



2016

# Silver Ion Technology SIWT Series



AKWA SOLUTIONS Pty Ltd

2/18/2016

## **About The Company**

**AKWA SOLUTIONS** is an Australian owned and based company whose major philosophy is to dedicate and provide environmentally responsible technologies and solutions which will benefit and enhance people's life and the world we inhabit.

In January 2013, AKWA SOLUTIONS acquired CCT along with ANC, by combining the necessary resources, this has allowed us to expand the business and continue the development of the group's propriety products.

Since 1993, CCT and ANC have been actively researching and developing their core technologies of electrolytic mineral ion process. Nowadays, AKWA SOLUTIONS has utilised these unique technologies to increase efficiency on mineral colloids production and also increase the capability of large water purification with precise silver ion technology known as Silver Antibacterial Technology.

*The Healthies water is water contains  
element trace of minerals and possess antibacterial ability*

These unique technologies which can be incorporated in any water treatment system or water filtration system have been proven to be effective in the treatment against bacterial, mould and fungi and to reach its intended objective by using water as its delivery system.

The water that possesses antimicrobial or antibacterial ability can be used or combined with many applications such as domestic, industrial, commercial, horticultural, agricultural, medical, dentistry and domestic animals.

It complies within the World Health Organization Drinking Water Standard, Australian Bottle Water Association Standard and the food grade standard. And it can be used in organic production.

## ***The system and concept***

The basic process that is used to create the silver and or copper ions is electrolysis. In reality, the electro-chemical process is immensely complicated, especially in very close proximity to the electrodes.

When the unit is activated, the electrons flow through the electrodes from the cathode ( $-^{ve}$ ) to the anode ( $+^{ve}$ ). The new Alternating polarity in the units provides the reversal of this current direction at a pre determined frequency which is adjustable to facilitate in keeping the electrodes clean.

The electrons move up through the positive electrode into the custom designed PLC (process logic controller) and power supply and then down into the negative electrode on the other side. Current flows through solid metals via electrons on the surface of the metal which causes an electron to be unattached from a silver atom, that atom now becomes a silver ion ( $Ag^{+}$ ) which is soluble in water. The electrons continue flowing 'up' the silver anode and leave behind the silver ions ( $Ag^{+}$ ), which in turn are repelled off the electrode and into the water by 'like charge' of the other  $Ag^{+}$  silver ions. In this 'dissolved' state they are attracted to the negative electrode most of them are prevented from reaching the other side by the flowing water that is running between the two electrodes. Most ions will remain isolated in solution but some will contribute to the formation of silver particles and oxides.

Free electrons travelling 'down' the negative electrode are 'pushed' into the water by electrical pressure, these electrons 'split' water molecules into hydrogen ions and hydroxyl ions. The hydroxyl ions travel to the anode where they combine with silver ions to form silver hydroxide.

The hydrogen ions become hydrogen gas molecules. Most of this gas will collect into bubbles buoyant enough to simply pass through the flowing water and dissipate, but some will remain adhered to the electrode where they become coated in a grey/white silver hydroxide.

## ***Electronic control of process***

The control of the process is via our custom designed controller (PLC) and a flow sensor. The electrode driver within the circuit provides pulsed DC excitation to electrodes at approximate frequency of 20Hz. The circuit is designed to be short circuit proof and is transient protected.

The average current flowing between the electrodes is measured and the excitation voltage to the electrodes is continuously varied to automatically maintain a set point current. Data from the flow sensor adjusts the set point relevant to the flow characteristics in the program.

The set point current is under program controlled can therefore be changed at any time. The polarity of the excitation & the electrode is also under program control, and as polarity reversal is achieved without the use of a relay, there is no wear out mechanism.

In conjunction with software, the circuit can also provide diagnostic functions on the operation of the electrodes overtime to provide advanced of electrode wear or fault conditions. The electrode excitation voltage is also measured for diagnostic purposes and can therefore be used to display a representative measure of conductivity of the current between the electrodes.



## ***How does SIWT (silver ion water treatment) work?***

The underlying technology behind SIWT is silver ionization. This is a proven, dispersive process that introduces long-lived, stable, positively charged silver and sometimes both copper and silver ions (depending on the application) into water systems to bond electrostatically with negative sites on bacterial cells walls and denature proteins.

In the long term, ionisation disperses and destroys biofilms and slimes that can harbor Legionella and other micro-organisms.

