



AquaNereda[®]

Aerobic Granular Sludge Technology



AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

AquaNereda®

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The AquaNereda® Aerobic Granular Sludge Technology is an innovative biological wastewater treatment system that provides advanced treatment using the unique features of aerobic granular biomass.

The aerobic granular biomass is comprised of compact granules which consist of layered microbial communities and provides superior settling compared to conventional activated sludge. Within a single tank, the process creates proper conditions to develop and reliably maintain a stable granule population without the need for a supplemental carrier. The layered aerobic and anaerobic zones within the granule allow for simultaneous processes to take place in the granular biomass, including enhanced biological phosphorus reduction and simultaneous nitrification and denitrification.

The unique process features of the AquaNereda technology translate into a flexible and compact process that offers energy efficiency and significantly lower chemical consumption culminating in a low life-cycle cost.

System Features and Advantages

- Optimal biological treatment is accomplished in one effective aeration step
- Settling properties at SVI values of 30-50 mL/g allow MLSS concentrations of 8,000 mg/l or greater
- 25% of the footprint compared to conventional activated sludge systems
- Energy savings up to 50% compared to activated sludge processes
- No secondary clarifiers, selectors, separate compartments, or return sludge pumping stations
- Proven enhanced nutrient removal (ENR)
- Robust structure of granule withstands fluctuations in chemical spikes, load, salt, pH and toxic shocks
- Significant reduction of chemicals for nutrient removal due to the layered structure and biopolymer backbone of the granule
- Ease of operation with fully automated controls
- Lowest life-cycle cost

Typical Applications

- Retrofit of existing tanks to increase treatment capacity
- Upgrade of existing treatment systems to meet BNR requirements
- New construction plants
- Municipal and industrial



SVI₅ comparison of aerobic granular sludge (left) and conventional activated sludge (right)



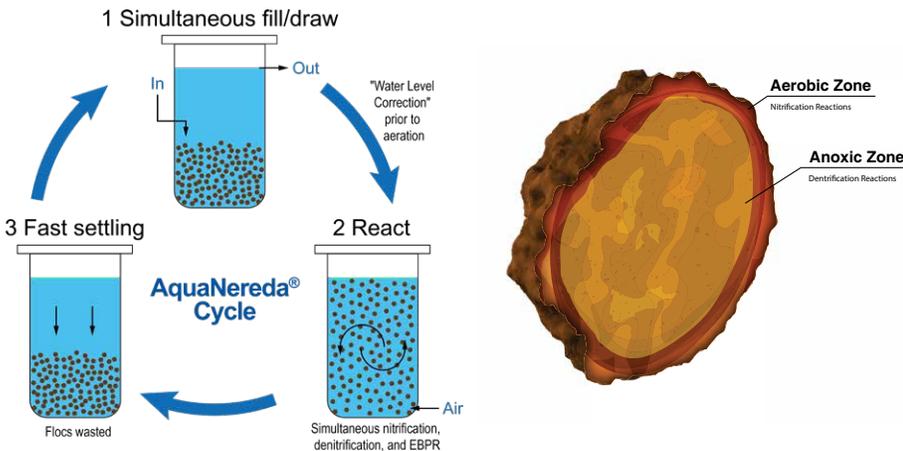
Three AquaNereda® reactors show compact design, typically 50% of a conventional plant.



Granule sample following sieve testing at the AquaNereda® demonstration facility, Rockford, IL

AquaNereda® Batch Cycle Structure

Based on the unique characteristics of granular biomass, the AquaNereda® Aerobic Granular Sludge System uses an optimized batch cycle structure. There are three main phases of the cycle to meet advanced wastewater treatment objectives. The duration of the phases will be based upon the specific waste characteristics, the flow and the effluent objectives.



Plant Profile: Riviera Utilities Wastewater Treatment Plant at Wolf Creek - Foley, AL

The AquaNereda® Aerobic Granular Sludge System represents a step-change in the wastewater treatment industry. The new system at the Riviera Utilities Wastewater Treatment Plant at Wolf Creek consists of three aerobic granular sludge reactors operating similar to a continuous flow system with a Fill/Draw phase that alternates between reactors. Downstream polishing is performed by AquaDisk® Pile Cloth Media Filters to produce Class B reuse-quality water. Although not currently required by permit to achieve Total Nitrogen (TN) limit, the inherent BNR properties of Aerobic Granular Sludge provide TN removal now and for future permit limits. Since start-up in January 2020, the plant has consistently produced remarkable effluent quality which far surpasses current permit requirements, and in fact, already meets future anticipated TN and TP limits.

Compared to the previous conventional treatment process, AquaNereda achieves:

- Overall power cost reduction of 40%
- Zero chemical usage
- 30% of footprint
- 75% increase in treatment capacity
- Elimination of secondary clarifiers and RAS pumping
- Increased process resilience during peak wet weather
- Events and influent load variations
- Exceeds anticipated future nutrient removal requirements

Riviera Utilities WWTP Upgrade Received
Distinction for Wastewater Project of the Year at
the 2021 Global Water Awards



Phases of Operation

1 Fill/Draw Phase

- Influent flow, substrate and readily available carbon source enter the reactor
- Anoxic and anaerobic conditions are present
- Biomass conditioning phase
- Phosphorus release to promote enhanced bio-P removal
- Treated water is discharged

2 React Phase

- Influent flow is terminated
- The biomass is subjected to aerobic and anoxic conditions
- Simultaneous nitrification/denitrification occurs
- Nitrate is transported by diffusion between outer aerated and inner anoxic layers of the granule, eliminating the need for pumping large recycle flows in the plant
- Luxury uptake of phosphorus is promoted
- Automated control of the process allows energy savings and process optimization

3 Settle Phase

- Influent flow does not enter the reactor
- Granular biomass is separated from the treated water during a very short settling phase
- Excess sludge is wasted in order to maintain the desired amount of biomass
- The system is ready for a new cycle

Since 1969, Aqua-Aerobic Systems, Inc. has led the industry by providing advanced solutions in water and wastewater treatment. As an applied engineering company serving both municipal and industrial customers, we work collaboratively with consulting engineers, owners, plant managers, and operators to design and manufacture the best treatment solution with the lowest lifecycle cost.

Providing **TOTAL** Water Management Solutions

Aeration & Mixing

Biological Processes

Filtration

Oxidation & Disinfection

Membranes

Controls & Monitoring Systems

Aftermarket Products and Services

The Development of Nereda®

A public-private research partnership in the Netherlands between the world-renowned Delft University of Technology, research institutes, water authorities and Royal HaskoningDHV led to the invention of the first technology applying aerobic granular sludge for the treatment of wastewater.

Since its development, Royal HaskoningDHV has transferred the process into an internationally applied, sustainable and cost-effective wastewater treatment technology. After 20 years of research and development, this innovative biological solution is now proving to be one of the most sought-after, progressive wastewater treatment technologies.

In 2016, Aqua-Aerobic Systems partnered with Royal HaskoningDHV to expand aerobic granular sludge into North America and is the exclusive provider of this technology in the United States and Canada.

AquaNereda® **Aerobic Granular Sludge Technology**

Visit our website at www.aqua-aerobic.com to learn more about the AquaNereda® Aerobic Granular Sludge Technology and our complete line of products and services.



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