CASE STUDY

HRSD INTENSIFIES DENTRIFICATION, SECURING SAVINGS & COMPLIANCE WITH BIO-BASED MICROC® 3000

When Virginia's Hampton Roads Sanitation District needed low-cost/high-performance denitrification from their Nansemond Treatment Plant, switching to EOSi's MicroC® 3000 non-hazardous carbon sources helped them improve denitrification at lower ongoing cost — and avoid the inherent safety and toxicity risks of using alternatives like methanol.

Client: Hampton Roads Sanitation District

Facility: Nansemond Treatment Plant

Flow Design / Actual: 30 MGD / 16.5 MGD

Treatment Technology: 5-stage Bardenpho®

TN Discharge Objective: 6-8 mg/L TN

Study Period: January 1st - June 30th

Background

Providing wastewater treatment services to more than 1.6 million people in southeastern Virginia, the Hampton Roads Sanitation District (HRSD) operates nine major plants in the Hampton Roads area and four smaller plants in the Middle Peninsula area. HRSD's Nansemond Treatment Plant is among HRSD's larger plants. With an average daily flow design of 30 MGD, the Nansemond plant utilizes a 5-stage Bardenpho® process to meet biological nutrient removal (BNR) standards of approximately 8 mg/L of total nitrogen (TN) and 1 mg/L of total phosphorus (TP).

The Nansemond plant had previously used glycerin-based carbon sources for wastewater treatment denitrification. But the plant's newly installed storage and feed system for dispensing external carbon sources enabled them to flexibly use several different types of carbon sources including methanol, which is typically effective in use — but with inherent safety and toxicity risks.

Methanol vs. Bio-Based MicroC® 3000

Methanol, a natural gas-derived chemical, has traditionally been used at wastewater plants to facilitate nitrogen removal, added in controlled amounts to provide a carbon food source for the denitrifying bacteria in wastewater to convert nitrates to nitrogen gas and reduce the nitrification of sensitive aquifers.

However, methanol's flammability and toxicity require expensive capital infrastructure and equipment, and strict regulatory requirements regarding storage, handling, and minimizing environmental impact. Fossil fuel-based methanol is also subject to significant market price fluctuations when plant operators are seeking price stability.

In contrast, EOSi's non-hazardous MicroC® 3000 is a completely bio-based product that replaces fossil carbon-based methanol within wastewater treatment applications. MicroC 3000 is a mixed-alcohols blend consisting primarily of methanol, ethanol, propanol, water, and some higher-weight alcohols. MicroC 3000's chemical-oxygen demand (COD) concentration is roughly equivalent to methanol but is marketed at a discount to pure methanol on a $/lb. of nitrogen-removed basis. Table 1 displays the MicroC 3000 specifications.

Table 1.

PARAMETER	VALUE
COD (Kg/L)	1.15
Specific Gravity (g/mL)	0.83
Alcohol Content	80%
Theoretical COD:N	5.1
Theoretical gal/lb N removed	0.52

MicroC®
Premium Carbon Sources

Transitioning to MicroC® 3000

HRSD decided to evaluate the performance of MicroC® 3000 carbon sources at their Nansemond Treatment Plant. Table 2 shows the supplemental carbon sources utilized in the plant's first and second anoxic zones for the first half of the year-long evaluation.

Halfway through the trial period, the MicroC 3000 feed to the first anoxic zone was discontinued and feed rates to the second anoxic zone were optimized to target a residual of 5 mg/L of nitrate + nitrite (NOx-N) in the effluent of the second anoxic zone.

Nitrate analyzers were used across the 5-stage Bardenpho to monitor biological nutrient removal (BNR) performance.

Table 2.

