

## About UV, Ozone and Copper Ionisation

Hans Holtz

[info@novozone.co.nz](mailto:info@novozone.co.nz)

The two key technologies that form the mainstay of the discussion around water disinfection are UV and ozone. While UV and ozone has been relatively well understood and promoted, Copper Ionisation is receiving a great deal of attention for the compelling reasons to choose ionization over UV and ozone.

### What is Ozone?

Ozone is a gas that is dissolved in water to kill microorganisms by oxidation. When ozone comes into contact with a microorganism, the weakly bonded oxygen atom oxidises the cell membrane, causing osmotic bursting and cell destruction. This occurs immediately at the ozone gas injection point, and continues with the water flow. A small residual of dissolved ozone will enter the irrigation lines, providing further oxidation of contaminants.

### What is UV?

UV light inactivates microorganisms with light energy. The ultraviolet radiation (UV-C) disrupts their DNA and removes their reproductive capabilities. This happens while the water is in the UV chamber only, and as long as the water has no turbidity. No further disinfection process occurs once the water flow leaves the chamber. UV provides no oxidation.

### What is Copper Ionisation?

Copper ions are created by submerging copper electrodes into the water stream. An electric current (DC voltage) is applied between the electrodes and the resulting current produces positive copper atoms (ions). The copper ions are then carried away by the water flow. The microorganisms are negative so there is a natural attraction between the positive charged copper ions and the negative cells. The copper ions surround the cell wall and puncture it, disrupting the enzyme balance thereby killing the microorganism. The copper residual can be made large (10 PPM) to enter the irrigation lines, providing disinfection down to the plant roots (where the root diseases occur). Copper ions live long

### Comparing Ozone and UV:

There is sometimes confusion as to the difference between ozone and UV systems. Actually, they are completely different technologies. Ozone is a gas that is dissolved in water to kill microorganisms, destroy organics by oxidation. In comparison, UV light inactivates microorganisms with light energy. With UV, this inactivation only happens while the water is in the UV chamber, and as long as the water has no turbidity. With Ozone, oxidation occurs immediately at the ozone gas injection point and continues down the irrigation lines. While both Ozone and UV provide very effective pathogen reduction as documented by third-party testing and validation, there are distinct differences between the two technologies when it comes to other areas of concern for commercial growers and operators, with clear advantages to Ozone over UV.

### Ozone and Copper Ionisation:

Whilst ozone oxidises (burns open) the cell membrane, copper pierces the cell enzymes and both kill the microorganism. Ozone has a relatively short life in the water. Depending on the amount of organics and microorganisms it can last from seconds to minutes and providing a residual down the irrigation lines can be a challenge. Copper ions can last for hours in the water and therefore can provide an effective residual and disinfection down the irrigation lines and cover the plant roots. It is not easy to adjust the ozone output (and very difficult for UV) but very easy to adjust the copper ion production electronically.

<b>OZONE vs. UV vs. COPPER IONS</b>		
<b>Ozone</b>	<b>UV</b>	<b>Copper Ions</b>
✓ Ozone kills microorganisms	✓ UV inactivates microorganisms	✓ Copper ions kill microorganisms
Ozone is a 'point' water treatment system, mainly treats the source water, has little residual at the plant level	UV is a 'point' water treatment system, treats the water only in the UV tube	✓ Copper ionisation is a residual water treatment system, treats the whole growing system from water source all the way to the plant roots
Ozone does not easily adapt to varying irrigation flow rates	UV does not easily adapt to varying irrigation flow rates	✓ Copper ionization easily adapts to varying irrigation flow rates
High capital cost, medium operating cost	High capital cost, higher operating cost	✓ High capital cost, low operating cost
✓ Ozone is a powerful oxidiser	UV is not an oxidiser	Copper ions are not an oxidiser
✓ If enough Ozone passes into the water it can provide additional oxidation (short life)	UV affects the water only as it passes through the UV chamber	✓ Copper ions pass into the water to provide long term disinfection
✓ Ozone functions poorly in dirty water and in heavy organic loads and is a micro-flocculent	Only clear water can be effectively dosed with UV; cloudiness in the water can absorb the UV light	✓ Copper ions function very well in dirty water and in heavy organic loads
✓ Ozone oxidises the organics and dissolved metals and nutrients	UV is not an oxidiser	Copper ions are not an oxidiser
✓ Ozone utilizes ORP (REDOX) to measure the disinfection level of the water	UV systems utilize a UV intensity meter which measures the UV dose regardless of water quality	✓ Copper ions are measured with a simple test kit
✓ Ozone cells require no replacement; require annual maintenance; no hazardous components	Mercury vapor lamps are replaced @ 3-12 months; disposal procedures must be considered as lamp mercury is considered hazardous waste	✓ Copper electrodes are consumed and require replacement; no hazardous components
Ozone does not affect biofilm and algae buildup in dripper lines	UV does not affect biofilm and algae buildup in dripper lines	✓ Copper ions destroy biofilm and prevent algae and scale buildup in dripper lines
Ozone is not a plant nutrient	UV is not a plant nutrient	✓ Copper is a plant nutrient