



Continuous Monitoring Real-time Decisions



What's in the water? It's a critical question, whether you're producing a multi-million dollar batch of a pharmaceutical or treating oil and gas waste water from fracking operations. Everyone is concerned about water. In fact, monitoring water is of major importance for biotech firms, biofuel plants, biopharma manufacturing facilities, oil and gas waste water treatment facilities, food and beverage manufacturing facilities, and environmental firms performing groundwater site remediation.

Today, process operators in these industries are flying blind. After sending samples to expensive analytical laboratories it takes hours, days, or weeks to get answers. Without real-time on-line data it isn't possible to optimize process performance, increase efficiency, and ensure process compliance and environmental stewardship.

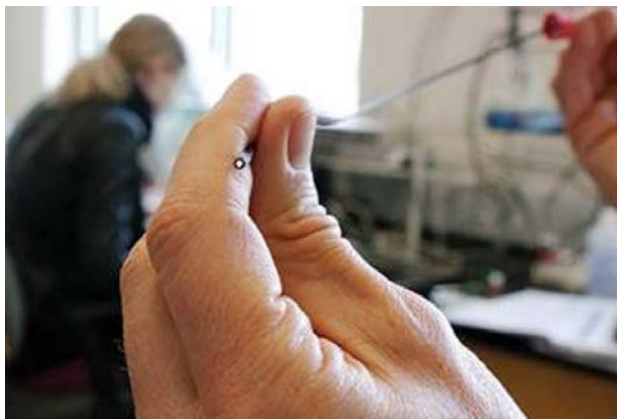
OptiEnz® Sensors has developed breakthrough technology for making real-time decisions – biosensors based on a combination of enzymes and fiber optic technology providing real-time continuous measurement results with the same accuracy as laboratory equipment. OptiEnz measures a broad range of organic chemicals including sugars, alcohols, hydrocarbons and solvents.

Traditional Sampling Methods



Today, identifying organic chemicals in water requires trained personnel to collect physical samples, perform chemical pretreatment, document the chain of custody, and process the sample through a chromatograph to produce a single measurement. In many cases samples are shipped to external laboratories for analysis, with results returned days or weeks later—making it impossible to implement real-time process monitoring. Chromatography yields accurate results, however it is a complex, time-intensive effort that requires expensive equipment and highly skilled labor. OptiEnz provides real-time results with the accuracy of laboratory equipment.

Technology That Sets Us Apart



OptiEnz provides continuous, in-place measurements without requiring sample pretreatment. The biosensors consist of a small optical transceiver connected to consumable sensor tips via a fiber optic cable. Bioengineered enzymes and a fluorescent chemical (fluorophore) are placed on the tip of an optical fiber. As these enzymes react with different organic chemicals in the water, a chemical reaction occurs on the tip of the sensor, changing the characteristics of the light emitted by the fluorophore. These changes are detected by the optical transceiver, where the data readings are then converted to direct, quantitative measurements of chemical concentrations. OptiEnz has a variety of sensor tips

designed to measure a wide range of specific organic chemicals, including alcohols, sugars, hydrocarbons, and solvents. To measure different chemicals, you simply change the sensor tip. Because the sensor tips are placed directly in the water — in a pipe, tank, vessel, or a bioreactor — the measurements are taken from precisely where the water needs to be sampled — at the source.



In-line Monitoring

The sensor probe is mounted directly in a pipe, vessel, or reactor in order to monitor concentration data directly at the source of the water or aqueous solution. Direct in-line continuous monitoring provides immediate results and enables real-time decisions for process control.

Applications

OptiEnz Sensors offers innovative, breakthrough technology for continuously measuring organic chemical concentrations in water and aqueous solutions. The OptiEnz sensor system is a platform technology that can measure a wide range of organic chemicals including hydrocarbons (e.g., BTEX), alcohols (e.g., ethanol, methanol), sugars (e.g., glucose, xylose, lactose) and solvents (e.g., TCE – trichloroethene). Unlike traditional measurement methods, the OptiEnz sensors deliver immediate results, providing analysis solutions that can be applied to a variety of markets.



