Metal Chelates TAP Supplement
CFNP
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PROTEINATED AND CHELATED MINERAL COMPLEXES:

Sources of Metal Polysaccharides and Metal Proteinates:

Organic mineral sources are characterized by the presence of an amino acid or a carbohydrate carrier for the trace mineral that is fed to animals. Chelation or proteination is the process of binding the trace mineral to the carrier and may function to increase the bioavailability of the mineral, in comparison to inorganic mineral sources. An increase in bioavailability may result in being able to feed less mineral to the animal (Larson, Olsen, & Hale, 2002).

The American Association of Feed Control Officials (AAFCO) has defined the various types of metal chelates/complexes. Metal proteinates (§57.23) is defined as the product resulting from the chelation of a soluble (trace mineral) salt with amino acids and/or partially hydrolyzed protein. It must be declared in the ingredient declaration of a formulated feed as the specific metal proteinate. The source of the protein does not have to be declared, since the amount and the quality of the protein are nutritionally unimportant.

The soluble trace mineral salt use to make a metal proteinate is a synthetic substance. Synthetic trace mineral salts are specifically allowed for use in organic livestock production as feed additives for enrichment or fortification, provided that they are approved for such use by the FDA [7 CFR 205.603(d)(1)].

Metal proteinates contain 10% to 20% of the metal; the remainder is protein. The amount of this residual protein is nutritionally inconsequential, as the average protein intake is many times that provided by the metal proteinate. The nature and method of production of the protein component of metal proteinates is confidential to the manufacturer and has not been disclosed. It is not possible to determine whether synthetic amino acids are incorporated into metal proteinates.

AAFCA defines Metal Polysaccharide Complexes (§57.29) as the product resulting from complexing a soluble (trace mineral) salt with a polysaccharide solution. The Canadian Food Inspection Agency defines it as the product resulting from coating a soluble mineral salt with polysaccharides.

The metal polysaccharide solution must be listed in the ingredient declaration of a formulated feed as the specific metal complex. Under AAFCA regulations, the source of the polysaccharide does not have to be declared. In contrast, Canadian regulations for metal polysaccharide complexes require that they be labeled with the name of the material from which the polysaccharides are derived.

As with metal proteinates, the soluble trace mineral salt use to make a metal polysaccharide solution is a synthetic substance. Synthetic trace mineral salts are specifically allowed for use in organic livestock production as feed additives for enrichment or fortification, provided that they are approved for such use by the FDA [7 CFR 205.603(d)(1)].

Metal polysaccharide complexes contain mostly polysaccharide. The nature and method of production of the polysaccharide component of the complex is confidential to the manufacturer and has not been disclosed.

When Used:

Chelates are used in conventional livestock production to protect trace minerals during digestion. This increases the bioavailablity of the mineral to the animal, allowing more of the mineral to be used to support the animal's metabolic functions. Chelates are typically administered to livestock during times of high stress, including pregnancy, weaning, growth and illness (Hutjens, Hale 2001, and Minerals).

Research has shown that these mineral forms may improve immunity, hoof health and reproduction over nonorganic forms. Some research has shown improved retention in the body with some of these products and less impact on the environment when fed properly. Specifically, data shows that these minerals improve resistance to mastitis, improve hoof health, decrease lameness, and improve reproduction and breeding efficiency. They have no role as a growth stimulant as they have no hormonal properties. According to an article by Dave Wieland in the August 2000 edition of BEEF, calves from cows fed with chelates were less likely to have scour problems and had overall less sickness and death (Potter, 2002). Much of the research conducted has shown varying results, and it is generally recommended that chelates be used in conjunction with good farm management techniques (Coleman 2001).

Detrimental interaction of metal proteinates or metal polysaccharide complexes with other materials used in organic farming systems:

The improved health and immune status would enhance other organic materials being used on farms. Moreover, the healthier animal would have improved resistance to disease and less need for various types of disease therapy. There are no known negative interactions of materials used in organic farming with metal proteinates or metal polysaccharide complexes.(Dan Giacomini, 2002a)

Interaction Between Minerals:

Certain minerals have been shown to interact, either positively or negatively, with absorption of other minerals. For example, copper and zinc interfere with the absorption of the other and excessive amounts of calcium can influence phosphorus and selenium absorption (Bell 1997).

