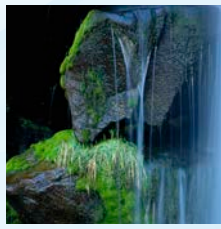
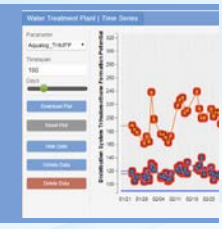
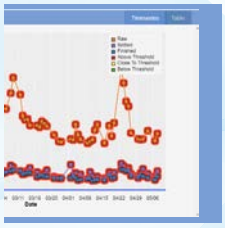
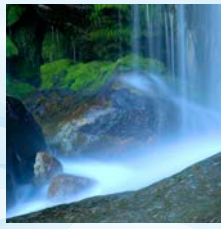
HORIBA
Scientific

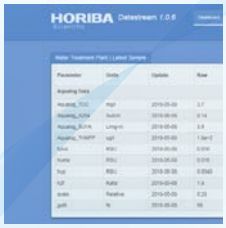
Aqualog® for Water Treatment Organics Monitoring

Featuring Datastream Dashboard





A Better, Faster Method for Monitoring Organic Carbon Concentration and Composition

www.aqualog.com

Aqualog®

For Drinking Water Treatment Plants

Validated, Automated Organic Analysis

The Aqualog monitors Dissolved Organic Carbon (DOC) concentration and composition, Disinfection By-Products (DBPs), DBP precursors, aromatic petroleum hydrocarbons, algae, and algal pigments associated with toxins, taste and odor issues. It comprises a patented two-in-one spectroscopic instrument providing absolute molecular fingerprints and a software package called “Aqualog Datastream” that automatically interprets the water sample measurements. Reported are high, low and Maximum Contaminant Level (MCL) threshold values of water quality parameters, providing timely actionable data to the water treatment plant operator. This is accomplished with simple push button operation and minimal sample preparation, and consumables.

Early Warning Sentinel

The Aqualog is an early warning sentinel for water treatment plants since it provides nearly instantaneous determination of DOC and composition, as well as Trihalomethanes (THM) formation potential, among many other key parameters. The early alerts facilitate prompt follow-up measurements according to established protocols, SOPs and regulations.

Saves Money

The DOC and enhanced THM formation predictive features of Aqualog have been documented to potentially save, on average, 5-10% of the annual chemical budget of a typical drinking water treatment plant. Chemical dosing needs to be applied only when the monitored levels are predicted to rise above pre-determined thresholds to ensure spending remains within the chemical budget for a given water treatment plant.

Rapid Return on Investment

The Aqualog provides rapid return on investment. With the typical annual chemical expense savings, the purchase of an Aqualog pays for itself within the first three to six months, and thereafter, those savings accrue every year.

For large municipalities, and large water companies, the Aqualog can save millions of dollars.

“We have been using the Aqualog instrument on a daily basis to monitor our treatment process performance, disinfection by-product formation potential and chlorophyll and phycocyanin signature intensities. The ability to obtain multiple measures from a single instrument is convenient and effective.”

Lori Silburt, Plant Manager
Wheeling Water Treatment

It's All About Organics

The Aqualog is a novel and valuable optical tool in the organics laboratory for water treatment plants. It is superior to conventional instruments in speed, sensitivity, and selectivity for organics.

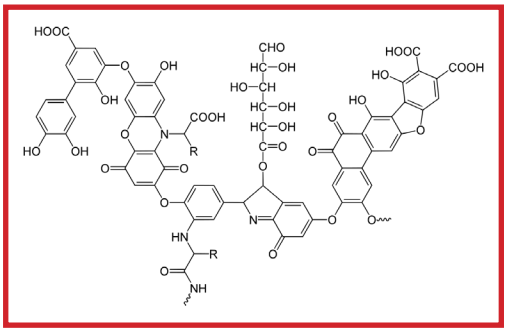
A primary concern for Drinking Water Treatment Plants (DWTPs), is humic and fulvic acids, due to their reactivity with halogenated disinfectants and tendency to form toxic DBPs, including THMs and haloacetic acids (HAAs).

