Aqua MSBR®
Typical Applications

The Aqua MSBR system is ideal for large scale projects in any municipal or industrial wastewater application with effluent requirements ranging from carbonaceous oxidation to enhanced biological nutrient removal.

Biological Nutrient Removal
- 31.7 MGD (120,000 m³/day) Avg. Daily Flow
- This Aqua MSBR system in China reduces COD, ammonia nitrogen, and total phosphorus to stringent levels for ultimate discharge into the Tai Lake.

Nitrification
- 9.0 MGD (38,000 m³/day) Avg. Daily Flow
- This plant in Thailand utilizes an Aqua MSBR system to provide BOD, TSS, and nitrogen removal.

Phosphorus Removal
- 31.7 MGD (120,000 m³/day) Avg. Daily Flow
- This plant in China utilizes (2) Aqua MSBR systems to meet phosphorus removal requirements and discharge into the Tai Lake.

Reuse
- 6.3 MGD (24,000 m³/day) Avg. Daily Flow
- This Aqua MSBR system in Korea meets the city’s nitrification, denitrification, and phosphorus effluent requirements, and is followed by (2) AquaABF® automatic backwash filters which produce reuse quality effluent.

Providing TOTAL Water Management Solutions

Visit our website at www.aqua-aerobic.com to learn more about the Aqua MSBR® Modified Sequencing Batch Reactor and our complete line of products and services:

- Aeration & Mixing
- Biological Processes
- Filtration
- Membrane Systems
- Controls & Monitoring Systems
- Aftermarket Products and Services

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Aqua MixAir®

Experience in traditional flow through activated sludge design allows us to provide a compact, continuous flow and constant water level system solution - the Aqua MSBR® Modified Sequencing Batch Reactor. For over three decades, Aqua-Aerobic Systems has led the industry in sequencing batch reactor technology with performance proven systems that effectively controls effluent flow. Stage functions can be designed for optimum conditions based on wastewater characteristics to meet specific effluent objectives.

System Features and Advantages
- Proportional aeration turndown via the Aqua MixAir® system
- No external secondary clarifiers required; small footprint
- Phase separator optimizes BNR
- True quiescent, isolated (batch) settling
- High equipment utilization
- No external secondary clarifiers required; small footprint
- Expandability
- Low life-cycle cost

Aqua MixAir® System
The Aqua MSBR® system utilizes the Aqua MixAir® system by providing separate mixing with AquaDDM® direct-drive mixers and an aerator source of Aqua-Aerobic diffused aeration. This system has the capability to optimally control the aeration and mixing to promote aerobic/aerobic and anaerobic environments with low energy consumption. In addition, the Aqua-MixAir system can achieve and recover alkaliinity through denitrification, prevent nitrogen gas disruption in the settling phase, achieve and recover alkalinity through denitrification, and scum into the pre-settling phase.

Aqua MSBR® Stages of Operation

**Anoxic**
- Influent flow enters the cell by gravity.
- Flow stabilizer is completely mixed with the thickened return activated sludge (RAS) pumped from the Pre-Anoxic stage to the Aeration stage via the AquaDDM mixer to seed the Anoxic reactor.
- Anaerobic conditions are created facilitating_demand (VFA) to polyhydroxybutyrate (PHB) in preparation for subsequent luxury uptake.
- The RAS via denitrification.
- Anaerobic conditions are created facilitating_volatile fatty acids (VFAs) to polyhydroxybutyrate (PHB) in preparation for subsequent luxury uptake.

**Aerobic**
- Nitrified mixed liquor is pumped from the Anoxic stage to the Aeration stage.
- Mixed liquor is received from the Pre-Anoxic stage.
- Complete mixing condition is achieved via the AquaDDM mixer.
- Anaerobic conditions are created to reduce NOx levels by adjusting the pumping rates from the Pre-Anoxic to the Anoxic stage.
- Anoxic, complete-mix conditions are created by the AquaDDM mixer.
- Liquid and solids in the RAS are further segregated.
- RAS is concentrated 20-50%.
- Concentrated RAS flows by gravity to the Pre-Anoxic stage.
- RAS is concentrated 20-50%.
- Anoxic, complete-mix conditions are created by the AquaDDM mixer.
- Liquid and solids in the RAS are further segregated.
- RAS is concentrated 20-50%.
- Concentrated RAS flows by gravity to the Pre-Anoxic stage.

