



Improving Microbial Efficiency at Wastewater Treatment Plants with ROX™ Optical Dissolved Oxygen Sensor

Dissolved oxygen (DO) monitoring in wastewater is critical for efficient operation of wastewater treatment plants. Continuous and reliable DO monitoring can improve plant efficiency (thus lowering operating costs) as well as decrease the risk of unwanted odor events.

While DO sensors have been available for decades, new *optical* sensor technology offers significant improvements to the reliability of DO measurements, especially in low-oxygen environments found in wastewater treatment processes, and lends itself to improved real-time monitoring and automated control.

Aeration Monitoring & Control

An Ohio wastewater treatment plant was interested in determining the efficiency of their treatment process. To help facilitate this evaluation, a YSI 600 OMS sonde – containing a YSI ROX™ (Reliable Oxygen) optical dissolved oxygen sensor – was installed in the harsh environment of its mixed-liquor wastewater basin to collect DO data continuously.

The Ohio plant uses an activated sludge biological process to treat wastewater. It serves a community of 25,000 citizens in southwest Ohio and processes about 3 million gallons of wastewater per day.

In a typical biological treatment process, wastewater is transferred to aeration basins after it has been screened to remove large solids. Dissolved oxygen can be monitored in the basins to optimize and, in some cases, control oxygen addition to stimulate aerobic microorganisms. These organisms turn the remaining organic wastes into inorganic by-products before the treated water is safely released back into the streams of rural Ohio.

Dissolved oxygen concentrations that are too low during treatment can negatively affect the microorganisms, while high DO concentrations result in higher energy costs and the promotion of unwanted microorganisms. The costs associated with aeration in this secondary stage of treatment can typically run 50% or more of the total power use of a treatment facility. Therefore, reliable and continuous monitoring of DO might help wastewater treatment

plants save money by aerating only when necessary.

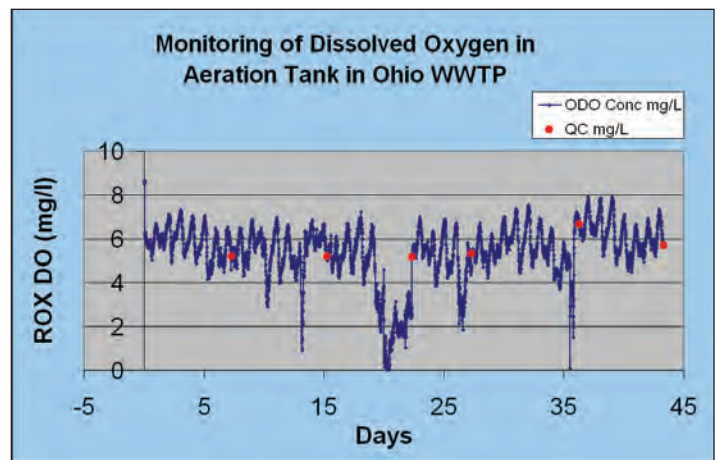
Data was transmitted from the 600OMS sonde via cabling to a YSI 6500 Environmental Process Monitor using SDI-12 protocol; the monitor is in a watertight enclosure. The Environmental Process Monitor has four relays that can drive alarm indicators -- such as lamps, horns, or automatic phone dialer system -- to indicate dangerously low or high DO concentrations.



Dissolved oxygen measurement at an Ohio WWTP using a ROX optical sensor, multiparameter sonde, and process monitor.

For future upgrades, the Ohio plant could automate aeration control by interfacing the 6500's 4-20 mA output into the plant's SCADA system and establishing upper and lower control criteria, further improving plant efficiencies and lowering the risk of out-of-range oxygen episodes.

The plant operators were most interested in the optical technology as it compared to traditional polarographic sensor technology. Initial results from this DO monitoring indicate that the ROX sensor is providing accurate data with minimal sensor drift. The sensor also requires less maintenance since it does not have a membrane nor require electrolyte solutions.



Continuous DO data from the ROX sensor installed in an aeration basin at an Ohio treatment plant. The ROX has provided stable and reliable data for 43 days (and counting) with no regular maintenance required.

Monitoring Settling Ponds

A wastewater treatment plant in Sacramento, CA is dealing with population growth projections that will affect the 165 million gallons of wastewater currently processed daily. As such, the regional sanitation district has an aggressive 20-year master plan to deal with the growth, address changes in regulatory compliance, and review emerging technologies used in wastewater treatment.

While keeping an eye out for new technology, the Sacramento plant became interested in the ROX optical DO sensor because it is less sensitive to corrosion and fouling.

In its treatment process, the Sacramento plant uses settling ponds to treat sludge. Settling ponds are unique environments where anaerobic bacteria break down sludge while aerobic algae near the surface break down the bacterial by-products, such as odor-causing hydrogen sulfide. This creates a dynamic dissolved oxygen environment and challenging conditions for *in situ* water quality monitors.

Plant technicians work diligently to maintain the oxygen-rich upper layers of the water column in order to prevent odor-causing gases from escaping and affecting the local environment. Continuous monitoring of dissolved oxygen in settling ponds allows them to respond quickly when dangerously low oxygen levels are measured. Then they can take preventive actions such as aeration or dilution with freshwater to restore the oxygen levels to normal.

In the past, the main challenges with DO monitoring in settling ponds have been:

- presence of hydrogen sulfide gas, which quickly corrodes the electrodes of traditional polarographic (Clark-type) DO sensors, and
- aggressive biofouling found in settling ponds.

The ROX sensor addressed these challenges because it is insensitive to hydrogen sulfide and has an integrated anti-fouling wiper to prevent organism growth on the sensor, thus prolonging the length of time an instrument can be deployed and taking accurate measurements.

Continuous data, longer deployment times, and less frequent visits to inspect the equipment by technicians, justifies the cost of ownership of optical sensor technology for the regional sanitation district.



Deployment of a YSI 600 OMS Sonde with ROX DO sensor in a settling pond at the Sacramento, CA WWTP.

Conclusions about Optical DO Technology

Monitoring DO reliably in wastewater poses several challenges that the ROX sensor addresses. For biological processes to work efficiently, continuous monitoring of the slightest changes in dissolved oxygen is critical. The Ohio and Sacramento WWTPs have been able to successfully monitor their DO levels with YSI's wide-range (0-500%) ROX optical sensor.

A ROX sensor plugged into a YSI multiparameter sonde and combined with the YSI 6500 Environmental Process Monitor create a powerful

and reliable system to continuously monitor DO, conductivity, pH/ORP, and temperature throughout the wastewater treatment process.

Additional capabilities include automated aeration control, alarm triggers, and integration into existing SCADA systems. Finally, the YSI system for deploying multiparameter instruments in PVC pipe makes it very easy, relative to most competitive products, to remove the sonde from the water for any required maintenance.

For more information on the ROX DO sensor or any YSI environmental monitoring equipment, please visit our web site at www.ysi.com or call our technical support staff at 800-897-4151.