Fact Sheet

Water Recycling and Disinfestation

Water used in a greenhouse is generally not diverted to collection facilities or recycled. Water and fertilizer solutions that are not used by plants eventually drain from the growing media and fall to the floor of the greenhouse to be absorbed into the subsoil. This practice can be harmful to the environment, wasteful with regard to water and fertilizers, as well as making it harder to control weeds.
A much better approach, and often more economically beneficial, is to collect and recycle the water that is not used by the plant. There are many considerations involved in water recycling, including how to manage water quality once the water has been collected.

Why recycle water?

- Reduce demand on water supplies
- Reduce water and irrigation costs
- Reduce fertilizer and other costs
- Reduce impact on environment and ground water supplies
- Independent control of water (not as reliant on town, bore, or other water source)

Problems with recycled water

- Contains nutrient and salts which can build up over time
- Risk of spreading pathogens if not monitored and managed
- Initial costs of storage and additional pumping costs
- More careful monitoring and management needed

Recycling Water

Recycling is chosen for the two primary reasons:

1) Reducing water waste
2) Preventing off-site pollution

For some operations, recycled water is the most economical way to ensure an adequate water supply for all growing seasons.
Disadvantages of water recycling are often very compelling. The cost of storage and additional pumping is one disadvantage and, depending on the site, these costs may make some recycling systems too expensive. However, in many cases, these additional costs may be recovered through water and chemical savings over time.
Using re-cycled water requires more careful management of herbicides and other chemicals (such as systemic pesticides) as well as diseases. The most often cited disadvantage of using recycled water is the increased risk of disease because waterborne pathogens such as *Phytophora* and *Pythium* may spread. Some operations use recycled water have installed elaborate water treatment systems to disinfect water, but many do not. Often the operations that do not have disinfection systems rely instead on prophylactic fungicide treatment programs to suppress pathogen activity. In many cases, operations with effective disease management programs do not seem to have a higher potential for increased disease development after implementation of a recycling system.

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Rural Water Use Efficiency for South East Queensland

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Types of Disinfestation Systems

Several technologies are available to disinfect recycled water, and they fall into one of the following categories:

- Non-chemical; and
- Chemical

Non-Chemical disinfestation methods are non-residual, and therefore will not alter the chemical properties of the water and growing media.

- **UV– Ultra Violet Light**

This method is commonly used by Greenhouse growers' world wide, with effective control over most potential greenhouse pathogens. The method has proven to be effective at controlling *Fusarium oxysporum*, *Phytothera Cinnomomi*, and *Alternaria zinniae* and is quite safe to the environment and workers. If considering this kind of treatment, water must be of high quality. Pre-filtering the water to remove suspended particles, and organic matter is required to ensure light penetration of the water is high.

While UV light can pass through 25 cm of clean water, lower quality water may reduce the penetration to only a few millimetres. UV lamps decrease in output over time (up to 10% after 1000 hours), so regular replacement of lamp should be factored into the maintenance of this kind of system.

- **Slow Sand Filtration- Bio-Filtration**

Slow sand filtration relies on both physical and biological activity in controlling plant pathogens. A slow sand filter is constructed of a medium with high surface area, which can be colonised by suppressive micro-organisms. This fine media also presents a physical barrier to the passage of spores of plant pathogens and nematodes but are not effective against bacteria. Slow sand filtration is recommended as a pre-treatment for the other sanitation technologies since particulates reduce the efficiency of treatment for chlorination, ozonation, UV light and micro-filtration. Once established, very little ongoing costs.

- **Heat Treatment**

This method is commonly used in Europe to disinfest greenhouse water before reusing it. Temperature of the water is recommended to reach 95ºC for at least 30 seconds for effective control. Disadvantages associated with this method are:

- high cost of heating water
- reduction of oxygen from water supply; and,
- ability to cool water especially in climates such as Queensland.

- **Ultra-Filtration**

Ultra-filtration relies on fine membrane filters that contain small pores which physically filter the suspended solids, colloidal and organic matter as well as bacteria and viruses. This kind of filtration completely eliminates the water pathogens, but can be quite expensive to run. Pre-filtration is required as in UV treatment and problems may arise from the filter pores becoming blocked over time. Reliability has been an issue in the past. Filters of different pore sizes have been tried *(0.05 - 0.25µm)*. Technically, it is difficult because of clogging and success has been variable.

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Chemical disinfestation relies on a certain percentage of the active ingredient to be present in the water to ensure disinfestation effectiveness. Residues of these chemicals can build up in the growing media over time, which may make management more difficult if media is reused or kept for long periods of time.

- **Ozone**

Ozone treatment is more expensive in capital and operating costs than other technologies. The treatment process consists of bubbling ozone gas through the water to saturate it with ozone which rapidly breaks down into dissolved oxygen and hydroxyl ions as it reacts with impurities in the water. The capacity of ozone to disinfest water is affected by organic matter present, water pH, salts (conductivity), and amount and type of iron chelates in the water. The rate of ozone breakdown increases at high water pH and its effectiveness is reduced by organic matter and higher salt concentrations. Some fertilizers, pesticides and herbicides are removed by ozone treatment. Ozone generators use electricity to create ozone and are relatively small and cost effective to operate.