**Phase Separator**
- Returned activated sludge (RAS) is pumped from one of the SBRs.
- Liquid and solids in the RAS are further segregated.
- RAS is concentrated 20-50%.
- Concentrated RAS flows by gravity to the Pre-Anoxic stage.
- Supernatant flows to the Anaerobic basin.

**Advanced Decanter/Air Weir**
- The weir provides efficient diffused aeration flow control and prevent discharge of suspended solids and scum to the effluent.

**Process Monitoring and Control System**
- **IntelliPro** is a personal computer (PC) based program that interfaces with the AquaMSBR® system's programmable logic controller (PLC) via a network connection to assist operators in optimizing the treatment process of the plant and further reducing operating costs.

**System Advantages**
- Real-time, online monitoring and control
- "Active Control Mode" which automatically receives, interprets and proactively adapts to basic instruments and process variables including biological nutrient removal, chemical addition and energy
- Reduces the operator's sampling time
- Real-time and historical graphical trending of process parameters
- "Active Control Mode" which automatically receives, interprets and proactively adapts to basic instruments and process variables including biological nutrient removal, chemical addition and energy
- Assists in the optimization of enhanced nutrient removal
- Online operation and maintenance support
- Remote troubleshooting provides on-demand troubleshooting assistance.
For over three decades, Aqua-Aerobic Systems has led the industry in sequencing batch reactor technology with performance proven and cost effective treatment systems capable of effectively removing nutrients and reducing phosphorus. This expertise coupled with 

**Aqua MixAir** System

The Aqua MixAir system utilizes the Aqua MSBR system by providing separate mixing with AquaDDM® direct-drive mixers and an aerator source of Aqua-Aerobic diffused aeration. This system has the capability to optimally control the anoxic and relating to promote anoxic aerobic and anaerobic environments with low energy consumption. In addition, the Aqua-MixAir system can achieve and recover alkilinity through denitrification, prevent nitrogen gas disruption in the settling phase, promote biological phosphorus removal, and control certain forms of filamentous bacteria.

**Aqua MixAir® System**

- Proportional aeration turndown via the Aqua MixAir® system
  - High equipment utilization
- Inlet, low pressure sludge slug reduces energy consumption
- Flow management, controlled mixing setting
- Phase separator optimizes BNR
- Fully automated control system
- No external secondary clarifiers required, small footprint
- Low life cycle cost

**Aqua MSBR® Stages of Operation**

The Aqua MSBR system incorporates multiple reactors that operate through a series of stages to provide a variety of treatment mode alternatives. The design configuration may range from a simple 2-stage configuration that provides sedimentation and efficient clarification to a 7-stage configuration that provides enhanced biological nutrient removal. An Aqua MSBR system will include two sequencing batch reactors (SBRs). The SBRs are equipped to assume multiple functions such as aerobic mixing, anaerobic mixing, quiescent settling, sludge wasting and clarification. Each stage features an air weir that effectively controls effluent flow. Stage functions can be designed for optimum conditions based on wastewater characteristics to meet specific effluent objectives.