Together, humic and fulvic acids comprise the majority of the DOC of natural organic matter in most surface water sources.

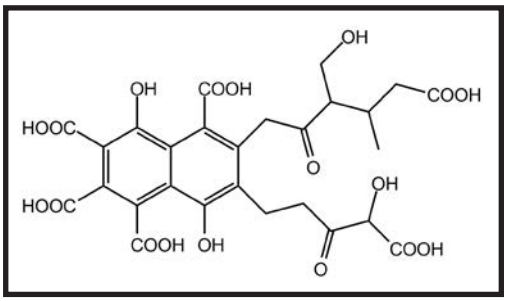
Humic acids are high molecular weight, aromatic compounds with multiple phenolic and carboxylic moieties linked together. They have a significant negative surface charge which gives them high affinity to positively charged coagulant compounds.

Fulvic acids, which are soluble in water at any pH, are relatively lower in molecular weight than humic acids, and have lower relative affinity to coagulants.

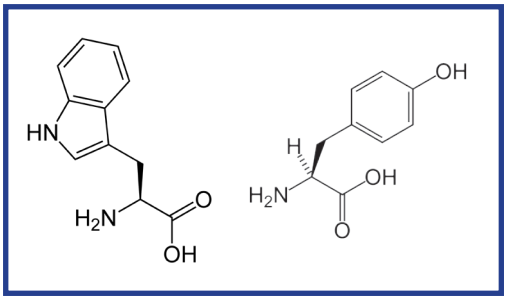
Protein-like compounds are another significant component of natural organic matter present in most surface water sources. They are also known to be associated with the presence of municipal wastewater and microbially available substrates. Compared to humic and fulvic acids, the protein-like compounds have a lower affinity to coagulants.



Humic Acids
- High MW
- Hydrophobic
- Highly Aromatic
- Absorbed by Coagulants
- Main SUVA (Specific UV Absorbance) Component)



Fulvic Acids
- Lower MW
- Hydro/Transphilic
- Less Aromatic



Tryptophan and Tyrosine
- Protein-like
- Associated with Wastewater Effluent
- Biopolymers

