Technical Note 28

Importance of Measuring UV Transmittance (UVT) for UV Disinfection

UV disinfection systems disinfect water using UV light at 254nm wavelength. UV light at this wavelength destroys the DNA of microbiological material in the water which prevents dangerous pathogens such as Cryptosporidium and E-coli from reproducing and causing harm.

UV Disinfection Dose and UV Transmittance (UVT)

The effectiveness of a UV disinfection system depends on the UV dose that the system is able to deliver to the water. The UV dose is primarily dependent on the combined effects of:

- **UV light intensity**
- **Exposure time of the system**
- **UVT of the water**

The intensity of the UV light source is dependent on the size and type of the UV lamp used and the power supplied to the lamp. The exposure time of the system depends on the flow rate of the system. The flow rate is often regulated between multiple UV disinfection systems operating in parallel, and there is often a manufacturer specified maximum flow rate for the system. The UVT of the water being disinfected can significantly affect the effective UV dose delivered to the water by the UV disinfection system and it varies over time, from site to site.

UVT is related to the amount of organics, colloidal solids and other material in the water which absorb and scatter the UV light as it passes through the water. In a UV disinfection system, if the UVT of the water is too low, then the UV light is not able to penetrate the water as efficiently, thereby reducing the effective UV dose delivered by the system. This is why manufacturers tend to state a minimum UVT for a UV disinfection system, below which the system will not function properly.

Turbidity and Colour

It is often thought that if water appears clear or if turbidity is low, then this means the UVT will be high. This is not necessarily true. Turbidity is a measure of the clarity of the water and is not related to the organics that tend to affect UVT. It is true that colour usually does indicate the presence of organics in the water such as tannins and humic material, however, it doesn't mean that just because the water doesn't appear coloured, the UVT will be high. This is because some organics that cause low UVT, such as pesticides, can be present in the water but do not add any visible colour to the water.

Changing UVT

There are occasions when one water source, such as a lake or river, can contain varying amounts of organic materials and have different UVT values at different times. Different kinds of weather can potentially affect the UVT of a water source, which can cause significant changes in UVT from season to season. Spring and Autumn months typically have the lowest UVT values due to melted snow runoff and decaying plant matter.

Due to the effects of UVT on the performance of UV disinfection systems, it is vital that the UVT of the water is known at all times for every UV disinfection system application to ensure proper treatment. If UVT drops then bulb output can be increased or an alarm can be triggered. If UVT increases then bulb output can be reduced to increase bulb life and reduce energy costs.

Pi's Solutions

Pi has several products that can be used to ensure the correct operation and performance of UV disinfection systems. The UV254Sense range of analysers allow continuous, real-time testing of the UVT of the water. The UVT is conveniently output via a 4-20mA communication interface either directly to the UV disinfection system or to a PLC. Pi offers several models to meet any specific site requirements.

- **UV254Sense (Water) -** can be used in most general water qualities.
- **UV254Sense (Waste) -** specifically waste water, but can also be used in general water supplies.

In addition to monitoring UVT in real-time, it is also often necessary to perform UVT testing on grab samples. Pi's UV254Portable is ideal for providing on-site UVT tests of grab samples within a couple of minutes. It can be used for servicing existing UV disinfection systems or for determining UV disinfection design requirements at potential installation sites. The UV254Portable can also be used to validate the performance of Pi's UV254Sense (Water) and UV254Sense (Waste) analysers.