

## Notes on Turbidity and Suspended Solids

Bulletin #1 (clar1) 2 pages: definition, relationship, formazin  
Re: Claritek SM8830L

Turbidity is the measurement of the effect that suspended solids has on the transmission of light through an aqueous solution such as water. This is a qualitative measurement.

Suspended Solids measurement is a quantitative analysis of a solution. In a lab this is usually accomplished by drying a known volume of the solution and then weighing the remaining particles in mg/l or ppm.

Since the properties of suspended solids in different applications may vary (ie. size, shape, density, organic structure, etc.), the resulting effect on the light transmission (turbidity) may vary. A stream of municipal wastewater, for example, carrying a suspended solid concentration of 15 mg/l will likely have a different turbidity than a stream of effluent from a coal plant also carrying 15 mg/l of suspended solids. The make-up of the suspended solids differs and will therefore scatter and absorb light differently.

Continuous and automatic measurement using a light transmission method can generally be accomplished in one of two ways.

- 1) measurement of the light that is scattered by suspended solids, referred to as nephelometric measurement, or
- 2) measurement of the amount of light that is able to pass directly through the medium, referred to as light attenuation.

Both methods can be related to turbidity.

Historically, light attenuation was used to measure turbidity. The effect of 1 ppm of silica in a solution was referred to as 1 Jackson Turbidity Unit. Limitations of light measuring technologies restricted the use of this method to higher ranges of turbidity.

For low range applications, like most environmental effluents and process applications today, the measurement of light proved to be more reliable if the scattered light was measured. Placing the light detector at a 90 degree angle to the source was the most predictable method and became the accepted standard for this technique.

While nephelometric measurements for turbidity allow a greater measurement range into low concentrations, applications are limited to streams with suspended solids that actually scatter light. Particulate, such as coal dust, has limited reflective abilities and tends to absorb light, rendering the scattered light technique ineffective in many applications.

With advances in light measurement and transmission technologies, the ability to measure light attenuation in low ranges is now readily available to industrial instruments. The Claritek SM 8830L uses the light attenuation technique for the measurement of effluents. A laser light source provides an intense and stable light path while a highly sensitive detector chip monitors the

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direct received light. This is coupled with the Arjay controller for calibration and signal conditioning.

Since nephelometric light measurements and attenuated light measurements are related in the same stream of measurement, an instrument can readily be calibrated to NTU's (nephelometric turbidity units) using either technique.

To provide an industry accepted standard for which to calibrate and maintain stability records of the variety of technologies and manufacturers, a formazin solution is used. Formazin solutions offer a repeatable and reliable basis to calibrate or reference a unit. It must be remembered that since stream make-ups differ, the ultimate Suspended Solids and/or Turbidity measurement cannot be accurately calculated or correlated without an in-situ calibration.

Once this is done, the instrument can be correlated to a Formazin solution for future calibration checks. For instance, where an in-situ calibration provides a reading 100 mg/l, a 100 NTU Formazin solution test may display only 25 mg/l on the instrument. This should be recorded and used as the correlation for future tests and calibration checks. This correlation would differ for each application, instrument, and manufacturer. If an instrument is calibrated for NTUs using an NTU Formazin sample, the actual stream measurement will read in NTUs relative to the Formazin sample. Different instruments calibrated to the same Formazin may not necessarily read identically in the same stream since factors such as the type of light source, detector, and physical mountings will come into play.

Since most applications prefer a quantified output in ppm or mg/l of suspended solids, an instrument should readily be able to be calibrated to these units, as well as NTUs if desired.

Since each application is unique, an instrument calibrated in NTUs cannot automatically flip to ppm or mg/l without a quantified lab analysis of the solution.

#### **The Claritek SM8830L from Arjay Engineering Ltd.**

- The Claritek SM8830L has been designed to provide the application diversity afforded by the light attenuation technique.

- Calibration is easily performed in-situ for greater accuracy.

- Output values may be entered in ppm, %, mg/l, or NTUs.

- The introduction of a prepared sample such as a Formazin solution is easily accomplished for reference calibrations.

- The Laser source provides the light strength and stability for a wide range of measurement.

- The Fiber Optic light delivery system into the stream keeps all electronics out of the stream to eliminate condensation and maintenance concerns.

- The patented water window design allows in-situ measurements with minimal maintenance. The result being a continuous and instantaneous (no lag time) output response for display, alarms, and recording requirements.