The Gold Standard for Water Treatment

A sampling of Aqualog customers around the world

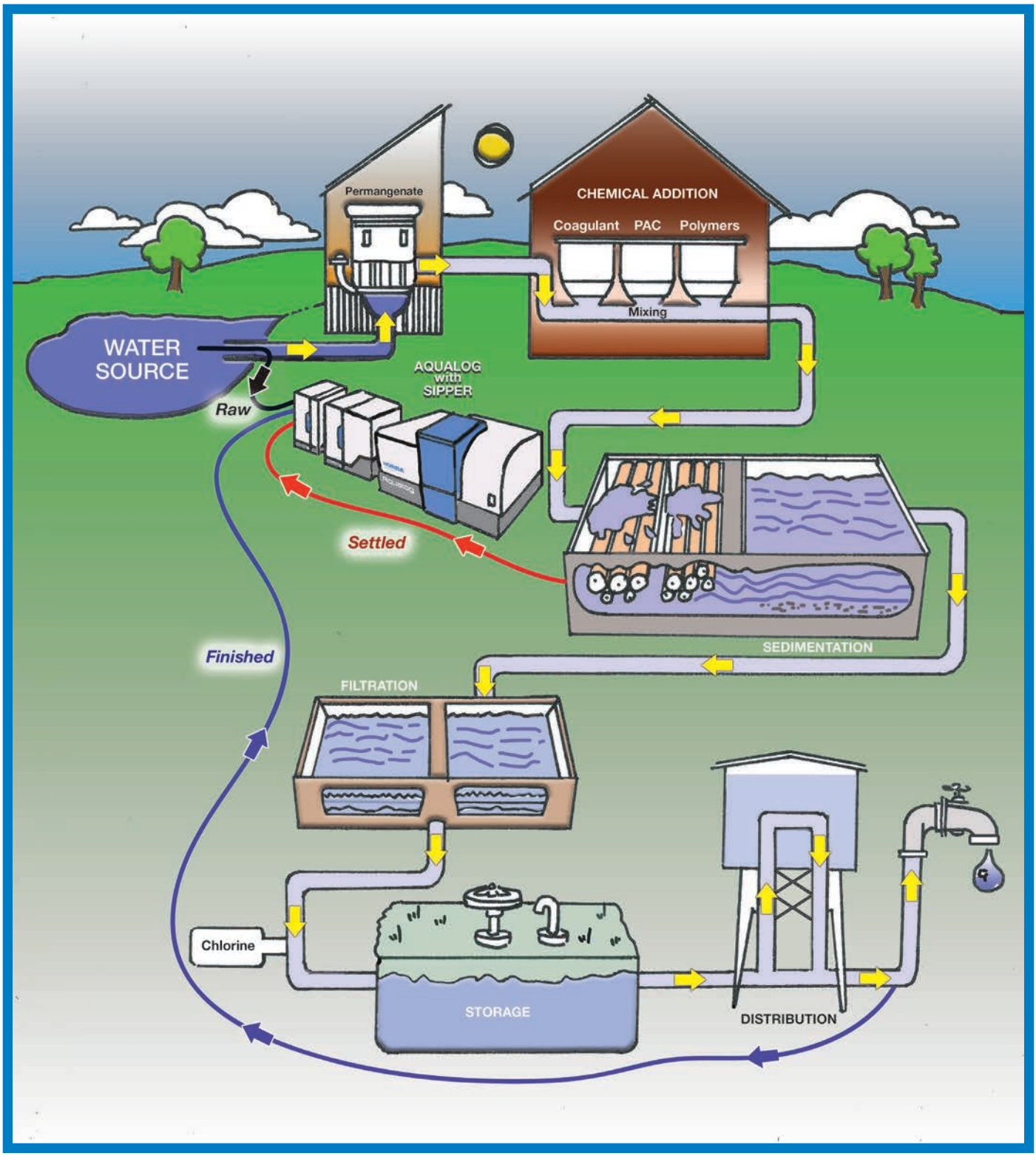
Water Companies
American Water
Chelsea Technologies Group
Doosan Heavy Industries and Construction
Eskom (South Africa)
Hazen and Sawyer
Kurita Water (Japan)
Public Utilities Board (PUB) of Singapore
Sabesp (Brazil)
Suez (Worldwide)
WET Labs

Municipal Water Facilities
City of Akron
City of Philadelphia Water Department
City of Sandusky
City of Wheeling Water Department
Denver Water
Hampton Roads Sanitation District
Las Vegas Valley Water District
Louisville Water Company
Metropolitan Water District of Southern California
Middlesex Water Company
Orange County Water District
Umgeni Water - Amanzi (South Africa)
West Basin Municipal Water District Water Recycling Facility

