Sequencing Batch Reactor

AquaSBR®

INTRODUCTION

Sequencing Batch Reactor systems represent a variation of the activated sludge process. Like any other activated sludge process, the AquaSBR works by developing a mixed culture of bacteria which is effective in removing BOD, COD and nutrients commonly found in wastewaters.

The AquaSBR can treat a wide range of domestic and industrial wastewaters, at flows ranging fromm a few thousand gallons to millions of gallons per day.

The AquaSBR is unique in its ability to act as an equalization basin, aeration basin and clarifier within a single reactor. The termination of flow and aeration during the treatment process provides perfectly quiescent settling conditions in the reactor, and permits even very fine particles to settle. Each reactor maintains its own treatment regimen and all phases of treatment occur in each reactor.

Optimum performance is attained when two or more reactors are utilized in a predetermined sequence of operation. In certain instances, a single reactor may be operated to provide an acceptable level of treatment.

Because the AquaSBR operates in a true batch treatment mode, optimum effluent quality is obtained during each cycle. Only a fraction of the total reactor volume, typically 1/6, is introduced into the reactor each cycle. This raw flow combines with the acclimated biomass, which remains in the reactor at all times.

The ratio of raw flow to biomass is a key factor in obtaining desired effluent quality results in the SBR. Since only a small amount of sludge is wasted each cycle, the quality of the biomass is always maintained.

A true batch reactor system, like the AquaSBR, does not allow influent wastewater to enter the SBR reactor during the final aeration, settle and decant phases, thereby assuring an excellent quality of final effluent.

Four-basin AquaSBR system

AquaSBR®

The use of microprocessor controlled phases enables the operator to vary the operating strategy of the AquaSBR to suit treatment requirements. Normally, the process follows basic steps of Fill, React, Settle and Decant. The ability to create aerobic or anoxic conditions within the reactor results in flexible operation, better treatment of waste, and optimum effluent quality.

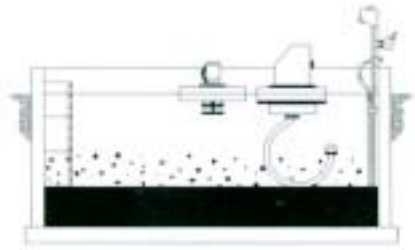
FILL PHASES

Mixed Fill - Influent enters the AquaSBR reactor. Complete mix of the reactor contents is achieved without the use of aeration. This phase assists in control of filamentous organisms, and is essential for those systems which require phosphorus removal.

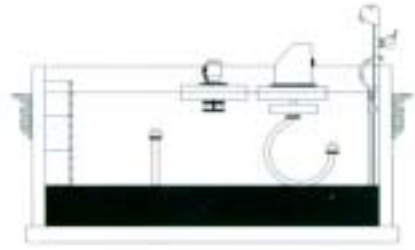
React Fill - Influent flow continues under mixed and aerated conditions. Aeration may be intermittent to promote aerobic or anoxic conditions. Nitrification and denitrification can be achieved. The aeration source may also be operated intermittently during low flow and low organic loading conditions to conserve energy.

NON-FILL PHASES

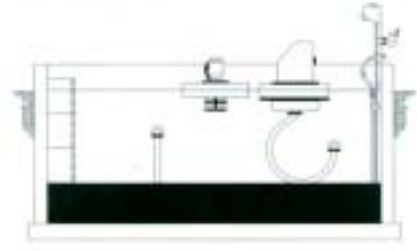
React - Influent flow is terminated, while mixing and aeration continue. Intermittent operation of the aeration system may continue to complete the nitrification/denitrification process, or to conserve energy.



Settle - Mixing and aeration cease. Solids/Liquid separation takes place under perfectly quiescent conditions.



Decant/Sludge Waste - The mixer and aeration system remain off and, at this time, the decantable volume is removed by means of subsurface withdrawal. The reactor is immediately ready to receive the next batch of raw influent. A small amount of sludge is wasted each cycle.



Idle - Occurs in multiple-basin systems anytime that flow conditions are less than peak design flow. Idle time varies depending on actual flow conditions.

AquaSBR® ADVANTAGES

True Batch Reactor System
The AquaSBR is operated in a true batch reactor treatment mode, which does not allow wastewater to enter the reactor during the React, Settle and Decant phases. The system:

- **Tolerates Variable Hydraulic Loads** - Mixed liquor solids cannot be washed out by hydraulic surges since effluent withdrawal is typically accomplished in a separate phase following the termination of flow to each reactor.
- **Tolerates Variable Organic Loads** - Each influent liquid batch is diluted with the reactor contents from the previous cycle.
- **Controls Filamentous Growth** - Filamentous organisms are controlled by creating an anoxic condition during the Fill phase.
- **Provides Ideal Quiescent Settling** - Since there is no flow to the reactor during settling, and no mechanical sludge collection device "stirring" the basin, ideal quiescent settling conditions exist.

Peak Design Flow
The AquaSBR maintains predetermined cycle times, even at peak daily flow conditions. Cycle integrity is maintained at all flows up to and equal to maximum daily flows.