**Aqua MSBR®**

- **Anaerobic**
  - Influent flow enters the cell by gravity
  - Flow is partially mixed with the thickened return activated sludge (RAS) pumped from the Pre-Anoxic stage via the Anaerobic stage to the Anaerobic basin in an anaerobic environment
  - Anaerobic conditions are created facilitating the breakdown of volatile fatty acids (VFAs) to polyhydroxybutyrate (PHB) in preparation for subsequent luxury uptake
  - Anaerobic conditions are established to control the growth of some types of filamentous organisms
- **Aerobic**
  - Mixed liquor is received from the Anaerobic stage
  - Mixed liquor is pumped from the Anaerobic stage
  - Complete mix condition is achieved via the AquaDDM mixer
  - Anaerobic conditions are created to reduce NOx produced in the Aerobic stage, on a set solids retention level, through a denitrification process
- **Pre-Anoxic**
  - Pre-anoxic, thickened RAS is pumped to the Anaerobic stage
  - Pre-anoxic, thickened RAS is pumped from the Pre-Anoxic stage to the Anaerobic stage to prevent secondary phosphorus release
- **Anoxic**
  - Pre-conditioned RAS flows to the Aeration basin
  - Concentrated RAS is received from the Pre-Anoxic stage
  - RAS is concentrated 20-50%
  - Biologically active solids (BAS) are segregated from one of the SBRs
  - Pre-conditioned, thickened RAS is pumped from the Pre-Anoxic stage via the Anaerobic stage
  - Anaerobic conditions are established to control the growth of some types of filamentous organisms
- **Aeration**
  - Mixed liquor is received from the Pre-Anoxic stage
  - Mixed liquor is received from the Anaerobic stage
  - Mixed liquor is pumped from the Pre-Anoxic stage
  - Concentrated RAS is received from the Pre-Anoxic stage
- **RAS**
  - Concentrated RAS is received from the Phase Separator
  - Anaerobic, complete mix conditions are created by the AquaDDM mixer
  - NOx levels are controlled by adjusting the pumping rates from the Pre-Anoxic stage to the Anaerobic stage to prevent secondary phosphorus release
  - Pre-conditioned, thickened RAS is pumped to the Anaerobic stage
- **Effluent**
  - Pre-Anoxic
  - Anaerobic
  - Anoxic

**Overview of a 7-Stage Aqua MSBR**

- **SBRs**
  - Four phase SBR operation is performed (1) Anoxic Mixing (2) Aerobic (3) Pre-Glodding (4) Clarification
  - Biological/chemical oxygen demand (BOD5/COD) and ammonia nitrogen (NH₃-N)
- **SRBs**
  - Sodium and solids in the RAS are further segregated
  - RAS is concentrated 20-50%
  - Concentrated RAS flows by gravity to the Pre-Anoxic stage
  - Supernatant flows to the Clarification phase
- **IntelliPro® Process Monitoring and Control System**

The IntelliPro system is a personal computer (PC) based program that interfaces with the AquaSBR system's programmable logic controller (PLC) via a network connection to assist operators in optimizing the treatment process of the plant and further reducing operating costs.

**System Advantages**

- Real-time, online monitoring and control
- “Active Control Model” which automatically receives, interprets and proactively updates in basin instruments and process variables including biological nutrient removal, chemical addition and energy
- Reduces the operator’s sampling time
- Real-time and historical graphical trending of process parameters
- Remote troubleshooting provides corrective action to eliminate operational interruptions and upsets
- Ensures the optimization of enhanced nutrient removal
- Online operation and maintenance support
- Remote troubleshooting provides on-demand troubleshooting assistance

**Phase Separator**

The phase separator is designed to concentrate return solids which enhances the environment for improved phosphorus release.

**Advanced Decanter/Air Weir**

The air weir provides efficient effluent flow control and prevents discharge of suspended solids and accumulates the effluent.
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Nitrification
- 9.5 MGD (36,000 m³/day) Avg. Daily Flow
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Phosphorus Removal
- 31.7 MGD (120,000 m³/day) Avg. Daily Flow
- This plant in China utilizes (3) Aqua MSBR systems and meets phosphorus removal requirements without chemical addition.

Reuse
- 6.3 MGD (24,000 m³/day) Avg. Daily Flow
- This Aqua MSBR system in Korea meets the city’s nitrification, denitrification, and phosphorus effluent requirements, and is followed by (2) AquaABF™ automatic backwash filters which produce reuse quality effluent.

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