

# How Do Ionizers Work?

by APSP Recreational Water Quality Committee

For centuries, copper and silver have been used to maintain water quality due to the fact that ions from these metals inhibit the growth of bacteria. Today, leisure aquatic vessels use copper and silver ionizers to perform the same function: release silver and copper ions into the pool or spa water to inhibit bacteria and algae growth.

Like other supplemental devices such as ozonators and UV systems, ionizers aid chlorine or bromine sanitizers and thus allow them to be used at lower concentrations, satisfying the common consumer desire of "lower chemical use."

Silver ions released into the pool or spa function as a bacteriostat. At the concentration released by ionizers, however, silver ions kill bacteria more slowly than is acceptable for pool and spa applications — thus the need for a sanitizer such as chlorine or bromine.

Nevertheless, in the presence of low levels of sanitizers, silver ions produce a bacterial kill rate at least as high as the 1 ppm to 2 ppm of chlorine level found in public pools.

Copper ions, on the other hand, act as an algaecide or algae inhibitor depending on concentration. Having copper ions function as an effective bactericide is problematic as certain bacteria (including various *Pseudomonas* bacteria species) readily develop resistance to copper ions.

Still, low concentrations of copper can help prevent algae growth if the concentrations of chlorine or bromine drop to an insufficient level, a condition that can occur for a variety of reasons.

## Ionizer Facts

Just as important as an understanding of the ionizer's capabilities is a knowledge of what ionizers can't do.

As a standalone device, ionizers do not sanitize pool or spa water. They must be used in conjunction with an EPA-registered sanitizer, such as chlorine or bromine.

Electrolytic metal-ion generators have no ability to oxidize, either. You should consult the product manufacturer for list of oxidizers compatible with your ionizer.

Typically, for proper oxidizing, it is necessary to periodically shock or superchlorinate the pool water to destroy any oxidizable contaminants entering the pool from the bather or environment.

### Ionizer Facts

- Silver ions act as a bacteriostat, but the action is slow compared to the action of sanitizers such as chlorine or bromine.
- Copper ions are an effective algaecide
- 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

## Oxidation of Organics

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. Therefore, ionizers must be used with recommended levels of oxidizers.

## Ionic Behavior

Dissolved metal ions, such as copper and silver, can be affected by other components in the water. Silver is known to be rendered inactive by protein-like matter, 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. 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, and their concentrations and activity will vary due to a number of different factors.

Saltwater 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.

## Equipment, Installation and Operation

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 to 97 percent 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 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.

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.

## Precautions

### 1) 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.

### 2) Supplementary Oxidizer

Required As previously stated, 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.

### 3) Metal Staining

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