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Water & Energy

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Energy-Efficient Plus

Introducing OmniMax-A and OmniMax-D, MBBR Treatment Systems that give operators more control

Article submitted by Orenco Systems

It takes energy to treat wastewater. Orenco® Systems' new OmniMax-A™ and OmniMax-D™ Moving Bed Biofilm Reactors (MBBRs) use less energy while treating secondary effluent to some of the most stringent BOD/TSS limits and denitrification standards in the industry.

For many municipalities, water and wastewater treatment plants use a lot of energy, often accounting for 30-40% of their total energy consumption. Pumps, blowers, aerators, controls and other necessary power-consuming components are part of what makes treatment systems work.

Much of that energy consumption goes toward keeping biological filtration functioning properly.

Activated sludge, the most commonly used process, requires continually mixing and aerating bacterial flocs with highly inefficient solids-handling pumps and positive-displacement blowers, as well as monitoring by operators.

The attached growth process uses fixed media to house bacteria. While air and liquid pass through the media, aerobic bacteria living on it break down the nutrients in the effluent. This process, used in advanced treatment units like Orenco AdvanTex®, uses significantly less energy than activated sludge.

MBBRs utilize a specific type of attached growth technology. Rather than using fixed media, they have moving media that create an environment for BOD- and nitrogen-removing bacteria to grow as they float through the secondary-treated effluent.

Orenco Systems' OmniMax MBBRs — OmniMax-A (A for Aerate) and OmniMax-D (D for Denitrify) — are designed for municipal and commercial and engineered for high-flow or high-strength waste applications. Able to be used independently or together, they're also designed to be energy efficient and simplify O&M costs.

OmniMax-A MBBR

OmniMax-A uses aeration and microbes to remove BOD/TSS and ammonia at flows from 30,000-120,000-plus gallons per day. The science behind it centers on the nitrification portion of the nitrogen cycle — the process that converts ammonium nitrogen into nitrates and nitrites.

Effluent from a primary treatment unit enters OmniMax-A and passes through a basin that's filled with thousands of free-floating HDPE plastic carriers. Each carrier has abundant surface area for beneficial



Orenco's OmniMax-A has removable air grids that can be taken out during operation for servicing. Plant operators will see massive savings in both time and resources. (Photo provided by Orenco Systems)

microorganisms, also known as biofilm, to form. These microorganisms consume and break down pollutants and convert ammonia-nitrogen to nitrate-nitrogen in the effluent.

To ensure the effluent is sufficiently exposed to the beneficial bacteria, diffusers aerate the liquid, keeping the biofilm-rich media in constant motion and in contact with the liquid. The bubbling action also provides oxygen for the microorganisms to thrive and function. When the treated effluent exits OmniMax-A, it shows significant reductions in BOD, TSS and TKN. It also achieves three to four times the oxygen transfer compared to coarse air systems.

OmniMax-A, which measures 10 feet wide by 11 feet tall with lengths between 27 and 50 feet, is a watertight, vacuum-molded, single-piece vessel. Its foam-core fiberglass walls are 6 inches thick with R-36



Because of their O&M friendly design, OmniMax-A and OmniMax-D settings can be dialed in sequentially as the effluent passes through the tanks' separate chambers. Operators have control of BOD, TSS, ammonia levels and other critical measurements. (Photo provided by Orenco Systems)



Both OmniMax-A and OmniMax-D are designed for municipal and commercial applications with high-flow or high-strength waste. They're also engineered to simplify O&M costs and be energy efficient. (Photo provided by Orenco Systems)

insulation. The unit maintains a consistent interior temperature year-round, allowing for efficient wastewater treatment in just about any environment and requiring less operator interaction. Inside the unit, durable stainless steel air diffuser lines transition to PVC under the waterline to a removable air diffuser manifold.

OmniMax-D MBBR

The technology behind OmniMax-D centers on the denitrification portion of the nitrogen cycle—the process that converts nitrates in wastewater into nitrogen gas. OmniMax-D reduces up to 85% of nitrates in wastewater and provides treated effluent meeting stringent discharge limits of up to 10mg/L total nitrogen.

Following secondary treatment in an AdvanTex AX-Max™ or similar technology, effluent enters the OmniMax-D's anoxic, oxygen-depleted environment. The liquid passes through thousands of biofilm carriers covered in beneficial anoxic bacteria. The effluent then receives a dose of carbon, which is consumed by bacteria while converting the nitrate-nitrogen into nitrogen gas.

Meanwhile, durable, corrosion-resistant pneumatic mixers move the effluent to ensure the nitrate-rich influent and carbon are available for the biofilm on the carriers. The resulting nitrogen gas disperses into the atmosphere, resulting in the removal of up to 85% of nitrate-nitrogen from wastewater.

OmniMax-D is 8 feet tall by 8 feet wide standard, with lengths of 7, 14 or 21 feet. Made with foam-core fiberglass like the OmniMax-A, the OmniMax-D can be installed above grade or partially buried in a wide range of climates, thanks to its 4-inch-thick walls and R-26 insulation that maintain interior temperatures in climatic conditions of -60 to 125 degrees Fahrenheit.

Energy-Saving Operator Control

Compared to an activated sludge system, an MBBR system provides superior treatment while requiring less space and energy, fewer materials and simplified operator maintenance.

With a smaller footprint, Orenco's OmniMax-A treatment tank uses fine-bubble aeration and regenerative blowers to move suspended carriers rather than an energy-consuming mechanical mixer. Regenerative blowers are controlled by variable-frequency drives to maximize overall blower efficiency. Plus, OmniMax-A has insulated walls and lids to keep temperatures in a narrow, consistent range for the beneficial bacteria to thrive.

Ease of maintenance is a standout feature of this unit. Rather than a dual-train system that requires a section shutdown, third-party pumping, and a crane to remove a section of plumbing, Orenco's OmniMax-A has removable air grids that can be taken out during operation for servicing. Treatment plant operators will see massive savings in both time and resources.

Because of their O&M friendly design, OmniMax-A and OmniMax-D settings can be dialed in sequentially as the effluent passes through the tanks' separate chambers. Operators have complete control of BOD, TSS, ammonia levels and other critical



OmniMax-A Applications

Orenco System's OmniMax-A is ideal for situations requiring advanced secondary treatment, including:

- Municipal, commercial, and industrial wastewater facilities
- High-strength waste pretreatment (e.g., food processing, dairies)
- Nitrification for ammonia reduction
- New installations, retrofits, or expansions in permanent or mobile locations
- At-grade or above-grade setups in diverse climates



OmniMax-D Applications

Orenco System's OmniMax-D excels in scenarios demanding nitrogen control, such as:

- Pre- and post-anoxic denitrification
- Permanent and mobile locations
- Above-grade or at-grade installation
- A wide range of climates
- Existing systems requiring stringent nitrogen limits

measurements—something that's not possible in an activated sludge system. **M**

For more information about Orenco's OmniMax-A and OmniMax-D MBBR units, visit Orenco.com or call (800) 348-9843.