Chelated Minerals

Are they worth the extra cost?

Dairy diets are commonly supplemented with both macro and trace minerals that are considered essential to animal health and productivity. Macro minerals include those required in relatively large quantities such as sodium, calcium, potassium and magnesium. Trace minerals are required in much smaller amounts and are generally found in very low concentrations in tissues. Those recognized as essential for dairy cows include cobalt (Co), copper (Cu), iron (Fe), iodine (I), selenium (Se), manganese (Mn), and zinc (Zn), and it is likely in future recommendations will be set for chromium (Cr).

Trace minerals naturally occurring in feeds exist primarily in organic forms, whereas trace minerals supplemented to livestock diets have traditionally been provided as inorganic salts. The utilization of either organic or inorganic trace minerals is dependent on the ability of the animal to convert them to biologically active organic forms. In the tissues trace minerals function almost entirely as organic complexes or chelates rather than as free inorganic ions. Most trace minerals act as catalysts in enzyme systems which perform a wide range of functions.

Development and interest in the use of complexed or chelated trace minerals for ruminant diets is based on the assumption that the complexes or chelates are more readily available to the animal compared with inorganic minerals because they are in a form similar to that which occurs naturally in the body.

There are a number of organic trace mineral supplements commercially available, varying in the type of organic molecules or ligands with which the mineral is combined. The most common ligands used are specific amino acids, or amino acids and peptides from hydrolysed protein. Complexed and chelated minerals are classified as shown in the table on the right. The Canadian Feeds Act requires that guarantees must be provided for each of these products specifying the minimal amount of mineral and the minimal amount of bound mineral.

Very little is known about the physical and chemical properties of complexed minerals, or of their physiological mode of action in ruminants. Characteristics of an effective mineral complex or chelate includes resistance to microbial degradation in the rumen, appropriate size for absorption and pH stability. There is some speculation that the low molecular weight amino acid chelates are absorbed as an intact molecule, although this has yet to be substantiated. The complex must also be pH stable in order to maintain its structure throughout the pH range of the gastrointestinal tract (pH 2 to 8).

The use of amino acid or protein complexed minerals in ruminant diets is controversial and much of the work to date has been performed in lambs and beef cattle, with very few studies performed in dairy cows. Of the scientific studies that have investigated the bioavailability of complexed minerals, there are those that support the hypothesis that the organic complexes are superior with reported improvements to growth, immune status, and reproduction. On the other hand, there are also those that have reported no advantages to their use over inorganic mineral sources. There is some evidence, however, that the organic forms are metabolised differently in certain tissues and that mineral repletion in deficient animals is more rapid with the complexed forms.

However, due to the variability observed in bioavailability estimates and performance for the complexed forms and their increased expense, there appears at present to be no clear advantage to their general use over the inorganic forms of the minerals. Further research is required to determine the mode of action of the organic trace element complexes, and the optimal amounts necessary to improve health and performance in dairy cows.

source: Karen Koenig, Agriculture & Agri-Food Canada, Lethbridge Research Centre

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