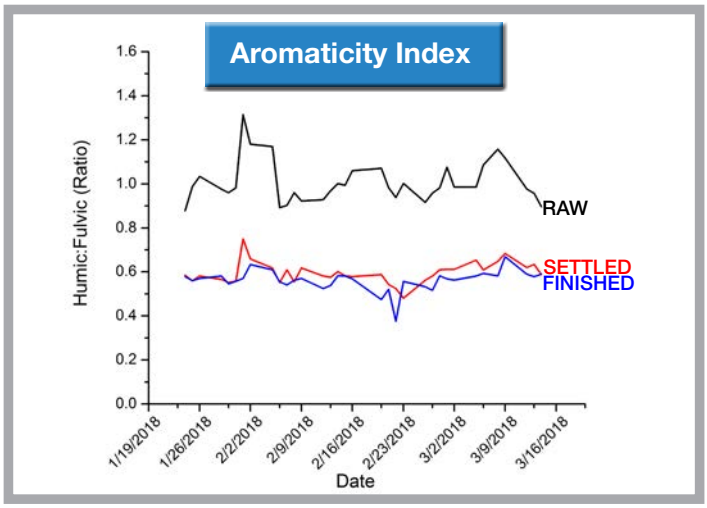
Environmental Research

US Environmental Protection Agency (US EPA)
US Geological Survey (USGS) Water Science Center
US Naval Research Laboratory
National Institute of Standards and Technology (NIST)
National Aeronautics and Space Administration (NASA)
National Oceanic and Atmospheric Administration (NOAA)
Woods Hole Oceanographic Institution
Stroud Water Research Center
Trussell Technologies
Vietnam Environment Administration
National Laboratory for Civil Engineering (Portugal)
Korea Institute of Civil Engineering and Building Technology (South Korea)
Arizona State University
Chinese Academy of Sciences (China)
Colorado School of Mines
Columbia University
Florida International University
Florida State University
Georgia Institute of Technology
Harbin Institute of Technology (China)
Indiana University
Kangwon National University (South Korea)
King Abdullah University of Science and Technology (Saudi Arabia)
Kobe University (Japan)
Louisiana State University
Michigan Technological University
New Mexico State University
Northeastern University
Oregon State University
Rutgers University
San Diego State University
Seattle University
Sejong University (South Korea)
Sichuan University (China)
Southwest University (China)
Swedish University of Agricultural Sciences (Sweden)
The Ohio State University
The University of Vermont
Tongji University (China)
Umeå University (Sweden)
University of Alaska
University of Alberta (Canada)
University of East Anglia (UK)
University of Extremadura (Spain)
University of Maryland, Center for Environmental Science
University of Massachusetts at Amherst
University of Michigan
University of Minnesota
University of Montana
University of New Orleans
University of Science of Technology of China (China)
University of South Africa (South Africa)
University of Western Ontario (Canada)

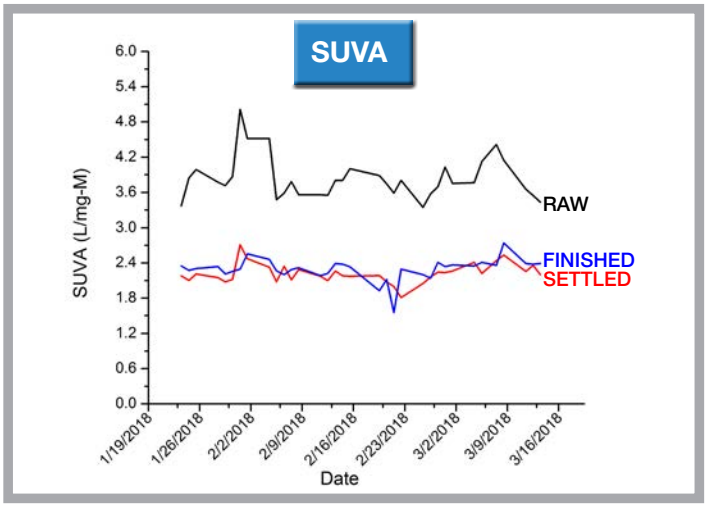
Aqualog in Use at a Drinking Water Treatment Plant



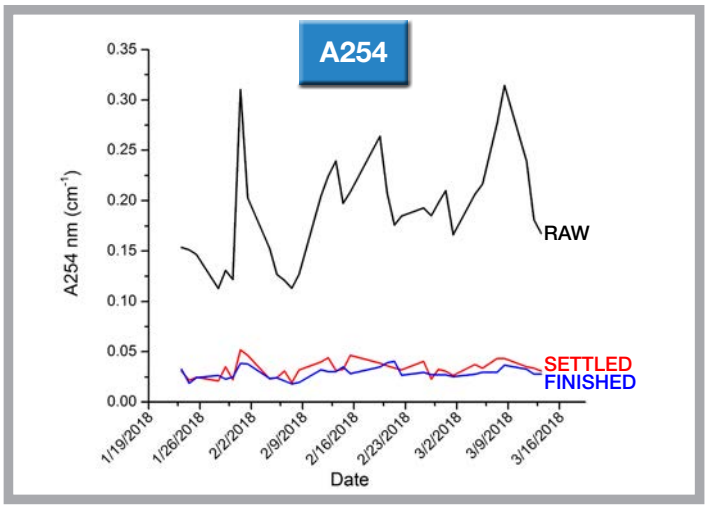
This illustration shows the Aqualog in use at a DWTP. It is found in the analytical lab where water is collected from various points along the water treatment process. Typically, Aqualog collects and measures water from three points in a WTP: The untreated water (Raw); after the sedimentation tank (Settled); and in the final treated effluent (Finished). The charts on the next page demonstrate the many parameters that are automatically reported and tracked over time with the Datastream Dashboard HTML interface.