### **Silver (copper and silver) Ionization –Basics**

Here are the basic steps of silver ionization process:

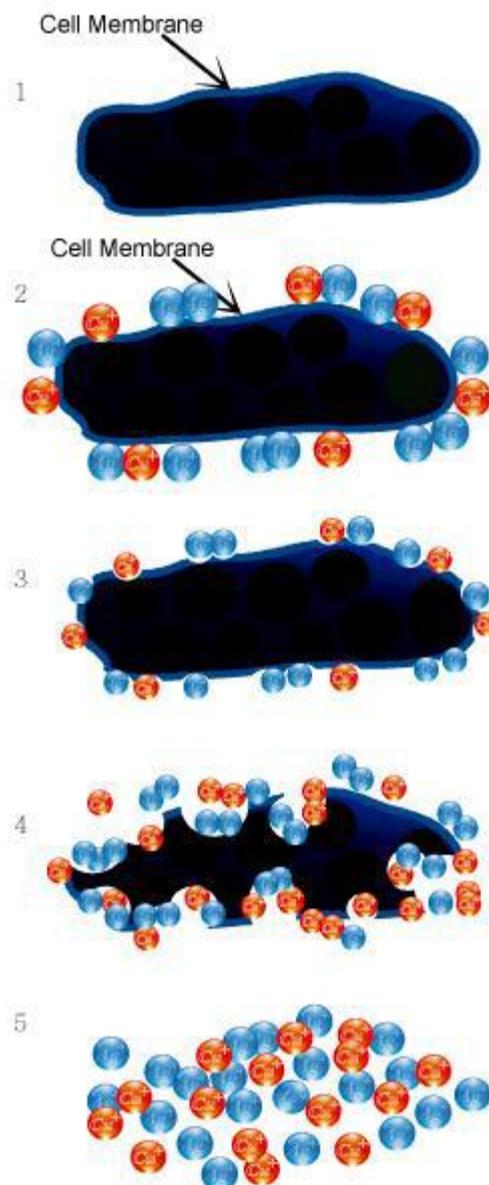
1. The ionisation process of silver (silver/copper) is provoked when these materials are electronically stripped of electrons and become positively charged ( $\text{Ag}^+$  and  $\text{Cu}^{2+}$ ).
2. By running an automated variable voltage between the sacrificial silver (copper/silver) electrodes submerged in water, positively charged Silver (copper and silver) ions are created and released into the water.
3. Having the water flow between the electrodes carries away the ions into the water system before they can reach the opposite electrode.
4. Once placed within a water reservoir or a distribution network, the positively charged silver (copper and silver) ions are attracted to negatively charged particles and commence the biocide process upon them.

### **Silver (copper and silver) ionization – Biocide process**

1. All micro-organisms such as bacteria, virus and alga have an exterior envelope called the cell wall or cell membrane. This wall in most cases is negatively charged. The ionisation process has introduced silver (or silver and copper) into the water which is positively charged. The  $+^{\text{ve}}$  ions are naturally attracted to the negatively charged cell membrane.

2. When the ions make contact with the cell membrane, they are electrically bonded.
3. The ions then permeate the membrane and begin to disrupt the cells essential functions.
4. Ionic silver can kill a broad spectrum of bacteria and viruses, copper is effective against Algae, but when combined, they have a synergistic relationship increasing their effectiveness to disrupt the cells membranes and metabolism to a point where the cell dies.
5. At this point, the process releases the ions and allows them to continue to move randomly throughout the water. As they are still +<sup>ve</sup> charged they continue to be attracted to other negatively charged organisms hence continuing to act as a biocide.
6. An important but often overlooked aspect of silver (copper / silver) ionisation is that ions do not volatilise, burn out or break down in the process as chemical disinfectants do.

**i.e. there is no diminishing of the residual biocidal effect**



## ***SIWT Series Basic Features:***

- The circuit is designed to be short circuit proof and is transient protected.
- A 4 x 20 Alpha numeric LCD screen with backlight, allowing flow rate, current, voltage, and system status to be monitored live.
- The total flow and a resettable flow can be displayed on LCD enabling checking of water delivered.
- Data recorded via inbuilt SD card data logger for statistical and performance purposes later (for specific model only).
- Visual lamps to indicate status and alarm condition.
- Unit is design to deliver the silver ions within the food standards of 0.01ppm maximum value and up to the WHO standard of 0.1 ppm.
- After the standard is set, operators have control of micro adjustments to ensure the silver output is correct at end of line.
- Controller is PIN coded for security and control of micro adjustments.
- The controller is capable of communications with other external systems, customer to identify requirements if needed (additional cost), i.e. lap top, or mobile phone.
- The unit can be supplied with an audible alarm. (optional extra, except SIWT70)
- Minimum Maintenance. The electrode is maintenance free. However, if there is visible discolouring. The user is recommended to wipe it down with micro-fibre cloth.
- The unit is supplied with dual dry contact enabling the unit to be connected to a central monitoring system for the purposes of connecting to a secondary warning lamp or siren to indicate an alarm status of unit. (Customer to connect)

