

ChemScan®

PROCESS ANALYZERS

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ChemScan® Application Summary #103 Ultraviolet Disinfection Control

Statement of the Problem

Ultraviolet light is frequently used to disinfect water or wastewater for economic reasons and because chlorine tends to form unwanted and potentially harmful by-products when combined with organics. Chlorine also tends to impart objectionable taste and odor in potable water and may be harmful to aquatic life when discharged in wastewater. Although by-product formation may not be completely eliminated when ultraviolet light is used, by-product formation is substantially reduced, there is no additional taste or odor residual and safety issues related to the handling of chlorine are eliminated.

Ultraviolet disinfection requires a minimum applied dosage to be effective. This applied dosage is a function of the lamp intensity and the exposure time. These parameters are directly affected by equipment configuration, flow path of the water through the bank of lamps, plus the solids content and transmissivity of the water to be disinfected.

Each manufacturer has their own proprietary equipment configuration. Some manufacturers offer UV disinfection systems with lamps configured in a manner which permits fewer lamps to be operated when the water to be disinfected offers less resistance to the transmission of UV light. Changes in turbidity, suspended solids, microbial populations and/or background water chemistry can result in substantial changes in the light transmittance characteristics of water at germicidal wavelengths. Substantial energy savings may be available if acceptable levels of disinfection can be achieved using a reduced number of lamps.

Process Control Issues

Some manufacturers offer an internal device, designed to measure the amount of ultraviolet light being received on the surface of an optical detector. Care should be taken so that changes in the output of the internal light source (due to age or fouling) and fouling of the detector surface can be separated from changes in the transmissive characteristics of the media to be disinfected. Otherwise, false information will be communicated by the internal sensor, which may be measuring conditions other than changes in the media.

Apparatus

ChemScan Process Analyzers can be used to detect the absolute percent transmittance at 254 nm, independent of fouling. A side stream sample of the disinfection influent flows through a cell within the ChemScan Analyzer, where a full spectrum of ultraviolet and visible light is transmitted through a fixed path length of sample. Frequent automatic zeroing and cleaning of the optical surfaces within the flow cell eliminates the effect of fouling on the UV transmittance measurements being made by the ChemScan Analyzer.

Percent transmittance of light at 254 nm can be continuously measured at frequent intervals. (See ChemScan Method Summary #42, % Transmittance in Treated Wastewater.)

Iron fouling is a significant issue for UV disinfection systems. Dissolved iron is oxidized by UV light and can plate out on the surfaces of the UV lamps, reducing their effectiveness. A full spectrum ChemScan Analyzer can be used to detect dissolved iron and other parameters of interest for process monitoring and control in the influent to the UV disinfection process. These measurements can be used to initiate alarms, adjust upstream aeration processes, or adjust UV dosages.