ORGANICS AREN'T INVISIBLE

A Guide for Simple Online Monitoring

REALTECH INC.

WATER QUALITY MONITORING SOLUTIONS

Control of dissolved organics has been one of the highest priority concerns for most water treatment plants for over 20 years. Organics monitoring is an even more critical issue today in the face of more stringent regulations and concerns around trace organics, emerging contaminants, and even counter-terrorism or water security. Despite the critical need, many plants still rely primarily on turbidity for monitoring and process control. Today, UV-based technologies are making continuous online organics monitoring simple, accurate, and affordable for many plants. In part one of this three-part series, we'll discuss the options for monitoring organics and the critical importance of this parameter to your process.

TURBIDITY MEASUREMENT: Less Than Half the Story

Beginning with EPA's passage of the original Surface Water Treatment Rule (SWTR) in 1989, removal of organics from raw water has become increasingly important for water treatment. Subsequent updates to the LT2ESWTR and more recent concerns about disinfection byproducts (DBPs), trace organics, and emerging compounds have made organics removal even more critical. While all treatment facilities have continuous online turbidity monitoring, it is a poor substitute for monitoring dissolved organics. As illustrated in Figure 1, turbidity spikes and organic content are often weakly correlated. Organic concentrations can change rapidly from seasonal variation, heavy rainfall or even accidental contamination without a corresponding change in turbidity. Conversely, organics concentrations can also remain elevated long after turbidity has settled. Moreover, turbidity rarely predicts how efficiently organics are being removed from the water.

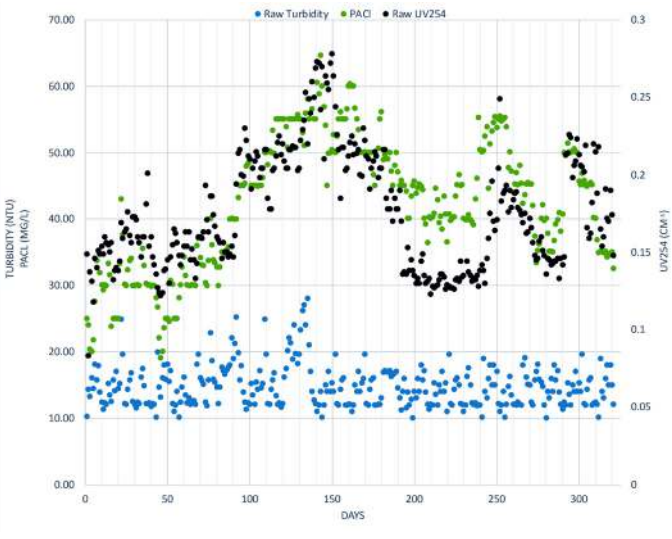

Figure 1: Real-time raw water organics in comparison to turbidity displays need for both measurements to effectively treat water.

If you're only measuring turbidity, you're getting less than half the story.

GRAB SAMPLING: Driving with Your Eyes Closed

Periodic grab sampling and lab analysis for organics is by far the most common practice for many treatment plants. While technically accurate, this practice provides only very limited snapshots of what is actually occurring in the raw water. Seasonal changes, weather, and other events can cause wide swings in raw water organics concentrations that can go undetected. The first indication of an organics event can often be noticed by seeing higher than expected finished water turbidity or from more frequent backwashing due to unmet coagulant demand. **In effect, grab sampling is like driving with your eyes closed.** A better approach is to provide continuous online monitoring which allows you to see, anticipate, and proactively respond to fluctuating raw water organics.

PREPARE MORE. React Less.

Early detection of changing organics concentrations is essential to get ahead of the problem. While aesthetic problems such as colour or taste and odour are closely linked to organics, a more serious concern is the formation of regulated DBPs which include trihalomethanes (THMs) and haloacetic acids (HAAs).

NOM + Cl_2 = THM, HAA, other DBPs

Through continuous online organics monitoring, the coagulation process can be simultaneously optimized for both organics and turbidity removal. Most plants find that such a treatment regime offers significant cost savings through more efficient coagulant dosing, less frequent filter backwashes, lower chlorine demand, and fewer upsets. **Most importantly, organics monitoring helps ensure that regulatory limits for DBPs are consistently achieved** enabling you to prepare more and react less.

