LiquID™

What is HMA?

Hybrid Multispectral Analysis

The LiquID™ Measurement Method

HMA Defined

Hybrid Multispectral Analysis (HMA) is an optical approach to online monitoring which uses a combination of in situ fluorescence, absorption and scattering measurements in a single flow-cell to characterize chemical bonding and molecular structure continuously over time.

HMA is a unique combination of advanced optical, photonic, and statistical technologies applied to the challenge of providing synchronized high frequency data for complex water types. Such information is required to control treatment processes in real time. HMA allows plants to continuously adjust treatment based on current and on-line historical data to eliminate over and under treatment, provide real time water security, and facilitate compliance with and more effective enforcement of environmental laws.

HMA is a 'green' technology in that it eliminates reagents and standards for sampling, eliminates sample preparation and storage, eliminates treatment guard bands used to compensate for delays in conventional data, and requires only 72 watts to operate. The HMA methodology was developed through support in part by the US Environmental Protection Agency, Office of Naval Research, Oregon State University and Oregon Nanoscience and Microtechnologies Institute.

Optical Techniques

HMA is the hybridization of three optical approaches

- Light Absorption
- Light Scattering
- Light-induced Fluorescence

These three optical techniques are applied at multiple wavelengths from the deep UV through the Visual portions of the light spectrum. Raw data from these measurements is then automatically analyzed and interpreted and graphically represented on a Web User Interface or other presentation format.

The LiquID™ Station

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.

HMA has found application in a wide variety of applications including most aspects of waste water treatment. Waste water is a highly complex matrix consisting mainly of organic material made up of carbon, hydrogen, oxygen and nitrogen atoms bonded together in the forms of proteins, carbohydrates and oils/fats. The HMA approach measures the presence of these bonds by analyzing the interaction of light at different energies (wavelengths) with the wastewater matrix. Different types of bonds are excited by different energies and will either absorb the energy or absorb and release this energy in the form of fluorescence. The relative response of the matrix at different energies is analyzed and used to determine the relative 'strength' of the overall matrix. In this sense the HMA approach views a complex wastewater matrix in a similar way microbes do by focusing on the bonding and energy potential of the

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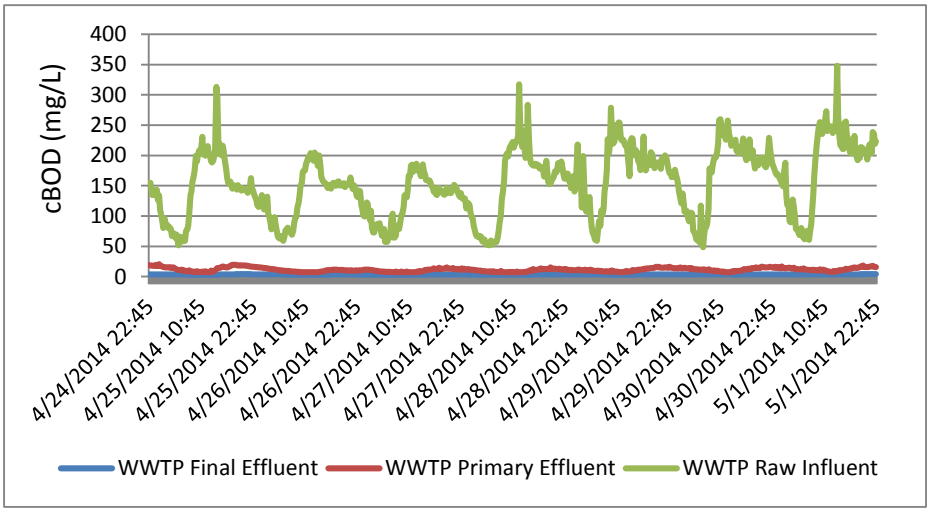
collective matrix and not solely on specific compounds present at any given time. An example of the use of HMA in a wastewater environment can be seen in the graph to the right.

Complete characterization of the matrix is achieved when the third optical approach, scattering, is factored into the analysis. Scattering at different energies is used to characterize the particle load and relative particle size distribution in the wastewater matrix.



One week of cBOD data from 3 different LiquID HMA Stations positioned throughout a wastewater treatment plant. This graph shows ~4,300 data points per series over a concentration range of 3.1 mg/L in the Final Effluent to 375 mg/L in the Raw Influent.

Benefits

The HMA combines the speed and reliability of well-established spectrophotometric technology with rapid modern computational and communication technology to measure, analyze and report matrix characterizations. Thousands of readings are taken in each HMA cycle to produce a output of typically 5-10 reported parameter values approximately every two minutes. This approach has several key advantages:

- **Continuous Data Record:** Readings at high definition with embedded, automated calibration validation.
- **Efficient Operation:** Allows plant operators to focus on their business and improve process while decreasing the impact of their effluent on the environment.
- **Direct measurement:** Characterize complex water matrices at the molecular level thereby improving the quality and value of data output while making the process of data acquisition less expensive and safer.

HMA in Practice

HMA utilizes a single optical probe to conduct over 3.3 million in-situ measurements per day, collecting direct molecular data on absorption, reflectance, and fluorescence. Molecular data is used to virtually instantaneously quantify critical water quality parameters such as BOD, chloramine, COD, E. coli, FDOM, NH3, NO3, SUVA, THM's, TKN, TOC, Total Free Chlorine (HOCl+OCl-), pH, TSS (MLSS), and turbidity; ranging from sub-pbb to over 10,000 ppm. About every 2 minutes parameter values and/or control signals are broadcast for real time control of processes that determine the chemical load or energy consumption of a plant and quality of water it discharges, such as, as outlined in this application, chlorine injection although also including, UV lamp settings, aeration blower speeds, or nutrient injectors; or to stop pumps when water security parameters are violated.

The ZAPS Technologies' LiquID is an industrialized and fully automated machine developed around the HMA approach. The machine itself brings additional technology into the process such as digital valves that allow for automated cleanings and internal calibrations to be performed without human intervention and at an appropriate frequency for the rate at which data is being generated (i.e. higher sampling frequency – higher calibration frequency).

Contact ZAPS For More Information

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