Reliable monitoring of Carbon in wastewater, the key to improved bio-Phosphorous removal.

Location: Idaho Falls Wastewater Treatment Plant, ID

Client: Ovivo

Type of Plant: 18 MGD Biological Nutrient Removal

Location of Sensors: Influent and Anaerobic Selectors

Problem Statement: Lack of real-time and reliable data on influent organic loading and rbCOD, results in non-optimal enhanced biological nutrient removal.

Outcome: SENTRY™ sensors provided reliable, real-time measurements of rbCOD at influent and in anaerobic selector. This information can be used to improve control of Carbon and outcomes for the bio-P process.

Overview:

Carbon is the engine for biological nutrient removal. Biological Phosphorous (bio-P) removal and dentification rely heavily on maintaining sufficient concentrations of soluble readily biodegradable carbon in the form of volatile fatty acids (VFA). For enhanced biological Phosphorous removal (EBPR) operators need to procure sufficient VFA concentrations in anaerobic stages to allow phosphate accumulating organisms (PAOs) store it as fuel to later uptake Phosphorus in aerobic environments.

A key for optimized EBPR is to promote the growth of PAOs. To accomplish this a plant needs to maintain a biological environment that is anaerobic and contains sufficient VFA. SENTRY™ sensors are seen as a new lens to monitor this VFA in real-time to help maintain and control these conditions.

Problem Statement and Facility Overview:

Ovivo sought to improve their Carrousel® product line with a focus on upgrading the monitoring of up-front anaerobic and anoxic selectors. SENTRY sensors were the tool to support this optimization. That is because waiting 5 days for lab results is not an option in a real time process. By using SENTRY sensors, Ovivo was able to demonstrate the benefits of improving the Carrousel technology. The goal is an upgraded version of the well established three-stage Carrousel® system with primary focus on Carbon management. The driving force for successful bio-P treatment is the reliable management of up-front soluble Carbon. The upgrade goals include:

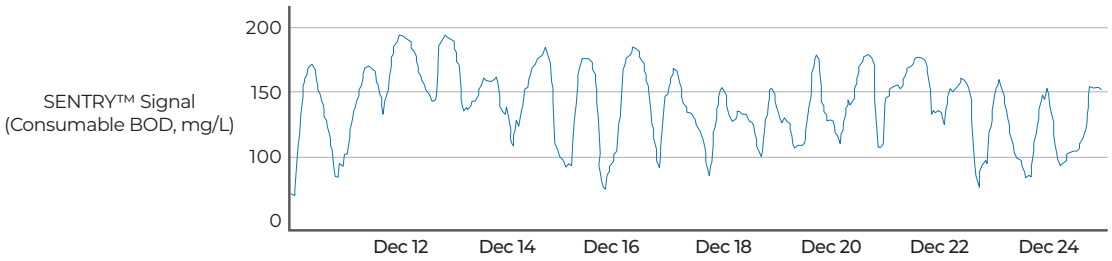
- Maximize the availability of soluble Carbon up-front efficiently to minimize bleeding into the aeration basin.
- Manage Carbon by looking at all sources, allows the plant to generate stable VFA rich conditions for the optimal growth of PAOs.

The Ovivo team wanted to correlate to biological oxygen demand (BOD) and readily biodegradable chemical oxygen demand (rbCOD) as a metric of soluble Carbon in the system to validate the value SENTRY™ sensors could provide in Carbon management.

Experience:

A SENTRY™ system was installed at the Idaho Falls WWTP. The plant has a design flow rate of 18 MGD with SENTRY™ sensors installed at the influent and in three anaerobic selector cells in series. SENTRY™ sensors were installed at the facility over one morning (~three hours) with four sensors, two electrical panels, and electrical conduit in place.

Simplicity is fundamental for the Carrousel® product and the SENTRY™ low-maintenance functionality aligns very well with this requirement. The sensors were rinsed with water once a month to maintain appropriate biofilm surface availability, demonstrating their reliability and low maintenance foundations. The sensors required no calibration and have no moving parts or chemical replacement requirements.



Diurnal quality trend as observed by SENTRY™ Sensor

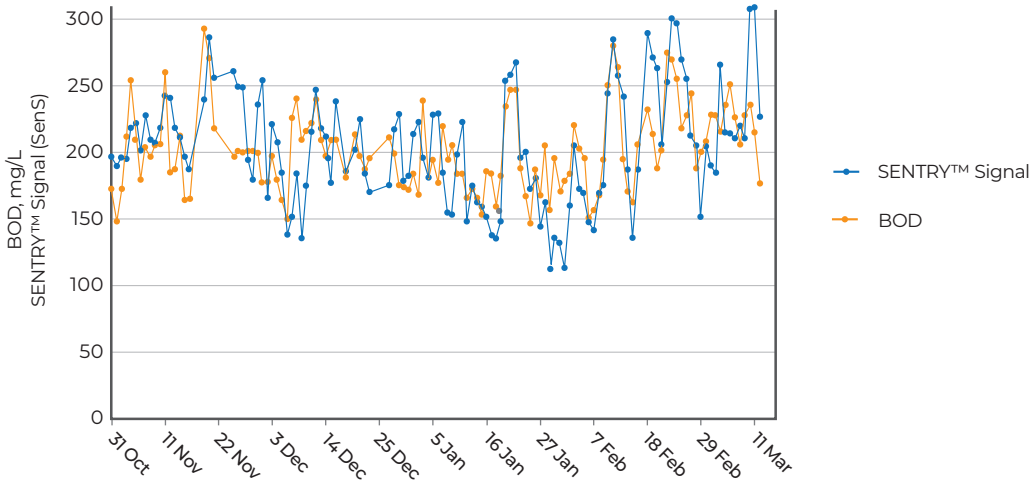
Results and Value:

Benchmarking showed a strong correlation between the SENTRY™ signal and the composite BOD samples. Second level of testing was completed to compare SENTRY™ signal to rbCOD and showed a very strong correlation. A temperature correction to normalize to 20°C was required to ensure signals aligned with laboratory analysis.

SENTRY™ sensors provided the only reliable real-time profile of the influent Carbon and added a tool in the toolbox as a new lens to see and measure Carbon. Diurnal trends are evident with low concentrations at night, allowing the plant to implement improved control strategies.

More advanced control concepts include:

- Optimizing the food to microorganism ratio in the first anaerobic cell to drive this carbon storing bacterial growth. The key is that in the first anaerobic cell maintaining a high sustained FM (food to mass) ratio being the key output for optimal PAO generation.
- Optimizing internal recycle flow nitrate so more nitrates can be sent up front when more Carbon is available. With Carrousel, this is particularly advantageous because no pumping is required and gate opening can take advantage of this and bring as much nitrate as required depending on the Carbon signal.
- Implementation of a fermentation cycle within the anaerobic basins. The system can produce VFAs from more slowly biodegradable Carbon in the anaerobic selectors. By having sensors installed through the length of the anaerobic selectors the sensors can monitor the VFA profile and Carbon gradient. This then ensures no bleeding of Carbon into aeration basins.



Real-Time SENTRY™ Signal (1440 points per day) compared with 5-day Lab Samples