UV254 Basics

A number of online organics analyzers have been introduced over the past 20 years. UV254 has proven to be an accurate and reliable method for measuring dissolved organics. Monitoring is achieved by shining ultraviolet (UV) light at 254 nm through a quartz cell that contains a representative water sample. Organic compounds, specifically those that contain aromatic rings or unsaturated carbon bonds (double or triple) in their molecular structure, absorb a portion of the UV light as it passes through the water. Since the intensity of the light source is known and constant, a detector at the opposite end of the cell is used to measure the amount of light absorbed by the organic compounds. If desired, the UV254 absorbance value can be calibrated to read as total organic carbon (TOC) or dissolved organic carbon (DOC) by means of a simple correlation.

SEEING THE INVISIBLE with UV254

Among the greatest benefits of continuous online UV254 monitoring is the ability to 'see' contaminants that were previously invisible to the treatment process. In addition, as noted by the USEPA guide[1], "studies conducted with different fractions of NOM have indicated the reaction between chlorine and NOM with high aromatic content tends to form higher DBP levels than NOM with low aromatic content. For this reason, **UV254, which is generally linked to the aromatic and unsaturated components of NOM, is considered a good predictor of the tendency of a source water to form TTHM and HAA5**." The simplicity of the UV254 measurement and relative low cost for online monitoring make it a practical selection for organics monitoring, process control, and ultimately limiting DBP formation.

[1] USEPA. (2008) Stage 2 Disinfectants and Disinfection Byproducts Rule – Operational Evaluation Guidance Manual.

ALTERNATIVE
Organics Methods

An alternative method for continuous organics monitoring is a TOC analyzer. In practice TOC is a measurement method that oxidizes organic carbon to carbon dioxide (CO_2) and measures CO_2 generated to determine TOC content. TOC is not biased or specific towards any one organic compound, rather it's a measure of the sum of all organic carbon present in a water sample. DOC is simply the fraction of TOC that passes through a 0.45 µm filter. In general, TOC is also useful for process control if measured online. Compared to UV254, online TOC analyzers are more complex and usually require reagents. This leads to both a higher initial cost and greater time and cost of ongoing operation.

UV-VIS DETECTION
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GREATER VISIBILITY

UV-VIS spectral absorbance instruments combine the benefits of UV254 with other wavelengths and measurement techniques. **The resulting instruments greatly enhance the overall detection capabilities and can even allow for the individual identification of specific organic compounds.** This powerful feature is key to addressing a host of trace organics and emerging compounds that may soon be regulated. An increasing number of facilities are using this advanced capability as a way to monitor for the presence of unknown compounds to address water security and counter-terrorism concerns in some areas. Overall, these instruments provide a powerful tool to understand, visualize, and respond to a wide range of contaminant in your water.

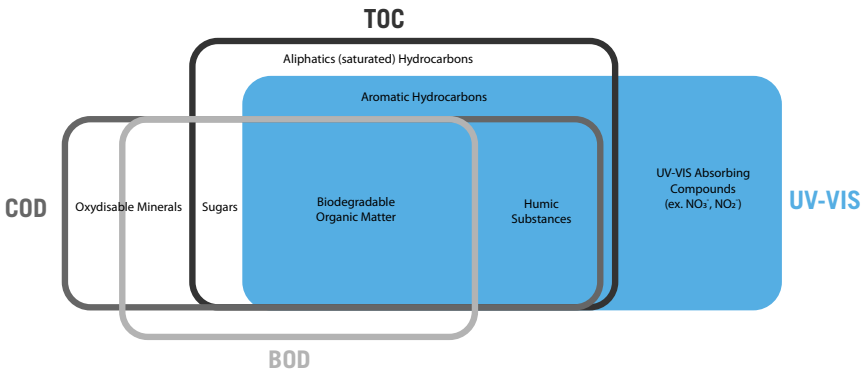

Figure 2: Broad overlap of multi-dimensional UV-VIS absorbance instruments with common aggregate organics parameters and additional absorbing compounds.

ORGANICS MONITORING:
The First Step

In summary, the addition of organics monitoring into your existing treatment process is a critical first step towards greater source water visibility. Early detection provides you with the necessary data to respond quickly and effectively before problems occur. Most facilities find that the cost and operational savings achieved from organics monitoring more than offsets the initial purchase and long-term operating cost of the instruments. Stay tuned for Part two of this series where we will discuss how simple, accurate, and affordable organics monitoring can help enhance process control at your plant.

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