Impact on soil organism or crops of using metal proteinates and metal polysaccharide complexes in livestock:

The breakdown products of amino acids and other protein sources include nitrogen, which can be excreted in the urine and feces. Excess nitrogen can cause burning of vegetation as well as toxicity to plant roots. Additionally, nitrogen from animal excreta may contaminate water sources. Minerals, such as copper and zinc can also be excreted in feces and make manure unsuitable for use as a fertilizer. This is because, once in the soil, copper and zinc are only slowly removed, so can build up to harmful levels, reducing the microbial life and the activity of nitrogen-fixers in the soil (Environment 2001). Trace elements considered by the U.S. Environmental Protection Agency to be of environmental concern include As, Cd, Cr, Cu, Hg, Mo, Ni, Pb, Se and Zn. Benefits of supplementing feed with Cr, Cu, Mn, Se and Zn are recognized but excretion of these elements may be increased. Therefore, minimum amounts of bioavailable trace elements needed to support peak animal performance should be identified. There is potential for using organic complexes with higher availability to reduce amounts of trace elements fed and thus excreted. Bioavailability of trace elements, notably Zn, could also be improved by feeding phytases or low phytase grains to reduce binding of the elements in unavailable forms. A highly bioavailable form, whether inorganic or organic, will allow for a lower inclusion rate and thus minimize mineral content in animal excreta. However, supplementing minerals in excess of animal requirements increases mineral losses through animal waste. Research is needed to further characterize the availability of minerals from commonly used protein and energy feedstuffs, allowing nutritionists to more accurately formulate diets for minerals.(Spears, 1998; Miller & Mosley, 2003)

Alternative Sources:

Non-organic sources are the routine source of all these minerals that are available for organic systems. The mineral complexes are generally included to provide between 10% and 50% of the supplemented mineral. Non-organic minerals are much cheaper and cost will limit the overuse of the chelates. Also, non-organic mineral sources are better utilized by the microbes in the cow's rumen than the complex forms.

There are studies currently underway using sea kelp or cornstarch as an alternative source of protein for chelation. Both show promise in their ability to decrease the total minerals necessary to supplement the animal and thereby decrease mineral excretion (William S.Swecker, 2002; 2002).

An additional option available in organic livestock production is the inclusion of phytases in animal feeds. Phytate is a compound that binds to trace minerals, especially zinc, making them unavailable for utilization. The enzyme phytase breaks down the phytate-mineral complex, allowing the mineral to be utilized by the animal. Research suggests that adding phytase to feeds will increase the absorption of trace minerals and the digestibility of amino acids (Phytase Fact Sheet 2001). Additionally, much of the phosphorus found in feed is stored in an organic form that is not available to non-ruminant animals. Phytase breaks down the indigestible form of phosphorus into a product that can be utilized by the animal. Research has indicated that adding phytase to swine diets can help decrease the amount of phosphorus supplement provided to the animal, while at the same time decreasing levels of phosphorus found in swine feces (McMullen 2001). Phytase was not found to be harmful to the swine's performance. Similar results have been seen in poultry (FASS 2001). Ruminant microbes produce phytase (Stanton 1999), so the inclusion of additional phytase in their diets may or may not be beneficial.

Nutritional advantage and disadvantage of the protein, polysaccharide and amino acid portion of the complex:

The protein, amino acid, and polysaccharide portion of the complex would provide nutrition to the animal once the product is absorbed as if that portion were fed separately. Due to the amounts supplemented of these products, the contribution of these portions is usually negligible. The only exception could be that specific amino acid mineral complexes may provide reasonable amounts of that specific amino acid to the diet, depending on the mineral.

In ruminants, truly and properly complexed minerals (except polysaccharides) are not available to the microflora in the rumen. Some producers have given natural 'inorganic' mineral forms to prevent mineral deficiencies that may develop. Generally, the cost of supplementing complexed minerals to an animal is much greater than supplementation from 'inorganic' sources. The issue of economics deterred producers from oversupplying mineral needs via chelated, proteinated or polysaccharide forms. Theoretically, the maximum tolerance level in an animal for a mineral could be lower if a large portion of it was supplied from these complexed mineral sources. Studies have not yet been conducted on how much to feed before problems arise (Dan Giacomini, 2002b) .

Regarding the question on circumventing the ban on synthetic amino acids:

According to Dan Giacomini, a livestock nutritionist, it would be unlikely that the ban on synthetic amino acids be circumvented for non-specific amino acid complexes and proteinates that concentrate particular amino acids since they carry an assortment of amino acids in either single or peptide form. These non-specific complexes and proteinates would not supply significant amounts of any one particular amino acid. It would be questionable if the supplementation of amino acids derived from natural sources were to be banned as well because the amino acid profile mirrors the natural protein source that they were hydrolyzed from.

According to Dr. Richard Theuer: "On circumventing the ban on synthetic amino acids, to me the key is full disclosure of the protein/amino acid part of the chelate. If you require labeling/disclosure, 'circumventing' then becomes "mislabeling." I also don't understand this paragraph completely. I am actually more concerned by the method used to hydrolyze protein to amino acids and small peptides. If it is enzymatic, it fits with OFPA. But if acid hydrolysis is used, it's a synthetic process and thus a synthetic material."

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