Testing for Water Sterilisation Effectiveness.

Good irrigation water quality is a keystone to producing quality nursery stock, and most water supplies require some form of treatment to make them suitable for nursery use. Water can be treated for four types of contaminates – particulate matter, pH, salts and pathogens. The following article discusses how to test for the effectiveness of treatments applied to kill or remove pathogens.

When testing for the effectiveness of treatments for pathogens, the type of tests used depend on the type of sterilisation process. Water sterilisation treatments can be divided into three groups – oxidizing chemicals e.g. chlorine, physical treatments e.g. ultra filtration (UF), and ultraviolet light (UV). Generally, oxidizing chemicals are measured using a chemical indicator to determine the amount of chemical in the water, and physical and ultraviolet light systems require direct measurement of the pathogens remaining in the water after treatment.

When using oxidizing chemicals, once the chemical has reacted with all the nutrients, organic matter and pathogens in the water, the amount of chemical that remains can be measured, and this is used as the indicator of the effectiveness of sterilisation. The amount of chemical used in reacting with the contaminants is referred to as the chlorine demand, and the amount of chemical remaining after treatment the residual level. Once a certain residual level has been achieved for a minimum amount of time after treatment, the water is considered to be sterilised. The amount of chemical required to achieve sterilisation will vary depending on the quality of the water being treated.

Unlike plant protection chemicals, a set amount of chemical per litre isn't added, as water quality varies with seasonal variations, and consequently, so does the chlorine demand. Therefore, the residual amount of chemical must be constantly monitored, and the amount of chemical added adjusted, to take into account these variations. On-site testing is the only practical way of measuring the amount of chemical present as the residual level continues to decline over time. Best Management Practice Guidelines recommend the residual levels required for effective sterilisation are, for chlorine - 2-3ppm residual at 20 minutes after treatment (contact time) (pH also needs to be below 7.5), for chloro-bromine -8ppm at 8 minutes, chlorine dioxide - 3ppm at 8 minutes and for ozone - 1.4ppm at 16minutes.

For chlorination systems, pool test kits are the cheapest option and can be used for chlorine, chloro-bromine and chlorine dioxide treatment systems. When using these kits for testing chloro-bromine or chlorine dioxide, the reading obtained must be multiplied by 2 to convert the reading to the actual amount of chemical present. Ozone can be measured by colorimetric test kits which give a direct reading in parts per million. A more accurate means of measuring residual levels of oxidants are photometers. These meters give a more accurate measurement of levels and remove the human error from interpreting the colour of the solution, but are significantly more expensive than pool test kits.

Physical treatments for pathogens either remove the pathogens by micro filtration or by using biological means (slow sand filtration). When using either physical treatments or UV sterilisation, efficacy has to be tested directly by determining if any pathogens remain in the water. This can either be done by a laboratory, or onsite, using a technique called baiting, in which a prepared pieced of leaf material is suspended in the water and then tested for pathogens using a Pocket Diagnostic Kit. The Pocket Diagnostics website www.pocketdiagnostickits.com.au/index.html has more information on baiting techniques, use of the kits and ordering.

In addition to testing the effectiveness of treatments by the above methods, maintenance of physical and UV sterilisation systems is critical in maintaining their efficiency. Microfiltration systems require regular cleaning of the filter elements to maintain their efficiency and slow sand filters must have the buildup that develops on the top of the sand regularly removed to maintain sufficient flows through the sand bed. UV tubes need to be replaced at the recommended interval and daily checks of their operation should be made, as well as regular laboratory testing of turbidity and UV transmissibility of the water to be treated.

For more information on water sterilisation refer to the “Nursery Industry Water Management Best Management Practice Guidelines” pp 45-48 which can be downloaded free from the NGIA website.

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