

ChemScan®

PROCESS ANALYZERS

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ChemScan® Application Summary #98 SBR Stage Control

Process Description

Although many different types of systems exist, Sequencing Batch Reactors (SBR) perform conventional or advanced wastewater treatment by providing reaction and settling within the same basins but at different time intervals. Sequencing Batch Reactors can be operated to achieve carbon and nitrogen oxidation, nitrogen removal and/or biological phosphorous removal by creating anaerobic, aerobic or anoxic conditions in the reactor. Figure 1 shows one possible sequence for conventional plus advanced wastewater treatment.

Conventional Control Strategy

Conventional control of an SBR uses a fixed time interval to control fill and react stages of the SBR process. Although it is possible to vary reaction times according to the time of day, in an effort to correspond to the normal diurnal variations experienced by the plant, such practices depend on contamination concentrations that consistently vary in proportion to the flow. Equalized flows from a holding tank may contain highly variable nutrient concentrations due to uneven nutrient loads into the holding tank. A time interval based control strategy may need to be designed to overtreat during each stage in the treatment sequence. This strategy can result in facilities that are oversized in order to accommodate these long reaction times and facilities that consume excess energy during the aerobic stage or for mixing during the anaerobic or anoxic stages of the treatment sequence.

ChemScan Control Strategy

A control strategy based on the ChemScan Process Analyzer uses on-line analysis of the major nutrients (ammonia, nitrate, nitrite and, if required, phosphate) to determine the end of each react stage. ChemScan Process Analyzer systems can be designed to analyze a sample taken from the reactor at frequent intervals, with the results communicated to the SBR controller.

Nitrification has been fully achieved when the ammonia-nitrogen concentration is at zero or at a pre-determined low concentration set point. Denitrification can be controlled by measuring nitrate plus nitrite (total oxidized nitrogen) at the start of the anoxic

denitrification stage and using this information to add an appropriate carbon source volume (methanol or other media). Denitrification has been achieved when nitrate plus nitrite are at zero or at a pre-determined low concentration set point. Biological phosphate removal can be monitored by measuring orthophosphate released during the anaerobic stage to achieve a set point concentration or a maximum end point value as determined by concentration values that are repeated during consecutive analysis events. Luxury phosphorous uptake can be controlled by measuring the orthophosphate residual in the anoxic stage for achievement of a low concentration set point or an end point determined by repeat concentrations for consecutive analysis.

(NOTE: Use of this strategy will require coordination with the SBR supplier for special SBR control system software. This control software is not provided by ChemScan. Contact the ChemScan factory or local representative for a list of SBR suppliers who have nutrient end point control software capabilities.)

Another alternative is for the SBR controller to initiate the ChemScan analysis sequence. If multiple SBR reactor tanks are employed, the SBR controller may also control the tank selection, initiate the analysis sequence and match the data output by ChemScan to the appropriate reactor and stage.

A single ChemScan Process Analyzer can detect ammonia, nitrate, nitrite and/or phosphate from one or more SBR tanks. Sample filtration using a ChemScan cross flow ultrafilter is required.

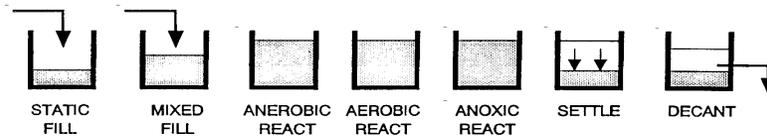


Figure 1
Sequencing batch reactor for carbon oxidation plus
phosphorous and nitrogen removal
(Source: WEF, MOP 11)