IONIZED MINERAL SOLUTIONS TECHNOLOGY for

- ❖Agriculture
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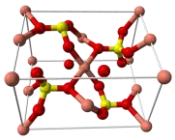
"Environmentally Safe, Pure Protection for Water, Crops and Food"

A Brief Background on Bactericidal Properties of Ionic Copper



That soluble copper salts have algaecide and herbicidal properties when dissolved in water has been known for nearly a century.

Recent research has expose many of the mechanisms by which cellular membranes of pathogens transport copper ions into the cells, accumulating metabolically disruptive amounts that result in reductions in bacterial populations.

Copper is quite rare in natural environments, so in order to accumulate this important inorganic material, cells have evolved complex mechanisms to accumulate this essential mineral from the environment using "chaperone" enzymes like ceruloplasmin and others. It appears that the mechanisms that control the concentration of the ions within the cell are unable to recognize slow accumulation of disruptive or even lethal levels. Levels of metallic ions within the cellular structures actively accumulate if the concentrations of those ions in the environment are at a low enough level. In more concentrated solutions, the bacteria offer resistance to the obvious threat, and if capable, form spores until the environment again become suitable for their reproduction.

Research shows that copper has the most common toxicity to microorganisms. When dissolved in water, copper salts form what are termed "weak field monodentate ligand" (colloidal suspension) and the cupric ions (CU++) are the primary toxicants. The presence of these ions at certain sit within the cell will disrupt the normal metabolic functions and the integrity of cell membrane and cellular components.

Gram-positive bacteria cell walls are 10 to 40 % of the dry weight of the cell, depending on the species and environmental growth conditions. Gram-negative bacteria cell walls are chemically and structurally more complex than the Gram-positive bacteria. The inner (peptidoglycan) layer of the cell wall is only 2 - 10 % of the dry weight of the cell. The outer membrane is located above the peptidoglycan. This outer layer in Gram-negative cell walls also contains sites with which metals can interact. These reactive sites within these layers are similar in both types of bacteria. The amount of metal chelated by Gram-negative cell walls is lower than in Gram-positive cell walls. It is believed this is because the peptidoglycan layer is thinner and does not contain teichoc acid, a potent chelator of metals. These then are the two binding sites for cupric ions in bacteria and the principle sites of reaction. One binding site consists of the phosphor groups of the cell membrane and the other site is the carboxyl group of the inverrase, a membrane-bound enzyme. Because the membrane bactericidal mechanism is so intertwined with the metabolic processes of the bacteria, the copper ion has to breach the cellular wall and the protective capsule without of any apparent threat to the survival of the organism.

It is this latter discovery that allows our products to be so effective. Each product formula is for a specific use to furnish wide bactericidal action in the broadest commercial application.