Biotech and Industrial Fermentation

OptiEnz Sensors can significantly improve the efficiency of industrial fermentation processes for biotech applications including biopharmaceutical development, biofuel production, fermented beverages, and chemical manufacturing through in-place monitoring of sugars and alcohols. The continuous monitoring capability results in improved operating efficiency, scrap reduction, and increased production capacity within new and existing plants.



Oil and Gas Waste Water Treatment

Of the more than 1,000,000 oil and gas wells in the United States, about 600,000 use hydraulic fracturing (“fracking”) processes that involve injecting water, sand, and chemicals into shale rock formations to create fractures and increase production. Fracking generates *produced water* and *flowback water*, significant byproducts associated with oil and gas production that require costly treatment processes. The OptiEnz sensing system will provide in-place, continuous monitoring of contaminant levels (such as BTEX and methanol) at each step in the treatment process, providing immediate analysis of contaminant chemicals and offering a low-cost alternative to traditional sampling procedures.



Food, Beverage, and Dairy Production

In 2014 the US produced 30.8 billion gallons of beverages. Given the scale of production, process optimization can lead to significant increases in profitability via improved product quality control. OptiEnz Sensors generate instant data that can be integrated into process control systems. The continuous monitoring also provides value in other process operations, such as mixing or separation.



Environmental and Ground Water

OptiEnz Sensors can be used in a wide range of water quality monitoring applications, including groundwater monitoring, site remediation processes, and municipal water treatment. In groundwater wells, the continuous in-place monitoring capability of OptiEnz Sensors provides data that can help track the effectiveness of aquifer remediation. Continuous monitoring can also increase site remediation efficiency at the more than 1,400 sites included on the

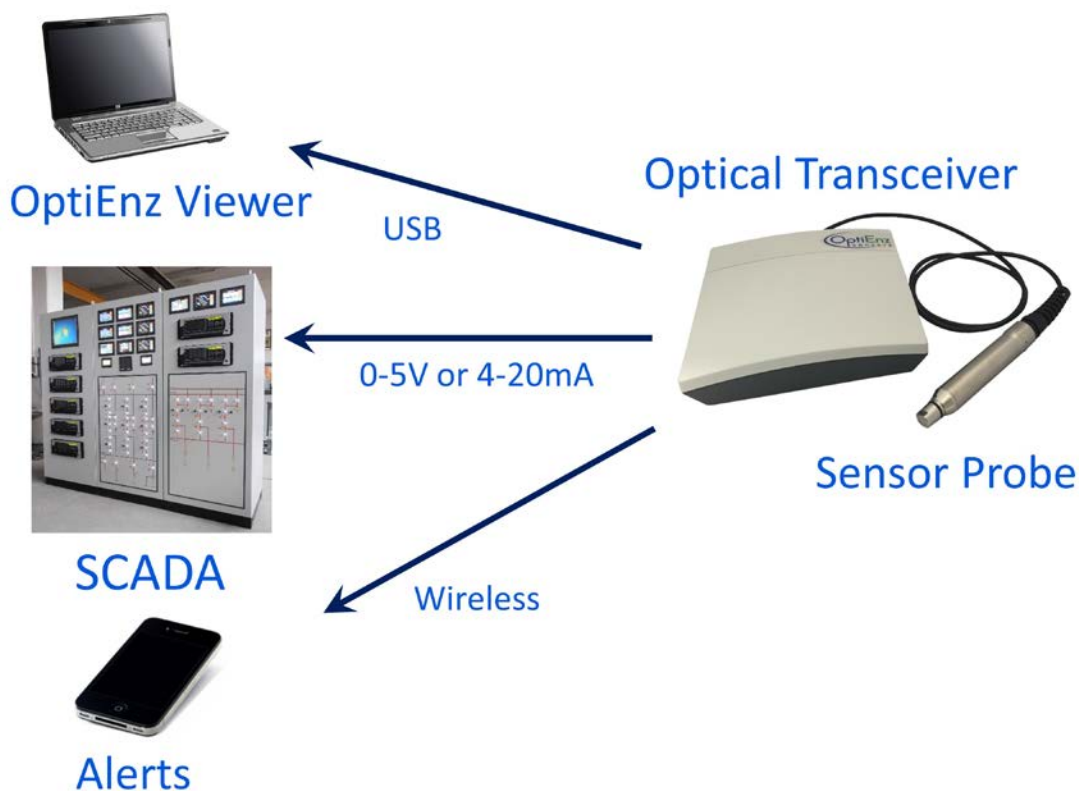
EPA’s National Priority List (Super Fund) and at thousands of former industrial (brownfield) sites.

