pH conditions, the Excential Smart hydroxy trace minerals maintained normal gas production (Figure 1). In contrast, the inorganic sulphate and organic trace mineral sources (glycinate, amino acid-complex, and proteinate) strongly depressed gas production and total volatile fatty acid production compared to the control with no supplemented copper and zinc.

**Figure 1: Gas production in a control buffer simulating optimal rumen conditions with a pH of 6.6.**



**L-selenomethionine to enhance selenium status in animals**

Both inorganic and organic sources of selenium can be used to supplement animal feeds, however, they are metabolised differently (Figure 2). Inorganic sources of selenium, such as sodium selenite, will partly be used to produce selenoproteins while the rest is excreted via the breath or urine. The absorption of inorganic selenium is rather low, especially in ruminants, with a value of between 10 and 16%. This is due to the action of rumen microorganisms which converts inorganic selenium to non-absorbable elemental selenium, thereby reducing its intestinal availability. Organic selenium, in the form of L-selenomethionine, can also be used for the synthesis of seleno-

proteins, but has the added advantage of being utilised in the body as an amino acid (in same way as methionine) and is built into animal proteins such as meat and milk. Organic selenium therefore ensures a safe deposit of selenium inside the animal, which can be mobilised for use during times of stress or low selenium intake. L-selenomethionine is therefore considered the most effective form of selenium.

**In conclusion**

The choice of a trace mineral source is crucial for supporting animal productivity and health. Excential Smart hydroxy trace minerals have the advantage of by-passing the rumen, thereby preventing the unfavoured toxic effects of free copper or zinc on rumen microorganisms and on fermentation. An optimal rumen environment, is essential for the fermentation of the fibre-rich diet and for optimal feed conversion and milk production. Orffa also offers Excential Selenium 4000, a dust-free and organic source of selenium in the form of L-selenomethionine. This form of selenium can increase selenium reserves in the body, which ensures a good selenium and anti-oxidant status at all times and secures efficient transfer of selenium to offspring via placenta and milk.

**Figure 2: The metabolism of different dietary selenium sources.**