Separation of Aeration and Mixing

Aeration - Can be provided by one of the following means: Aqua-Jet surface aerators, or Aqua CAM-D aerator/mixer/decanter, fine or coarse bubble diffusers (retrievable or fixed configuration). Retrievable diffuser systems lift from the basin and rotate for inspection and maintenance.

Mixing - The separation of aeration from mixing is essential to the success of any SBR. The floating direct-drive AquaDDM mixer provides a powerful downflow discharge for maximum solids suspension and aeration enhancement throughout the basin. Mixing efficiency is approximately three to five times that of jet mixers or submerged horizontal mixers. The use of the AquaDDM mixer enables the AquaSBR to be operated for nutrient removal and to control filamentous organisms by providing a mixed, non-aerated anoxic environment during selected phases of operation.

Retrievable and Accessible Components- The AquaSBR is designed to minimize operation and maintenance. All AquaSBR components are accessible from the side of the tank, eliminating the need to dewater.

- Retrievable Diffusers
- AquaDDM Mixers
- AquaDecanters
- Sludge Pump

AquaDecanter System
This positively sealed effluent decanter system incorporates several mechanical design features and a mode of operation that results in optimum performance. This design assures that sub-surface withdrawal of supernatant will always be extracted from the reactor at an adequate depth, and within the diameter of the flotation structure, to avoid drawing surface material into the effluent flow.

Nutrient Removal
The standard AquaSBR system can be operated for nutrient removal. No additional equipment or controls are required; no licensing fees are required in order to use the system for nitrification, denitrification or phosphorus removal, if operated according to the instructions of Aqua-Aerobic Systems.

Aqua-Aerobic Manufactured
All critical components of the AquaSBR are designed and manufactured by Aqua-Aerobic Systems, a leader in the wastewater treatment industry for more than 25 years. The AquaSBR provides you with one company accountability for design, supply, start-up supervision and service.

Return Activated Sludge Pumping Eliminated
Extensive piping and pumping for return activated sludge is not required since the mixed liquor remains in the AquaSBR at all times. Sludge production from an AquaSBR is comparable to a flow-through activated sludge system, and will typically produce settled sludge concentrations of 1% or more. The system's microprocessor can be programmed to waste sludge at the end of every cycle, during the Decant phase.

Lower Installation Costs
The AquaSBR is adaptable to several basin configurations. New or retrofit, lower installation costs are apparent with the AquaSBR. This system serves as an aeration basin, final clarifier and provides the equivalent of flow equalization. It eliminates the need for separate structures for each unit process. The use of fewer structures in the treatment system generally results in lower construction and installation costs.

Consistent Effluent Quality
The use of microprocessors allow the operator to adjust time and/or aeration and mixing based on organic loads and flow conditions to achieve required results.

PlC-Based Control System
The AquaSBR control system is a timer-based system with level overrides. This system provides control, sequence monitoring, and annunciation capabilities, and is designed to focus on an operating strategy to optimize the biological treatment process, while minimizing required operator attention. Control system upgrades to include a P.C. are also available.

AquaSBR® APPLICATIONS

AquaSBR systems are currently used in a wide variety of treatment situations, under a wide range of loading conditions. The AquaSBR process can be employed to treat any wastewater that can be treated by activated sludge systems, including: anoxic/oxic systems, aerated lagoons or extended aeration systems, trickling filters, RBC systems and oxidation ditches.

Wastewater treatment applications include:

1. Domestic applications

- Municipal
- Resorts
- Casinos
- Institutions

2. Industrial applications

- Chemical/Petrochemical
- Leachate
- Tobacco
- Food
- Pulp and paper
- Dairy
- Beverage
- Textile
- Tannery
- OCPSF (organic chemicals, plastics, synthetics and fibers)
- High nitrogen
- Any other wastewater that can be biologically treated

Dairy plant in Pennsylvania effectively treats waste with an AquaSBR system.

Diffusers easily retrieved at this pharmaceutical company in Puerto Rico.

Domestic waste treatment with the AquaSBR system.

Covered tank AquaSBR system.

Aqua-Jet®	Aqua-Jet Aerators
AquaABF®	ABF Filters
AquaMixAir®	MixAir Aeration Systems
AquaDDM®	Direct Drive Mixer-Blenders
AquaSBR®	Sequencing Batch Reactors
AquaDisk®	Cloth-Media Filters
ThermoFlo®	Surface Spray Coolers

Aqua-Aerobic Systems, Inc.

6306 N. Alpine Rd. • P.O. Box 2026 • Rockford, IL 61130
TEL. 815/654-2501 • FAX 815/654-2508

The information contained herein relative to data, dimensions and recommendations as to size, power and assembly are for purpose of estimation only. These values should not be assumed to be universally applicable to specific design problems. Particular designs, installations and plants may call for specific requirements. Consult Aqua-Aerobic Systems, Inc. for exact recommendations or specific needs. Patents pending. Patent #'s 4,695,376 - 4,422,771 - 4,733,972 - 4,723,848 - 4,764,053 apply. Other patents may apply.

Bulletin No. 950C 1/02