Products

OptiEnz biosensors provide in-place, quantitative, continuous real-time measurements without sample pretreatment. The product consists of a small hardware sensing unit connected to quick-connect consumable sensor tips via fiber optic cables. The sensor tips are placed directly in the tank or pipe – exactly where the water should be measured. Sensor tips for a wide range of organic chemicals are being developed including methanol, benzene, toluene, ethylbenzene, and xylene.

OptiEnz Sensing System

The OptiEnz sensing system consists of an optical transceiver connected to a sensor probe via a fiber optic cable. The sensor probe contains the sensor tip that makes the continuous measurements of the specific organic chemical in the water or aqueous solution. The optical transceiver receives information from the sensor probe that it converts to continuous concentration measurement data. That data is transmitted to the OptiEnz Viewer via USB for analysis, to a SCADA system via a 0-5V or 4-20mA interface for process automation, via a wireless interface to provide alert level information, or integrated into a third party cloud-based sensor dashboard.





OptiEnz Viewer

The OptiEnz Viewer provides a Windows PC-based graphical user interface that can be customized to display concentration measurements from up to six sensors probes. The PC connects to the optical transceiver via a USB port. The OptiEnz Viewer provides for configuration of the optical transceiver and calibration of the sensor probe. Measurement concentration data is displayed in a numerical readout format with “red yellow green” level alerts providing notification of thresholds being exceeded. The OptiEnz Viewer also provides graphs for more detailed analysis.



OptiEnz Transceiver and Sensor Probe

The optical transceiver is a transmitter and receiver instrument that measures the output of the sensor probe and provides concentration data via a USB, 0-5V, or 4-20mA interface. The USB interface is used with the OptiEnz Viewer application on a Windows PC. The 0-5V and 4-20mA interfaces are used to interface with a supervisory control and data acquisition (SCADA) system for control of production equipment in operating environments. The optical transceiver is software configurable, using the

OptiEnz Viewer, enabling customization for the specific organic compound to be measured. The sensor probe provides the mechanical housing necessary to access a pipe, vessel, or reactor for various industry applications. The probe contains enzymatic sensor tips (one per organic chemical to be measured), a reference sensor for measuring background oxygen, and a temperature sensor. The sensor probes do not need to be replaced however the enzymatic sensor tips on the probes have a one-month lifetime and then require replacement via a quick connect attachment.

Company Profile

OptiEnz Sensors, LLC, founded in 2010 as a Colorado State University spin-off, is an innovation-oriented early stage company. OptiEnz Sensors has developed a novel analytical system for continuous measurements of organic chemical concentrations in water and aqueous solutions. The company is in pre-production and currently in product trials with prospective customers.

Our Mission

OptiEnz Sensors is committed to developing innovative sensor technology to provide continuous monitoring of chemicals in water and aqueous solutions. Building on the breakthrough technology that led to the success of the first generation of biosensors, OptiEnz Sensors continues to focus on the development and commercialization of sensor systems for a wide range of chemicals. The sensor systems are a platform technology that can be applied to a broad spectrum of chemicals within a wide range of applications including the biotechnology, environmental, and manufacturing industries.

Our Vision

OptiEnz Sensors will revolutionize the methods used for acquiring critical measurement data necessary to control water-based processes.



OptiEnz Sensors, LLC is located in the Innosphere in Fort Collins, Colorado.

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