## ***Example of life expectancy of electrodes***

### ***Model: SIWT70***

Based on the food standard of 0.01 PPM silver requirement .

Therefore 10 grams of silver would be consumed every 1,000,000 litres of water .

The weight of silver in the electrode pack is 935 grams, from experience only 70% ~ 80% of this is usable (This is highly depends on water quality), if it is 70%, therefore 635 grams of silver is available for use.

Taking 635grams and dividing it by the 10 grams every 1 million litres of water, this gives us

**=63,500,000** Litres of water per electrode life

If one bases on 0.025 ppm silver standards that provided by ABWI Mode Code 2005 Revised 2010.

Therefore 25 grams of silver would be discharged with every 1,000,000 litres of water. The weight of silver electrode depends on the SIWT model. From our clients' feedback, usually 70% ~80% of the electrode are used. **\*\*\* This is highly dependent on water quality and condition of silver plate. \*\*\***

For example:

- Approx electrode weight: 1000g
- Estimate usage: 70% - 700g
- Cost of 1000g: \$4500 (***not a quote***)

To work out the life expectancy of electrodes, 700g divided by 25g every 1 million litres of water, this gives us "**28,000,000**" litres of water per electrode life.

If the cost of the replacement electrode at \$4500 and 28 million litres would be consumed per set of electrodes then the average cost per litre is "**\$0.00016 per litre**" or "**0.016 cents per litre.**"

## Gallery









## Dental Clinic





## SIWT Series

**SIWT 70**



**SIWT 450**



**SIWT 1000**



## FQA

**Q1.** Does the system require any post filtration? If so, what size of filtration required?

**A1.** In the very rare case, larger silver particles may break off from the electrodes due to the high flow velocity. 5 um post filtration will be sufficient enough.

**Q2.** How does one test the silver colloidal produced within standards?

**A2.** Water samples required to be tested externally. There aren't any commercial products in the market for testing very fine silver accurately.

**Q3.** Do you set the silver dose on the PLC?

**A3.** The SIWT unit has controller that designed to comply with water and food standards. If a flow sensor is installed and running together with the controller. It will output silver production according to the flow rate. That leads to the end result to be within the standards.

The result of silver production is subjected to the conductivity of the water and the pre-filtration systems. Therefore, it makes every production line unique.

For this particular reason, AKWA Solutions came up with two parameters (Silver Ratio and Duty Cycle) for users to adjust their desired silver production accordingly. This may take several samples before achieving the optimal solutions.

**Q4.** Is there anything on the system that needs regular calibration?

**A4.** It is recommended for users to calibrate the system whenever is needed. Regular water sample result might require in order continuing fine tune the desired silver production. SIWT is an almost maintenance free machine.

**Q5.** How do you clean/maintain the electrode?

**A5.** The electrode is maintenance free. However, if there is visible discolouring. The user is recommended to wipe it down with micro-fibre cloth.

**Q6.** What is the on-going cost for replacement silver ? eg. Cost per 10,000,000 litres processed

**A6.** If one bases on 0.025 ppm silver standards that provided by ABWI Mode Code 2005 Revised 2010.

Therefore 25 grams of silver would be discharged with every 1,000,000 litres of water. The weight of silver electrode depends on the SIWT model. From our clients' feedback, usually 70% ~80% of the electrode are used. **\*\*\* This is highly dependent on water quality and condition of silver plate. \*\*\***

For example:

- Approx electrode weight: 1000g
- Estimate usage: 70% - 700g
- Cost of 1000g: \$4500 (*not a quote*)

To work out the life expectancy of electrodes, 700g divided by 25g every 1 million litres of water, this gives us “**28,000,000**” litres of water per electrode life.

If the cost of the replacement electrode at \$4500 and 28 million litres would be consumed per set of electrodes then the average cost per litre is “**\$0.00016 per litre**” or “**0.016 cents per litre.**”