

# Copper-Silver Ionizers

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*Brought to you by the APSP Recreational Water Quality Committee*

## I. INTRODUCTION

Copper/silver ionizers are electrolytic devices that deliver silver, copper and sometimes, other metal ions into swimming pool or spa water. This fact sheet examines the properties and the application of these devices.

## II. SUMMARY OF CHARACTERISTICS

- Copper/silver ionizers are electrical devices that release silver and copper ions into the pool or spa water
- The silver ions act as a bacteriostat, but the action is slow compared to the action of sanitizers such as chlorine or bromine
- Copper ion is an effective algacide
- Copper/silver ionizers require a sanitizer such as chlorine/bromine for daily sanitation and a supplemental oxidizer to control organics from bathers and the environment
- Copper/silver ionizers are incapable of oxidizing contaminants
- The NSF/ANSI Standard 50 for ionizers requires the addition of chlorine or bromine
- There is an increased probability of staining pool surfaces if the concentrations of copper and/or silver ions are too high

## III. GENERAL DESCRIPTION

### A. What It Is

An electrolytic ion generator is usually a watertight container installed in the pool's return line, though there are exceptions to this arrangement. It always has a pair of electrodes of varying shape, size and composition. The most common electrodes are alloys containing 90% – 97% copper, with the remainder being silver. When a low voltage, DC current is passed between these electrodes copper ions ( $\text{Cu}^{+2}$ ) and silver ions ( $\text{Ag}^{+}$ ) are released into the water by

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electrolysis (hence the term “ionizer”). The source of this low voltage DC is usually a step down-transformer and rectifier reducing AC household voltage to low voltage DC. Solar and galvanometrically generated DC voltages have also been used in systems on the market.

## **B. What It Does**

The silver ions released into the pool or spa function as a bacteriostat. At the concentration released by ionizers, silver ions kill bacteria more slowly than is acceptable for pool and spa applications. However, in the presence of low levels of sanitizers (e.g., chlorine, bromine) silver ions produce a bacterial kill rate at least as high as the 1 ppm - 2 ppm of chlorine level found in public pools.<sup>1</sup>

Copper ions act as an algacide or algae inhibitor depending on copper levels. Having copper ions function as an effective bactericide is problematic as certain bacteria (including various *Pseudomonas* species) readily develop resistance to copper ions.<sup>2</sup> Low concentrations of copper can help prevent algae growth if the concentrations of chlorine or bromine are insufficient.

Electrolytic copper/silver ionizers must be registered as pesticides with the USEPA. Electrolytic copper/silver and copper ionizers can be tested to NSF/ANSI Standard 50 – Equipment for Swimming Pools, Spas, Hot Tubs and other Recreational Water Facilities for supplemental treatment of water in public and residential pools and spas/hot tubs.<sup>3</sup>

## **C. What It Does Not Do**

As a stand alone device, ionizers do not sanitize pool or spa water. They must be used in conjunction with an EPA-registered sanitizer.

Electrolytic ion generators do not oxidize organic materials. All devices of this type must be used in conjunction with compatible oxidizers. Consult manufacturer for list of compatible oxidizers. Organic material, including bacteria, enters a pool or spa continuously from the environment. If this material is allowed to build up, the pool will first become cloudy and then algae and other problems will develop. In a chlorinated pool, it is estimated that a large portion of the chlorine consumption is due to oxidation of organics, while the remaining chlorine is utilized controlling bacterial growth. Ionizers must be used with recommended levels of oxidizers.

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Dissolved metal ions, such as copper and silver, can be affected by other components in the water. Like all the other sanitizers, silver is known to be inactivated by protein-like matter<sup>4</sup>, so pool contaminants from bather load and other sources could reduce the efficacy. Silver can also form insoluble complexes with chloride and most metals will form insoluble complexes with carbonate<sup>5</sup>. This can cause issues with staining and/or efficacy. The solubility and efficacy behavior of silver can be very complex and hard to predict in a pool environment because both soluble and insoluble silver chloride species can be formed<sup>6</sup>, and their concentrations and activity will vary due to a number of different factors.

Salt water chlorinating systems are sometimes used with ionizers, and we are unaware of any complaints or problems that have arisen with the combination. However the user should be made aware that the test kits used to monitor ionizer operation generally only measure copper in the water. Such tests can provide no assurance of whether or not silver is present at the target concentration or whether it is in a biocidally active form.

#### **IV. APPLICATION**

##### **A. Installation**

The ionizer should be installed in your pool's return line. This operation is usually done by a pool professional because it requires moderate plumbing and gluing skills. The electrical connections of a copper/silver ionizer can only be safely installed by a professional familiar with the equipment. Some types of ionizers will require pipe adapters to go from one size to another. An ionizer is an electrical device that should be connected to a ground fault interrupter. The safety precautions of the device manufacturer should be reviewed and followed.

##### **B. Operation**

Copper/silver ionizers are operated by turning on an electrical supply. A step-down transformer and rectifier transforms the AC current into DC current required by the ionizing cell, converting silver and copper in the electrodes into silver and copper ions in the water. The concentration of ions released into the water is controlled by varying the electric current according to the manufacturer's specifications.

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### **C. Sanitizer Requirement**

The section of NSF/ANSI Standard 50 dealing with ionizers requires the addition of chlorine or bromine. As a stand alone device, ionizers do not sanitize pool or spa water. They must be used in conjunction with an EPA-registered sanitizer.

### **D. Oxidizer Requirement**

Ionizers have no ability to oxidize. Therefore, it is necessary to periodically shock-oxidize or superchlorinate the pool water to destroy any oxidizable contaminants entering the pool from the bather or environment.

### **E. Testing Methods**

Follow manufacturer's guidelines for testing pool or spa water treated with ionizers. While copper test kits are commercially available, there are no silver test kits marketed for pool use. Copper is commonly used as a surrogate; however other sources of copper, such as copper algaecides and corrosion of copper surfaces can compromise the results.

## **V. PRECAUTIONS**

### **A. Health Effects**

It is important to follow the directions of the device manufacturer as contained in the operating instructions on the device plate and/or in the manual. If the readings for metal concentration in the pool water exceed the manufacturer's recommendations, the system should be turned down to a lower setting.

### **B. Supplementary Oxidizer**

As ionizers have no ability to oxidize bather contaminants, periodic oxidation of pool water, especially when experiencing heavy bather loads, is essential to maintain water quality and clarity.

### C. Metal Staining

Excess metal concentrations will eventually cause the precipitation of insoluble metal salts on pool surfaces, which can cause surface staining.

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## VII. ADDITIONAL INFORMATION

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