- **Chlorine-Dioxide**

Chlorine-Dioxide is a new disinfectant in the horticulture industry for controlling algae, bacteria, viruses, fungi and other microbial pests on greenhouse surfaces and in greenhouse irrigation systems. Chlorine-Dioxide is a yellowish gas which is formed on site by combining hydrochloric acid and sodium chlorite. The advantages of this system are that it works effectively on both high and low pH ranges and very low concentrations are needed for effective control of most pathogens. Disadvantages include cost and complexity of the system, and residual build up in media over time as well as the need for appropriate storage facilities for the chemicals.

- **Chlorine**

Chlorination is effective over a wide range of biological agents, works rapidly, and is a relatively inexpensive disinfection system that is simple to operate. It is active though, over a smaller pH range than some of the other methods. Chlorination is usually carried out by injecting metered amounts of sodium hypochlorite solution, calcium hypochlorite solution or chlorine gas. The difficulty with effective chlorination is that the amount of chlorine required depends on the impurities, primarily organic matter in the water. To determine whether chlorination is effective, the residual free chlorine needs to be monitored regularly. There is a danger of phytotoxicity to plants if the residual free chlorine levels rise too high. Health hazards are a concern and safety precautions that must be taken when handling the chlorination chemicals and also when storing the product.

- **Bromine**

Bromine is similar in action to chlorine but it is more active at a wider pH range. Bromine is created similarly to chlorine, by adding sodium bromide, a natural compound found in sea water, to sodium hypochlorite. Less bromine is needed in the water supply to be effective at killing pathogens in comparison to chlorine.

- **Iodine**

Iodine is an extremely powerful fungicide and bactericide control. Iodine is quite effective even with high organic load (dirty water) and is not affected by pH. It remains active in a water pH between 3 and 8.5 without altering the pH solutions. Iodine has no impact on nutrients in solution, therefore, fertigation and sanitation can be used together. Monitoring of Iodine levels is very important to reduce toxic affects on plants.

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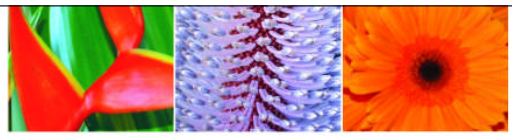

FAQI

Flower Association of Queensland Inc.
www.flowersqueensland.asn.au

Advantages & Disadvantages of Types of Disinfestation Systems		
Method	Advantages	Disadvantages
Sand Filtration	No chemicals	Does not control fusarium
Membrane	No chemicals	High maintenance costs
Heat	No chemicals	Expensive process
Chlorine Gas	Effective at disinfecting. Residual easy to measure	Careful handling & storage needed
Chlorine Dioxide	Works in poor quality water at any pH	Residual effect may affect plant health if not monitored properly
Ozone	No residual chemicals. Ongoing costs low	Works better at below pH7
UV Light	No chemicals. Ongoing costs low.	Works effectively only in good quality water. No residual. Works below pH7
Iodine	Effective control over a wide range of pH	Expensive operating costs, poor reputation in recent times.

Suppliers of Disinfestation and Filtering Systems and Methods		
Alliance Water Solutions (*Nambour, Qld)*	Ozone, Iodine, Chlorine Dioxide, Liquid Chlorine, Bromine, UV, High Temperature	Phone (07) 5456 4378 tom@alliancewatersolutions.com.au
Rothwells (*Alstonville, NSW)*		Phone (02) 6628 6609 darrels@rothwellspumps.com.au
ALLDOS Oceania Pty Ltd *(Acacia Ridge, Qld)*		Phone (07) 3712 6888 alldos.au@alldos.com
GRAYSON AUSTRALIA	Chlorine Dioxide	Phone (03) 8727 6900 sales@tecnica.com.au www.tecnica.com.au
PurePro	UV systems	Free call: 1800 850416 sbrassington@purepro.com.au www.purepro.com.au
RB Irrigation	Ozone, Nirosoft Ultrafiltration	Phone (02) 6372 2888 Email: rbgats@bigpond.net.au
Ozone Industries	Ozone	Phone (02) 9872 8501 Email: sales@ozoneindustries.com.au www.ozoneindustries.com.au
Ozone Generator Specialist	Ozone	26 Export Dr Ernest Qld 4214 Phone 0400 633 680
Abtech Environmental Services	UV systems	Phone (08) 8243 0633 enquiries@abtech.net.au www.abtech.net.au
Ultraviolet Technology Of Australasia Pty Ltd (Orica)		PO Box 222 Marden SA 5070 71 Lewis Rd Glynde 5070 Phone (08)8337 0079 uvta@uvta.com.au www.uvta.com.au
PowerPlants (Priva UV systems)		10 Wedgewood Road, Hallam Vic 3803 Phone (03) 8795 7750 Fax (03) 8795 7752 www.powerplants.com.au

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