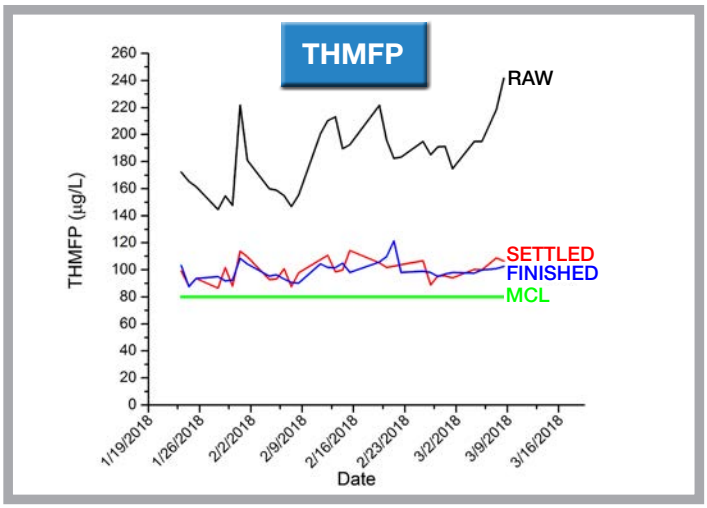
Humic/Fulvic ratio decreases due to humic acid coagulation in transitioning from Raw to Settled/Finished state.



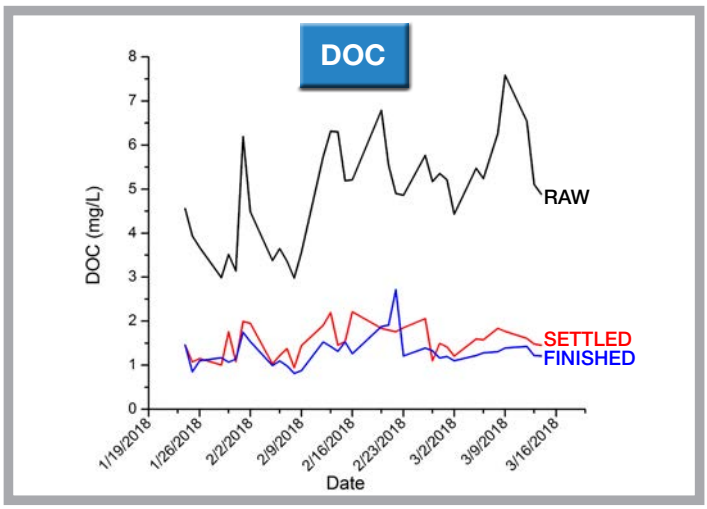
SUVA, an indicator of aromatic organic concentration, decreases upon coagulation treatment. This is primarily due to the relative decrease in humic acid content and consequent reduction in aromaticity.



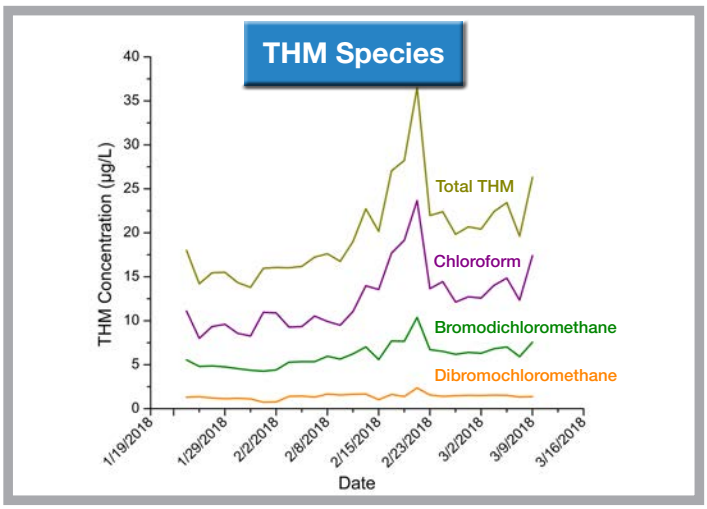
A254 is an indicator of aromatic organic (humic compounds) concentration as it decreases from Raw to Settled/Finished state.



