UV Disinfection: STEP BY STEP

By Sheila Berg

Basics of putting UV disinfection systems to good use

Many of us may not realize that our water supply is not a never-ending supply and it is not as clean as it may appear. Chlorine can provide an effective disinfectant residual, but it is unable to effectively treat some pathogens. Ultraviolet (UV) technology is more effective than chemicals in destroying certain waterborne contaminants without altering the taste of water, making it a practical process for treating water used for drinking and food preparation.

How Does It Work?

UV light destroys bacteria and viruses by altering DNA. This natural, non-chemical method of treatment alters the DNA of the microorganisms in a process called thymine dimerization. The microorganisms are "inactivated" and rendered unable to reproduce or infect.

UV Light Advantages

Treating a water supply with UV disinfection is not only effective, but it is also environmentally responsible. There are no disinfection byproducts with the use of UV, which is safe and chemical free. The use of UV disinfection also removes the need to handle and dispose of hazardous materials. Additionally, UV does not alter water chemistry and its constituents, such as pH, taste, odor or color.

Purchasing a UV disinfection system for a home or even a light commercial application has a low capital cost as well as a low operational cost. The energy used by a UV disinfection system in an average home is comparable to the energy used by a 40-watt bulb.

UV disinfection systems can be used in conjunction with other water treatment methods such as softeners and require very little maintenance as long as the water has been properly pretreated.

Installation and Operation

UV disinfection systems are extremely user-friendly and are easy to install and operate. There are no moving parts that wear out—only a UV lamp to replace on an annual basis for optimal disinfection. They have a compact design, making them easy to fit into any plumbing layout.

Determining Dosages

The UV disinfection process is quick, but different germs require different UV dosages to be destroyed. By definition, dosage is a function of intensity multiplied by time.

Intensity is the magnitude (amount) of UV energy that lamps generate at a given distance from the lamp per square centimeter of surface area (expressed in microwatts per centimeter squared). The lamp's intensity is measured at different distances from its surface. The intensity decreases by the square of the distance from its source; as the distance from the lamp increases, the intensity decreases. The level of intensity is usually measured at the farther point in the UV chamber, or the distance from the lamp's surface to the chamber's inside wall.

Time is the period it takes water to travel from the inlet port to the outlet port of the UV chamber.

This is expressed in seconds and is calculated at a given flow rate, taking into consideration the dimensions of the chamber.

Factors Affecting Performance

UV is only effective if it hits its target, so it is important to be aware of the factors that could affect the performance of UV disinfection equipment.

Flow rate. The UV equipment capacity must match the target microorganism's UV dose requirement. In other words, the microorganism must be held in direct contact with the UV-C light for a specific amount of time (UV exposure uWs/cm^2), enough to irradiate it.

UV absorption. Dissolved substances such as iron and manganese and certain organic substances will absorb UV energy and leave little for disinfection.

Suspended solids. Contaminants can be shielded from UV by suspended

solids, which act like umbrellas hiding organisms from the germicidal light.

Water quality (hardness and iron). Water temperature will affect the UV energy produced. Quartz sleeves can minimize the temperature fluctuation effect and regulate UV dosage levels transmitted into the water. The water's hardness can also affect the performance of the UV system by causing scale to form around the lamp's sleeve, reducing UV light transmission and the germs-kill ratio.

Try on the Right Size

Consider the following parameters to accurately size and install a UV system: capacity (flow) required, feedwater quality, the pretreatment used and the purpose of treatment.

If in doubt, always oversize the UV unit instead of under-sizing it to save on cost. Often the cost of a larger unit is only a few dollars more. Usually an 8-gal-per-minute (gpm) UV unit is adequate for an average size home. UV units should be placed as close to the point of use as possible.

Pre-sterilize all pipes and tanks by chemical shock treatment and flush thoroughly prior to using a UV unit for the first time. Install the system on the cold water line before any branch lines.

The UV unit should be installed after all other treatment processes except microfiltration.

To ensure the safe operation of a UV system, test the water periodically for bacteria and other contaminants. *wqp*

Sheila Berg is marketing communications manager for VIQUA – a Trojan Technologies Co. Berg can be reached at sberg@viqua.com or at 800.265.7246.

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