Aerobic Granular Sludge Technology Improves Wastewater Treatment While Reducing Lifecycle Costs

By: Alan Vance, Industry Manager Environmental, Endress+Hauser, and Brian Bates, AquaNereda®Channel Manager, Aqua-Aerobic Systems

Activated sludge has been a cornerstone of wastewater treatment since the early 1900s. Over the years, variations of the activated sludge treatment process have surfaced. These variants were efforts to improve treatment performance or reduce capital or operating costs. A new technology, known as Nereda®, uses aerobic granular sludge to meet all those criteria.

Endress+Hauser is a global leader in industrial measurement instrumentation. As a preferred supplier for Nereda wastewater treatment installations, Endress+Hauser has a thorough understanding of the instrumentation and automation required. Water Online spoke with Alan Vance Industry Manager Environmental from Endress+Hauser and Brian Bates, AquaNereda®Channel Manager, from Aqua-Aerobic Systems, to learn more about this exciting new technology.

What is the Nereda system of wastewater treatment?

The Nereda system is an innovative biological wastewater treatment technology that provides advanced treatment. Nereda uses the unique features of aerobic granular biomass. An aerobic granular biomass is comprised of compact granules. These granules provide advantages compared to other secondary treatment processes without the need for a biofilm carrier.

The Nereda process was created by a public-private partnership between Delft University, the Dutch Water Authorities and Royal HaskoningDHV in the Netherlands. It is the only aerobic granular sludge system operating at full-scale. At this time, there are 40 plants in operation or under construction around the world.

Aqua-Aerobic Systems is the exclusive licensee of the technology in the U.S. and Canada, where it is marketed under the name of AquaNereda Aerobic Granular Sludge technology.

What is aerobic granular sludge (AGS), and how does it work?

Aerobic granular sludge is defined as aggregate of microbial origin that settles much faster than flocculant sludge without the need of biofilm carriers or media. The layered microbial community that forms the granule can achieve enhanced biological nutrient removal. AGS provides simultaneous nitrification/ denitrification and phosphorus reduction.

The system operates in batches. The fast settling granules enable operation on a vertical plug-and-flow configuration, allowing for full nutrient removal capabilities.

What benefits does AGS have over conventional activated sludge processes?

Based on the rapid settling of the granular biomass, the system can be operated at higher mixed liquor concentrations. This reduces the plant footprint by up to 75% compared to a conventional system design for biological nutrient removal.

In addition, treatment can take place in a single reactor. The single reactor concept and the efficiency of the process lead to energy savings of up to 50% compared to conventional activated sludge technologies.

Lastly, less mechanical equipment is needed to achieve enhanced nutrient removal. Along with the chemical savings for phosphorus removal, an aerobic granular sludge system provides the lowest lifecycle cost.

How does the AquaNereda system differ from a typical sequencing batch reactor (SBR) process?

While the AquaNereda system is a batch process, the characteristics of the aerobic granular sludge and the equipment layout allows for a more efficient treatment process. Area and energy usage can be reduced up to 50% and 30% respectively when compared to a traditional SBR.

A typical SBR system has five phases of operation per cycle. The AquaNereda process has only three phases. The technology provides the perfect environment to create granulation and maintain the granules in the system. The cycles in the AquaNereda process will include a very short settle period compared to a typical SBR system, thus allowing additional reaction time.

What type of training do operators and technicians require to operate and maintain an AquaNereda system?

Any operator with basic knowledge of secondary wastewater treatment will be able to operate the AquaNereda system. Operators will be trained on the specifics of system operation. However, the sampling, tests, and routine maintenance are similar to those performed on a standard activated sludge system.

Can existing wastewater treatment facilities be retrofitted to provide the AquaNereda process?

While the AquaNereda system is a batch process, it can be retrofitted into any existing system. All the processes occur in a single basin. When retrofitting a flow-through system, secondary clarifiers can be repurposed as buffer tanks and/ or sludge tanks. Furthermore, the AquaNereda aerobic granular sludge technology is not dependent on tank geometry. The process works well with circular, square, or rectangular tanks.

What types of instrumentation are required to operate an AquaNereda system?

Instrumentation is provided for the AquaNereda system to optimize performance. Analytical instrumentation monitors critical process parameters such as dissolved oxygen, pH/ ORP, total suspended solids, turbidity, nitrate, ammonium, and orthophosphate. In addition, magnetic flow meters monitor water flow to and from the reactors, while radar level transmitters monitor the water level variation. Finally, thermal mass flow meters measure air flow to the batch reactor.

What are some of the challenges of installing and handling the analytical instruments necessary for the process?

It's important to begin by looking at the process application and make the best recommendation for sensor type, sensor range, sensor application, etc. A typical batch process operates in stages. It is important that the analytical sensors are installed accordingly to maintain contact with the process water. For example, a sensor may be required to mount on a float system so that it will move up and down as level changes in the reactor.

How can instrumentation be used to optimize energy usage and operational performance of a system using AGS?

Proper instrumentation is critical for accurate process control and for providing accurate, repeatable measurements. For example, in aeration control, a plant should minimize running its blowers to avoid over-aerating a reactor. Analytical sensors measure critical parameters such as dissolved oxygen, nitrate, and ammonium, which are important for efficient nitrification/denitrification. Overaeration adds nothing to the process, yet consumes electricity. Excessive blower use also increases maintenance due to wear and tear on the pumps, valves, motors, and blowers.

What options are available for assistance with maintenance and calibration of instrumentation?

As a preferred supplier for Nereda technology, Endress+Hauser provides instrumentation that is easy to maintain, calibrate, and verify. Magnetic flow meters used for flow monitoring have no moving parts. They can be verified in place without disrupting the process versus the original wet calibration. Endress+Hauser's analytical instruments offer Memosens technology. The technology enables remote maintenance and calibration outside the process. This technology facilitates sensor exchange at the process and controlled sensor management. Endress+Hauser also offers a range of calibration standards for sensors. In addition, Endress+Hauser can provide technical experts to help with calibration, maintenance, repair, and training.

WP01063X/24/EN/01.17
(07.17)

Endress+Hauser, Inc.
2350 Endress Place
Greenwood, IN 46143
Tel: 317-535-7138
Sales: 888-ENDRESS (888-363-7377)
Fax: 317-535-8498
info@us.endress.com
www.us.endress.com

Endress+Hauser
People for Process Automation