Trihalomethane Formation Potential (THMFP) decreases from a Raw to Settled/Finished state due to removal of the disinfection by-product precursors. The MCL indicates the EPA regulated maximum contamination limit of 80 µg/L allowed for THMs.



DOC decreasing from Raw to Settled/Finished state.



Aqualog model prediction of THM species in finished water. A good correlation (R^2 = 0.972) was observed with the independently measured data.

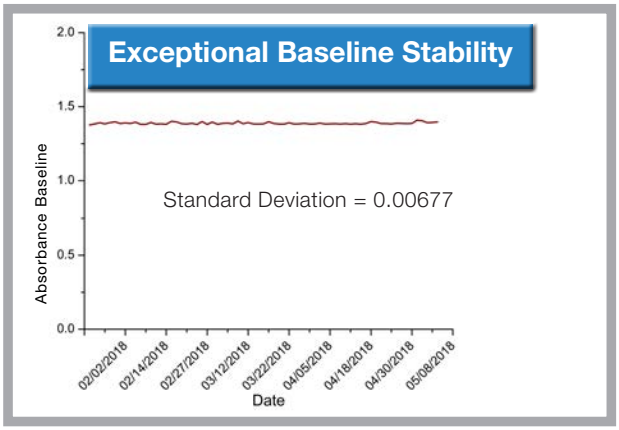
Aqualog offers unique capabilities for monitoring Natural Organic Matter (NOM). Many DOC components are DBP precursors. Halogenated disinfectants, such as chlorine, can react with the DBP precursors to form unwanted DBPs, which include toxic substances, such as THMs and HAAs. Because these substances are potentially carcinogenic and are regulated by the US EPA, their formation should be controlled by properly managing and optimizing the water treatment process.

Automation Accessories

Aqualog can be used with grab samples for manual measurements in an optical cell, as shown in the picture above, however, it is best configured with Sipper accessories described below.

AQ-Sipper:
HORIBA Sipper for automated sample extraction and sample measurement with Aqualog software. Includes sipper accessory and sample tray with thermostated cuvette holder and leak sensor. Extracts from a single sipper tube. External water bath not included.

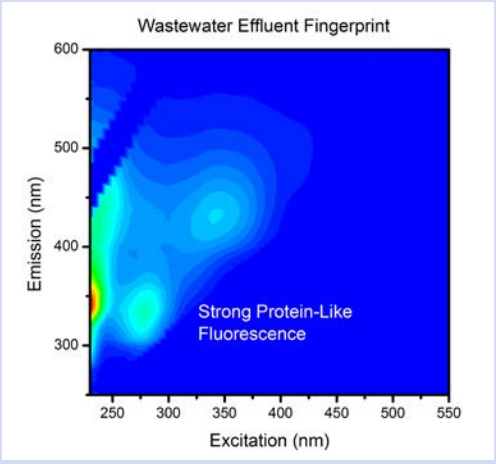
AQ-Sipper-4S:
Optional four-position sampler for AQ-Sipper. Allows the AQ-Sipper to automatically extract from up to four different sipper tubes (raw, settled, and finished). Multiple units may be used in parallel.