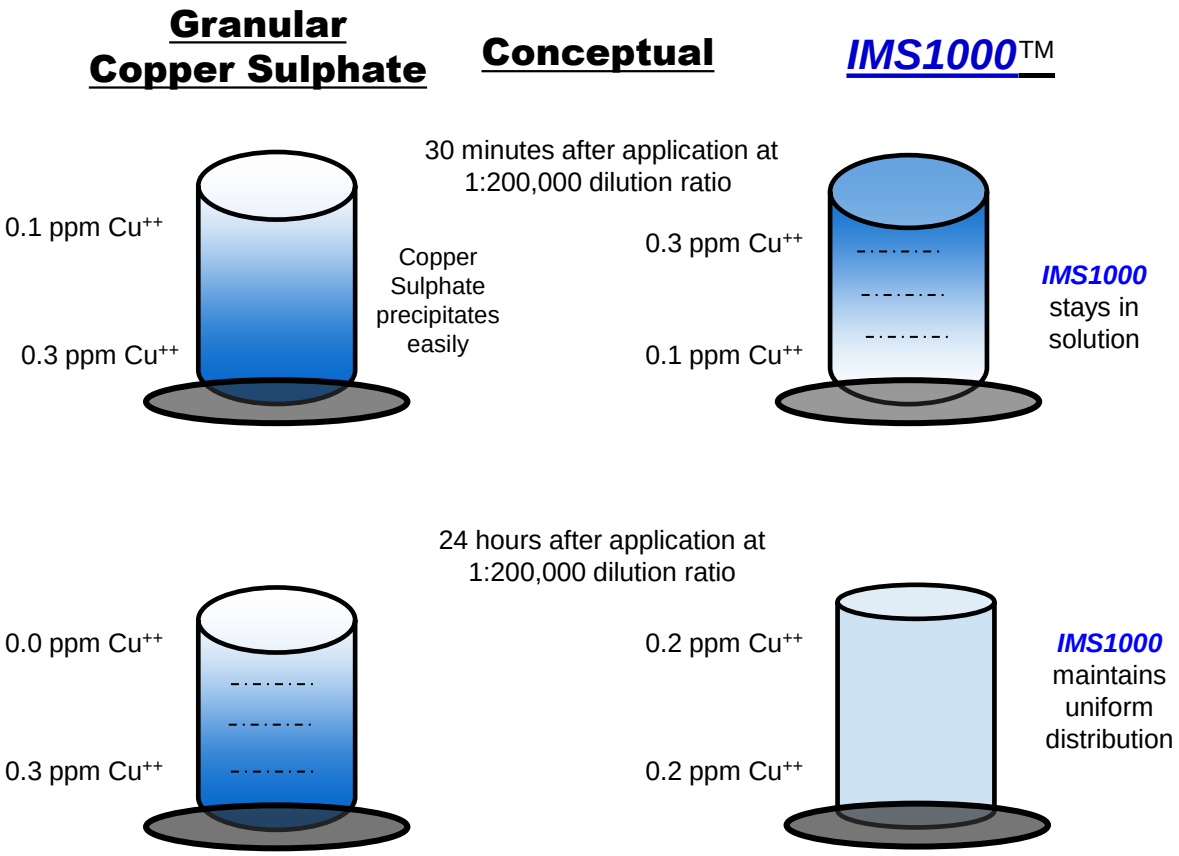
IMS1000 vs Copper Sulphate

The Cu++ ion is the active ingredient in ***IMS1000*** and other copper-based products. The ability of any solution to maintain more Cu++ ions in solution for longer periods defines the biological efficacy of any ionic copper solution.

According to independent laboratory tests (by Golder Associates) funded by EnvirEau Technologies to evaluate and compare the complexation and adsorption actions of ***IMS1000*** and copper sulphate in water environments, ***IMS1000*** solutions are consistently more effective at maintaining Cu++ ion particularly at high pH. When organic matter is present, ***IMS1000*** was able to sustain higher levels of Cu++ even with changes in alkalinity and / or pH.

In short-term environmental persistence tests, ***IMS1000*** maintained higher Cu++ concentrations for the first 30 minutes during which time target organisms quickly assimilate the ionic copper. For longer (12 to 48 hours) exposures ***IMS1000*** was able to increase Cu++ over 400 times that observed for Copper Sulphate due to precipitation of the Copper Sulphate. EnvirEau's proprietary ionizing agent makes the difference.

These test results explain why ***IMS1000*** out-performs alternative products in a variety of applications. ***IMS1000*** has an intrinsic ability to rapidly inactivate dangerous pathogens including E.coli, 0157:7, Salmonella, Cholera, Legionella Streptococcus, H1N1 Influenza, MSRA, and others in water. ***IMS1000*** has also been shown to be effective in controlling many fungi, bacteria and insect larvae. ***IMS1000*** typically accomplishes this without harming beneficial organisms, or healthy plant or animal cells.



