

SWIMMING POOL DISINFECTION

An Evaluation of the Efficacy of Copper:Silver Ions

Excerpts from the University of Arizona Department of Microbiology and Immunology Lab Reports.

"Metals for use in disinfection have been documented for many years, although they have only been in use as electrolytic devices in the United States since the early 1930's."

"Free-chlorine concentrations can be affected by sunlight, temperature, organic materials and the chemical consistency of the water. Organic material may be introduced into swimming pools by rain drainage, soil, foliage and animals. Swimmers can also contribute large amounts of organic matter to pool water in the form of sweat and urine. Active swimmers can perspire up to 1L/h and the average swimmer can contribute 25-50 mL of urine. All of these factors have a chlorine demand and act to lower the levels of free chlorine in the water. This poses one drawback to the use of chlorine as a swimming-pool disinfectant. Other negative aspects include eye and skin irritation, low residual effect and the formation of trihalomethane compounds which can be absorbed through the skin or volatilized and inhaled. For these reasons, alternative disinfectant systems have been investigated."

A letter quoted from Dr. Charles Gerba University of Arizona:

"During our experiments we paid particular attention to the efficacy of copper:silver ions against Legionella pneumophila. Our experiments have proven that copper:silver ions combined with very low levels of chlorine produces a synergistic effect which enables the dual disinfectants to kill Legionella bacteria much more rapidly and is up to 1000 times more effective than chlorine alone."

"The additional benefit of the copper:silver system is that there is always a disinfectant in circulation that is unaffected by sunlight and temperature and, in fact, the bactericidal effect is enhanced by sunlight and high temperatures."

"Legionella pneumophila is resilient to high levels of chlorine and is a most difficult bacteria to eliminate, especially within systems that are exposed to sunlight and temperature such as cooling towers and hot water lines where levels of chemical biocides are difficult to maintain, and in most cases, non-existent due to dissipation. This breakthrough in water purification means that the combination now produces a far more effective constant disinfectant against Legionella pneumophila and other chlorine resistant strains of bacteria. These systems are automatic and are easily monitored once they are installed."

Journal of Environmental Health Volume 51, Number 5

Abstract - "Electrolytically generated copper:silver ions were evaluated as an alternative disinfectant to high levels of chlorination in swimming pools. Pure cultures of *Escherichia coli* and *Streptococcus faecalis* were individually tested by inoculating autoclaved well water with and without 0.20 mg/L free chlorine. Copper:silver ions in combination with free chlorine reduced bacterial numbers more rapidly than chlorine or copper:silver ions alone. Numbers of *S. faecalis* also were reduced more in the combined system than in the system containing only free chlorine when exposed for 0.5 min. The addition of copper:silver ions allowed concentrations of free chlorine to be reduced to 0.20 mg/L while still being able to meet guidelines for commercial swimming pool disinfectants."

"In the United States, 95 percent of water disinfection is achieved using chlorine. Chlorine routinely is added to swimming pools to achieve concentrations of 0.6 - 1.0 mg/L free available chlorine. Noticeable chlorine odor usually occurs at concentrations greater than 0.6 mg/L. High concentrations also may also cause irritations of the eyes, mucus membranes and skin, creating considerable discomfort for swimmers."

"As alternative to chlorine compounds, electrolytically generated copper and silver ions have been introduced recently as a relatively safe and odorless method for water disinfection."

"Both copper and silver are bactericidal and virucidal and copper has been shown to be algicidal and possess fungicidal properties."

"In experiments using standard procedures, *E. coli* numbers were more effectively reduced by the combination of copper:silver ions and free chlorine than with free chlorine alone. In the copper:silver ions with the free chlorine system, the numbers of *E. coli* were reduced 3.5 log 10 in 0.5 minutes. The system containing free chlorine alone inactivated *E. coli* numbers 2.8 log 10 in 0.5 minutes."

"The levels of copper and silver to be used in swimming pools apparently would not pose any health risks. Standards for copper levels in drinking water were established more for aesthetics than for health concerns."

"The use of copper and silver with low levels of chlorine as a method of commercial swimming pool disinfection, thus, should greatly outweigh the negative aspects of high level chlorination, such as eye and skin irritation."

"The data obtained indicate that a system of electrolytically generated copper:silver ions with concurrent low level of free chlorine in water appears to have an enhanced effect in reducing microbial numbers. This would allow the level of chlorine currently recommended for commercial swimming pools to be reduced."