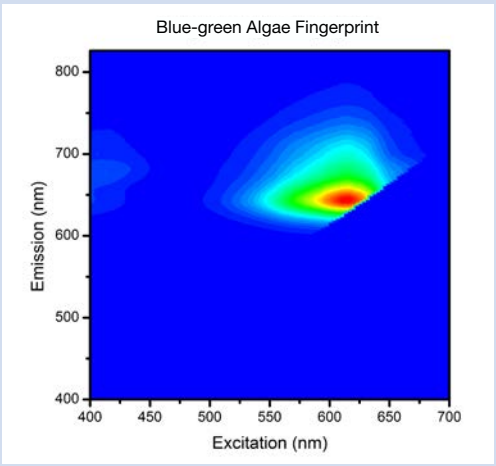


A stable baseline absorbance for over 90 days of operation shows excellent sipper performance in a real plant condition. The flow cell prevents air bubbles and biofouling in the sample cell. Only quarterly cleaning is required for the flow cell, thanks to the automatic cleaning protocol.

Fingerprints of Wastewater, Algae and Aromatic Hydrocarbons

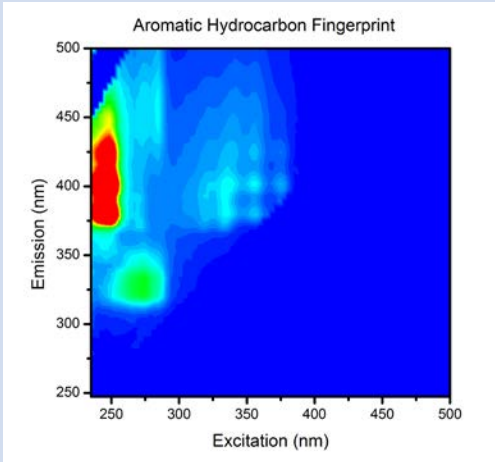
The Aqualog readily identifies and quantifies wastewater effluent, which exhibits a distinct A-TEEM™ fingerprint.*





Green, blue-green and brown algae cells and pigments, associated with toxins, taste and odor issues, can be easily measured with the Aqualog because they each have characteristic A-TEEM fingerprints.

The Aqualog exhibits high-sensitivity to aromatic hydrocarbons, and oils. These can also be identified and quantified through their distinct A-TEEM fingerprints.



The Future of Fluorescence
A-TEEM™ MOLECULAR FINGERPRINTING

***A-TEEM**
Absorbance-Transmission and Fluorescence Excitation Emission Matrix

Instant Water Quality Reports

The Datastream Dashboard is the industrial enhancement to the HORIBA Aqualog. With push button operation, the Aqualog Datastream Dashboard facilitates completely automated analysis and reporting of a wide range of organic matter parameters that are critical for managing and optimizing the drinking water treatment process. The Datastream parameters have been selected to specifically target disinfection by-product issues, organic membrane fouling, algal issues, and other contamination components.

The Dashboard provides the latest readings, time series and tables or trend analyses, % removals, thresholds and MCLs for all of these parameters. It reports on fit statistics and residuals evaluation for system performance monitoring, contamination detection and early warning alerts.

Water treatment laboratories can also upload their independently measured data into the HTML Dashboard to simultaneously analyze pH, alkalinity, turbidity, Cl_2 and other key parameters.

Expert installation and model calibration included.

Aqualog Datastream Dashboard is powered by Solo_Predictor software from Eigenvector Research, Incorporated

EIGENVECTOR RESEARCH

> *"We have been using the Aqualog instrument to monitor organic matters in seawater to better evaluate the membrane fouling of a reverse osmosis membrane at seawater desalination plants. Compared to TOC measurements, it provides a sensitive quantification, as well as properties of organic matters, to membrane fouling."*
>
> Kwanghee Shin, Ph.D.
> Senior Research Engineer
> Corporate R&D Institute
> Doosan Heavy Industries & Construction

> *"Our HORIBA Aqualog has provided Hazen and Sawyer and our clients with a state-of-the-art tool for managing multiple challenges in the production of drinking water. We have used the instrument for rapid response to the spill events and environmental events that may negatively impact community water supplies, providing a way to monitor for contamination in a timely fashion."*
>
> Ben Stanford, Ph.D.
> Senior Director/Water R&D
> American Water
> (Formerly with Hazen and Sawyer)