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Fruits and Vegetables: Because lettuce, carrots, and cabbage are particularly vulnerable to colonization and promulgation of Coliform organisms, they act as a starter contaminant for salads. Treatment controls this growth while destroying the bacteria that have otherwise contaminated the product. The solution is applied as a spray or a dip, extending the shelf life of the product by virtually eliminating bacteria. Some fruits are easy targets for spoilage bacteria, which use sugars as carbon sources. Spraying or dipping before shipment is a fresh and safe for the consumer and extends the cosmetic and actual shelf life.

Poultry: Estimates hold that 40 to 60 percent of chicken in the United States and Europe is contaminated with the Salmonella and Campylobacter bacteria. The contamination is usually on the surface owing to the aerobic growth requirements of these organisms. Treatment destroys these pathogenic organisms, but owing to its overall bactericidal qualities, makes the treated poultry product more pleasing and palatable at the consumer level.

Red Meat Industry: Treatment inhibits growth of pathogen and spoilage bacteria and extends the shelf-life of the meat. This fosters freshness from the processor to the retailer and on to the consumer. Treatment is also extremely effective in the destruction of surface pathogens that might find their way onto the product through handling. Hemoglobin in red meat converts to oxyhemoglobin by bacterial action and some greening of fresh meats is caused by other forms of bacteria. As meat ages, there is a release or "weeping" of fluid that makes the product unsightly although still suitable for human consumption. This weeping is produced by enzymatic action of bacterial strains as they colonize the meat. After treatment, the surface of the meat is nearly free of bacterial contamination. Producers may look forward to delivering meat that is not only cosmetically acceptable, but that is truly more wholesome then when it left the meat cutter's block.

Sea Foods:
It has been estimated that 25% of ALL fresh food spoil because of microbial action and fresh fish products spoil at this same rate. Microorganisms are the major cause of spoilage of most seafood products. However, only a few members of the microbial community give rise to the offensive flavours associated with seafood spoilage. Using IMS1000™ at minimum concentrations will inhibit the growth of these types of bacteria for a period of up to 28 hours.

Agriculture: Odors are a natural part of hog farming. When gas-producing bacteria levels rise, the resulting odors and gases are unpleasant. Compacted solid waste buildup can cause a reduction in liquid storage capacity in waste pits and lagoons. We have the unique property of controlling gas-producing bacteria and routinely reducing ammonia gas levels by 50% during the two weeks after application. When the ions penetrate the bacterial cell walls and membranes, they act on the sites of DNA, proteins and metabolic enzymes and disrupt the bacteria's replication process. An added benefit of using our solution is its ability to break down solid waste. In a twelve week study conducted at a sow and piglet barn, confinement's pits regained the liquid storage capacity previously lost due to solid waste buildup.

Pond/Lake/Reservoir Management: Recurring algae blooms can create a real problem in the maintenance of ornamental lakes, golf course ponds and fountains. IMS1000™ is a proven, reliable and environmentally responsible solution. IMS1000™, an algaecide/bactericide, is designed for use in lakes, ponds, fountains and other water systems. The release of our product's active ingredient is controlled by biological demand (such as an algae bloom) instead of by water conditions. This allows you to treat your body of water prior to an ugly outbreak of algae. The copper will not precipitate out of solution, but will remain fully dissolved indefinitely, thereby insuring long-term algae control without overtreatment. Lake and pond water may be used immediately following treatment for irrigation without harm to plants or grass. The product may also be used in fish bearing ponds at prescribed application rates.

Wastewater: Unlike other copper sulfate water treatment products available today, the copper is already fully dissolved, and more importantly, the release of its active ingredient is controlled by biological demand instead of by the conditions in your wastewater treatment plant. These unique characteristics allow you to achieve long term control of algae and bacteria without overtreatment. We bring science and nature together by enhancing the bacterial action of a typical treatment system. When the copper penetrates a bacterial cell wall and membrane, it acts on the sites of DNA proteins and metabolic enzymes disrupting the proliferation of bacteria, including the proteolytic bacteria which are responsible for producing ammonia, hydrogen sulfide and other harmful gases.

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