

UVA -%UVT -Turbidity Monitoring with the LiquID™ Station

Defining UVA, %UVT and Turbidity

Measuring UV-light at the specified wavelength of 254nm is a well-known and common tool with a history of use in both clean and waste-water applications (EPA method 5910B). In essence UVA and UVT% represent the same data presented using different, but related, mathematical treatments as described by the following equations:

$$(1) \quad \text{UVA} = A_{254\text{nm}} = -\text{Log}(I / I_0)$$

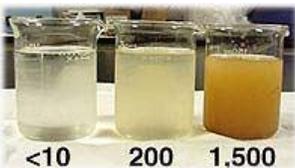
$$(2) \quad \%UVT = 100 \times I / I_0$$

$$(3) \quad \%UVT = 100 \times 10^{-\text{UVA}}$$

Where: I = intensity of light at the detector (light out)

I_0 = intensity of light incident to the sample (light in)

Although the raw data used to generate both parameter outputs are the same the information they provide is different. UVA, as described by equation 1, represents the amount of light absorbed by constituents within a sample stream (light energy that does not reach the detector) there defined as **UV absorption**. %UVT, as described by equation 2, represents the amount of light transmitted through a sample stream (light energy that reaches the detector) and therefore defined as **UV transmittance**. In practice, which parameter used is determined by what information the user needs. For instance, UVA is commonly used as an indicator of general water-quality or the potential for disinfection by-product formation, whereas %UVT is more commonly used to gauge lamp intensity requirements for UV-disinfection.



Turbidity in NTU.
USGS, Chattahoochee River

Turbidity is an indicator of the visual “haziness” of a sample stream and is defined as a measure of the amount of light scattered by particulate matter suspended in the sample (examples pictured on the left).

Historically, turbidity is a measure of either attenuated or scattered light (e.g. EPA Method 180.1) measured in the visual or near-infrared spectrum and reported as either nephelometric turbidity units (NTU), Formazin turbidity units (FTU), Formazin nephelometric units (FNU) or simply turbidity units (TU). The units used by a given instrument relate back to the design

About LiquID™

The LiquID Station from ZAPS Technologies (pictured below) is an innovative, optical instrument for continuous water quality monitoring. The automated online instrument analyzes a continuous flow-through stream from a pressurized water sample line using multi-spectral light and software algorithms, and uses no reagents nor produces any waste other than the original sample (which is returned or wasted as appropriate). With this method LiquID is capable of monitoring a wide range of water quality parameters in a number of different industry applications, including those relevant to municipal water and wastewater treatment, water reuse systems and industrial process control.



and calibration of the instrument with the use of “N” implying light scattering measured at a 90°-angle and “F” indicating the use of Formazin solution as a primary standard. In practice turbidity is quantified by relating it back to a known standard. However, despite these common practices it remains very difficult to relate turbidity measurements between instruments and from one sample stream to another because the intensity of scattered light is dependent on particle size, density, refractive index, the true color of the sample stream, bubbles, sample cell variations and optical fouling all of which will impact different instruments in varying ways depending on the wavelength(s) of incident light used in the measurement.

LiquID’s advanced approach to UVA, %UVT and Turbidity

The ZAPS LiquID Station’s unique design and hybrid multi-spectral output provides several advantages toward improved UVA, %UVT and Turbidity monitoring:

- By delivering light directly to the fluid being analyzed the need for corrections at media interfaces, such as light passing through variable distances of air or at cuvette surfaces, and variations introduced by different sample cells are eliminated.
- The use of a single light source and detector allows component degradation, such as signal decay due to fouling, to be easily tracked and corrected for on all parameter outputs eliminating the effects of variable fouling on different probes within a probe array.
- Board spectrum analysis and multi-parameter output allows for correction due to interferences such as the impact turbidity has on a UVA or %UVT measurement (and other absorption based outputs).

In addition, we at ZAPS Technologies believe our unique approach toward turbidity monitoring produces a more robust, applicable and transferrable view of sample stream turbidity. The advanced view of turbidity provided by the LiquID Station builds on the features discussed above and from the combination of 3 key features:

1. The use of a high-sensitivity PMT and attenuation measurements allows the LiquID Station to operate in both low (< 1 NTU) and high (>100 NTU) turbidity environments.
2. Hybrid multi-spectral analysis allows measurement at multiple wavelengths and provides greater sensitivity to a wider range of particle size and particle density.
3. The ability to ratio spectral peaks reduces the effect interferences such as the contribution true color has on the attenuation of a signal at a given wavelength.

These advancements allow the LiquID Station to recognize and account for particles over varying size distributions resulting in a turbidity measurement that is less biased by shifts in the particle density at one size fraction. By accounting for a wider range in particle sizes we are able to provide our customers with a more comprehensive view of particulates within their sample stream and ultimately leading to a more detailed view of particle behavior within a given system. The combination of the design features and measurement approach described above gives the LiquID Station the flexibility to continuously monitor UVA, %UVT and/or Turbidity in a wide range of environments and applications without requiring frequent operator cleaning or calibration.

Contact ZAPS For More Information

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