Aqualog Method vs. Conventional Methods

Parameters for Monitoring DBPs	Patented Aqualog A-TEEM Method	Conventional Methods
Dissolved Organic Carbon (DOC)	Provides DOC composition information not available from TOC	TOC Analyzer Single parameter, no information on organic composition or contaminations
UVA@ 254nm (UV254)	Aqualog measures both DOC and UV254, thus also providing SUVA DOC (Patented method)	UV-Vis Spectrometer UV254 only
Disinfection By-products (DBPs)	No sample prep, less expensive, real-time analysis	GC/GC-MS Lots of sample prep, much more expensive, not suitable for real-time
Natural Organic Matter (NOM) Precursors to DBPs	Aqualog measures DOC, DBPs, and organic foulants Less expensive, fast, and real-time analysis	LC-OCD For research and chemical optimization, more expensive, slow (~2 hrs/sample) and not suitable for real-time

Aqualog with Datastream Dashboard Software Specifications

Scan this QR code for more information.
l.ead.me/aqualog

Reported Parameters (up to 60 user selectable parameters)	**Specifications**	**Notes**
Dissolved Organic Carbon Concentration (DOC)	30µg/l to 20mg/l	Requires filtration (0.45µm)
*A*254	1cm path length	
SUVA	L DOC mg^{-1} *A*254m^{-1}	
Simulated Distribution System, Trihalomethane Formation Potential (SDS THMFP)	10 to 500µg/l	US EPA MCL = 80µg/l
Parallel Factor Analysis Component Scores	Up to 7	Can include algal, oil/PAH, tracer dyes, and other components
Residuals (Q)		Detect contaminants and measurement issues
% Variance Accounted for		
Absorbance Spectrum	200 - 800nm; 1cm path length	Any wavelength coordinate or ratio can be analyzed
Excitation Emission Matrix (EEM) Regions	I-V plus Algal (Blue-green/Brown/Green)	Custom EEM regions also available; Based on interpolated EEM processing
Total Fluorescence	Sum of EEM Regions I-V	
Humic Index		
Fluorescence Index		
Independent Treatment Plant Data (Additional Parameters Available)		
DOC	mg/l	
Alkalinity	mg/l	
Chlorine Residual	mg/l	
THM/SDSTHMFP	µg/l	
*A*254	Adjustable Path Length Specifications	
pH		
Weight	32.72kg (72 lbs)	Aqualog
	9kg (19.8 lbs)	Sipper WS-10
	4.2kg (9.26 lbs)	4 Sample Changer WS-10-S
Dimensions	LWH (618 x 435 x 336mm); (24 x 17 x 13")	Aqualog
	LWH (250 x 250 x 308mm); (9.84 x 9.84 x 12.13")	Sipper WS-10
	LWH (250 x 125 x 308mm); (9.84 x 4.92 x 12.13")	4 Sample Changer WS-10-S

Beyond Water Treatment Plants

Aqualog was designed for quantitative and predictive water analysis, and it is ideal for the task. However Aqualog, with its unique A-TEEM molecular fingerprinting benefits, has proven itself to be an invaluable tool in a wide variety of other industrial QC/QA, as well as environmental and academic research applications.

Please contact the Fluorescence Division of HORIBA Scientific to learn more about the ever growing list of exciting applications where Aqualog provides unique benefits.

Acronyms

A-TEEM	Absorbance -Transmission and Fluorescence Excitation and Emission Matrix	MW	Molecular Weight
DBPs	Disinfection By-product(s)	NOM	Natural Organic Matter
DOC	Dissolved Organic Carbon	PAC	Powdered Activated Carbon
DWTP	Drinking Water Treatment Plant	SDS	Simulated Distribution System
EEM	Excitation and Emission Matrix	SOP(s)	Standard Operating Procedure(s)
EPA	Environmental Protection Agency	SUVA	Specific Ultraviolet Absorbance
HAA	Haloacetic Acids	THM	Trihalomethanes
MCL	Maximum Contaminant Level	THMFP	Trihalomethanes Formation Potential
		TOC	Total Organic Carbon

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