Treating Recycled Water for Healthier Plants

As the need for recycled water increases, new technologies must be explored.

By Robert Larose

To grow healthy plants, there are a number of key ingredients that are required: plant materials, substrate to grow the plants in, sunlight, nutrients and water. Water is critical; most plants require their own weight of clean, disease-free water each day to thrive.

A typical acre greenhouse can require up to 50,000 gallons of water per day. Commercial growers are increasingly using recycled water due to regulatory and economic pressures. While using recycled water makes good sense, it poses a problem with regard to controlling algae and pathogens that cause plant disease. Most greenhouses already have methods in place to improve water quality, but as the need for recycled water increases other options and strategies have to be explored.

New Chemical Technologies

As greenhouses grow, recycled water demands increase. Utilizing chemicals to clean water is an old game that has traditionally used old technologies such as chlorine, bromine, and heavy metal chemistries such as copper.

The green movement that is promoting sustainable horticulture is looking for alternatives to the old chemistries of the past 100 years that do not negatively impact the environment or create worker exposure hazards. New products are on the way that utilize activated peroxygen chemistries and/or novel applications for long chain fatty acids.

Water Treatment Equipment

The lure to purchase equipment that takes care of all water treatment applications is a strong one. When debating this option there are many factors that must be considered. There are a number of technologies available that are based upon an onsite generation of water sanitation technology that can treat irrigation water. The most popular technologies are ozone, reverse osmosis, UV, chlorine dioxide generation, and copper ionization. These technologies rely on various types of electromechanical generation systems that either produces a light wave, an oxidizer gas or chemical, or ionized copper particles.

A major consideration is that vendors have to size each unit to an existing set of conditions of your operation. These attributes include pipe sizes, water flow, water pressures and current water quality issues.

Take into account the current situation, but also make sure vendors are informed of future goals and plans. Expanding greenhouses should consider their expected growth and plan ahead. Make sure the new equipment is not going to be outdated in just a couple months or years. These considerations add stress to purchasing equipment for some growers, as coming years may be hard to predict. Sometimes growers anticipate these changing conditions by "over-engineering" the size of the unit to account for increased flows and to accommodate other conditions they cannot account for. Subscribing to the idea that bigger is better can lead to equipment quotes that are too expensive and, in the end, not what you were looking for.

But don't make your decision entirely on price. Equipment designed and sized to fit a set of economic limitations may be undersized but meets the customer's budget threshold. Price is a factor but make sure the equipment is appropriate for your operations. It may be wiser to wait and utilize chemicals until you can purchase the correct equipment than settle for less than you need.

The equipment you purchase will be the best estimate to meet your irrigation needs if it is based on the set of conditions that exist at the time of sizing the equipment and prediction of future needs based on specific goals and timelines. Don't over-reach, but don't forget

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to plan ahead.

When considering a potential purchase of equipment such as UV, ozone, copper ionization, or similar technology, ensure you are considering your water conditions and how they will affect your equipment.

The original, overall water quality is the major factor that will affect most systems. These factors include high levels of suspended solids: water turbidity, water color, and solubilized organic matter. Characteristics found in chemically-treated water also include nitrites, sulfites, iron, hardness and aromatic organic levels. These factors will affect most systems, and some type of pre-treatment filtration should be installed in front of any system to try to remove as many organic and inorganic particulates as possible. Very few filtration systems will be able to handle the suspended solids, nitrites, sulfites, iron, hardness and aromatic organic levels without careful planning.

Most importantly, have a water test completed by a service that can test for the typical water characteristics of suspended solids, pH, iron, water hardness, hydrogen sulphites, humid acids, sulfites, nitrates and manganese. The water test should also look for biological contaminants including algae, bacteria and fungi. Remember, the system is being installed to eliminate these organisms. Knowing what the targets are will help system designers more correctly size the system for utmost efficiency. In addition, insist on a post installation follow-up test. In this manner, you will be able to properly assess the success of the system installed and make any adjustments that may be required.

All systems have their advantages, but all systems also have the common disadvantage of requiring a relatively high up-front investment. Another consideration is they all require the consumption of electrical power to run their systems, an increasingly expensive commodity.

Combination Solutions

Water is affected by biological and inorganic contaminates and water characteristics such as pH, bicarbonates or fertilizer elements that are constantly changing during the growing season. Whatever method is chosen — chemicals or equipment — it is almost impossible to achieve 100 percent efficiency and effectiveness with one technology solution.

The inherent challenge to all of the equipment systems is that they provide an essentially static approach to the problem of treating irrigation water, a continually changing matrix. Only the most expensive equipment, which most growers cannot access, can meet the constantly changing water conditions. To account for these changing conditions, growers should consider supplementing their equipment water treatment system with a compatible chemical injection. Growers should pick a product that is easy on the system. One chemistry that does not harm equipment are peracetic acid chemistries such as those manufactured by BioSafe Systems under trademarks ZeroTol Broad Spectrum Algaecide/Fungicide or SaniDate 12.0 MicroBiocide. The small but effective amounts of activated peroxide that can be injected will help supplement the operating deficiencies that the equipment will encounter,

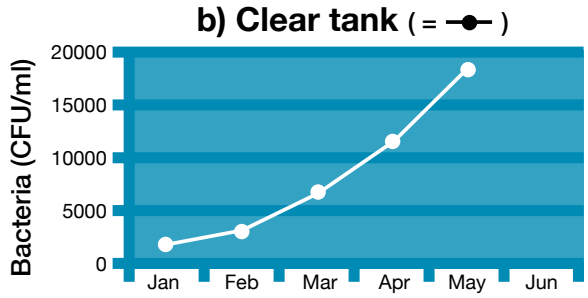

Figure 1. *Number of microorganisms present by month*

and help adjust for changing operating conditions throughout the year.

Figure 1 (above) is an example of how populations of microorganisms increase during the months that are warmer and have higher light levels. During these times a generation system can be outpaced by the expediential growth of microorganisms, especially in the return tanks of recycled water systems. The additions of activated peroxygens to water treated by either UV and or ozone systems can help produce an effect known as advanced oxidation.

Generation systems such as UV and ozone generators can be the cornerstone of a yearlong prevention program, treating large volumes of water. These systems have been proven effective at helping reduce general populations of microorganisms, but often need to be supplemented during the spring and summer months to help overcome increasing populations of algae, bacteria and fungi. In addition, these systems may become less efficient over time due to the buildup of minerals and organics that may interfere with their internal lamps and electrical components.

Advanced Oxidation Processes (AOP) combine the use of mechanical-electrical generators such as ultraviolet radiation (UV) and ozone (O3) with the injection of highly reactive materials such as peracetic acid. Advanced Oxidation Processes have several advantages, including the potential for treatment of inorganic and organic chemicals and the lack of formation of disinfection by-products. The resulting reaction often produces results greater than the single treatment by itself and sometimes produces results of 1 + 1 = 3. This allows the generation system to overcome design and operating inefficiencies with the addition of the activated peroxygen chemical.

The bottom line is that activated peroxygen technology may be used as a stand-alone treatment or in combination with electro-mechanical systems such as ozone, UV and copper ionization to help enhance or overcome design and throughput limitations. Companies such as BioSafe Systems have the technical understanding, laboratory and testing expertise, and chemical and regulatory expertise to allow us to work in partnership with growers to ensure that they meet their water treatment requirements in the most efficient and cost effective manner, while at the same time ensuring high levels of BioSecurity for their growing operations.

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