DATE RANGE	1ST ANOXIC CARBON	2ND ANOXIC CARBON
January 1st - March 20th	Glycerin-based product	Glycerin-based product
March 21st - April 27th	MicroC® 3000	Glycerin-based product
April 28th - June 2nd	MicroC® 3000	MicroC® 3000
June 3rd - June 30th	No Carbon	MicroC® 3000

FIGURE 1 COD ADDED AND EFFLUENT NOX-N

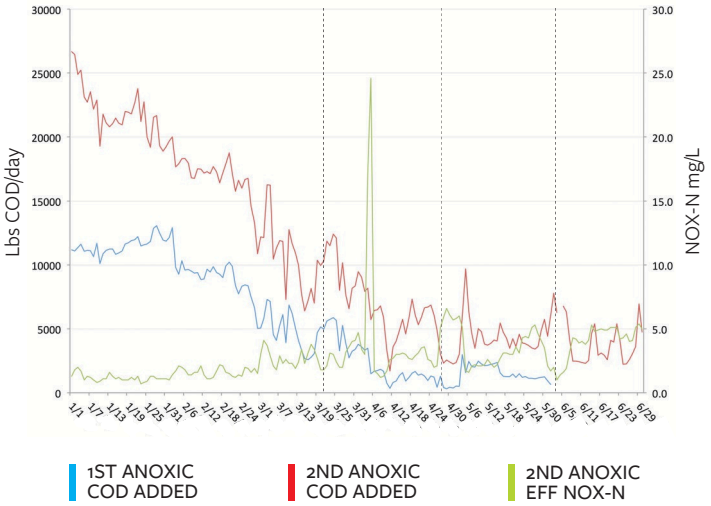
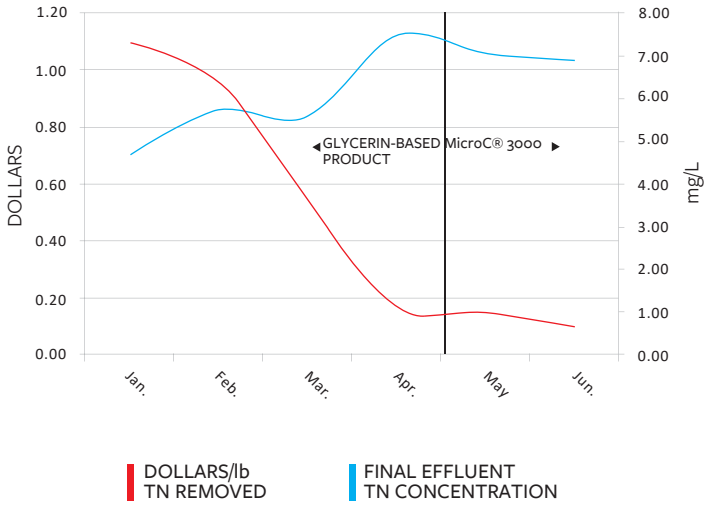


FIGURE 2 REDUCTION IN DOLLARS/lb N REMOVED



Results

Figure 1 shows the COD concentration added in lbs./day to both anoxic zones, and the effluent NOx-N value in the second anoxic zone showing the optimization of the chemical oxygen demand-nitrate ratio (COD:N) in the first half of the trial period during the transition from Nansemond plant's previous glycerin-based product to MicroC® 3000.

Figure 2 shows the $/lb. of N (nitrogen) removed. HRSD calculates this value based on the spend on external carbon divided by the lbs./nitrogen removed across the Nansemond plant's entire wastewater treatment system.

Substantial Savings for HRSD

Influent flow during the evaluation period averaged 16.5 MGD with a 300% nitrate recycle (NRCY) and 59% return sludge flow rate (RAS flow). Aerobic solids retention time (SRT) was 12.1.

Total nitrogen removal averaged 84% during this period, enabling the Nansemond facility to easily meet its TN target of 8 mg/L.

Transitioning to EOSi's MicroC® 3000 carbon sources enabled saving approximately $0.85/lb N removed during the January/February-to-June timeframe, resulting in substantial supplemental carbon cost-savings for HRSD — and avoiding costly infrastructure and specialized equipment required to safely store and dispense fossil fuel-based carbon sources like methanol.