

ChemScan[®]

PROCESS ANALYZERS

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ChemScan[®] Application Summary #59 Denitrification Process Control

Statement of the Problem

Denitrification is a term applied to a biological wastewater treatment process used to convert nitrate (NO₃) into nitrogen gas. The process employs a special class of bacteria that metabolize carbon and oxygen. Under anoxic (low/no oxygen) conditions in nitrified wastewater, these bacteria are forced to strip an atom of needed oxygen from a nitrate or nitrite molecule. Carbon is typically obtained by the bacteria from a carbon source such as methanol which is added to the treatment process as a food source. The availability of nitrate and methanol are therefore the limiting factors that sustain a given population of denitrifiers. Underfeed of methanol will limit the reduction of nitrate in the process, while overfeed of methanol will result in a higher BOD value in the final effluent. The ideal is a methanol feed rate which is sufficient to obtain a desired amount of nitrogen removal given an overall process demand, which is a function of nitrate concentration and wastewater flow rate variables for a given set of process conditions.

Process Control Strategy

Methanol feed can be controlled through the use of on-line analysis of nitrate concentration before and after the denitrification process, as shown in Figure 1. Prior to the process, nitrate concentration can be monitored and combined with flow and other factors to produce a calculation of methanol feed for the process. A measurement of nitrate concentration after the process can be used to trim the methanol feed setting.

Apparatus

On-line analysis of nitrate can be performed at frequent intervals from multiple sample points using a ChemScan Process Analyzer. The ChemScan system measures light absorbance at numerous wavelengths in the ultraviolet and visible wavelength range. This information is used to calculate the concentration of nitrate in the sample while compensating for the presence of background chemicals and turbidity variations.

If desired, ChemScan can also detect nitrite, which is an intermediate step in the denitrification process, as another indicator of process efficiency. Detection of total oxidized nitrogen (nitrate plus nitrite) is also possible.

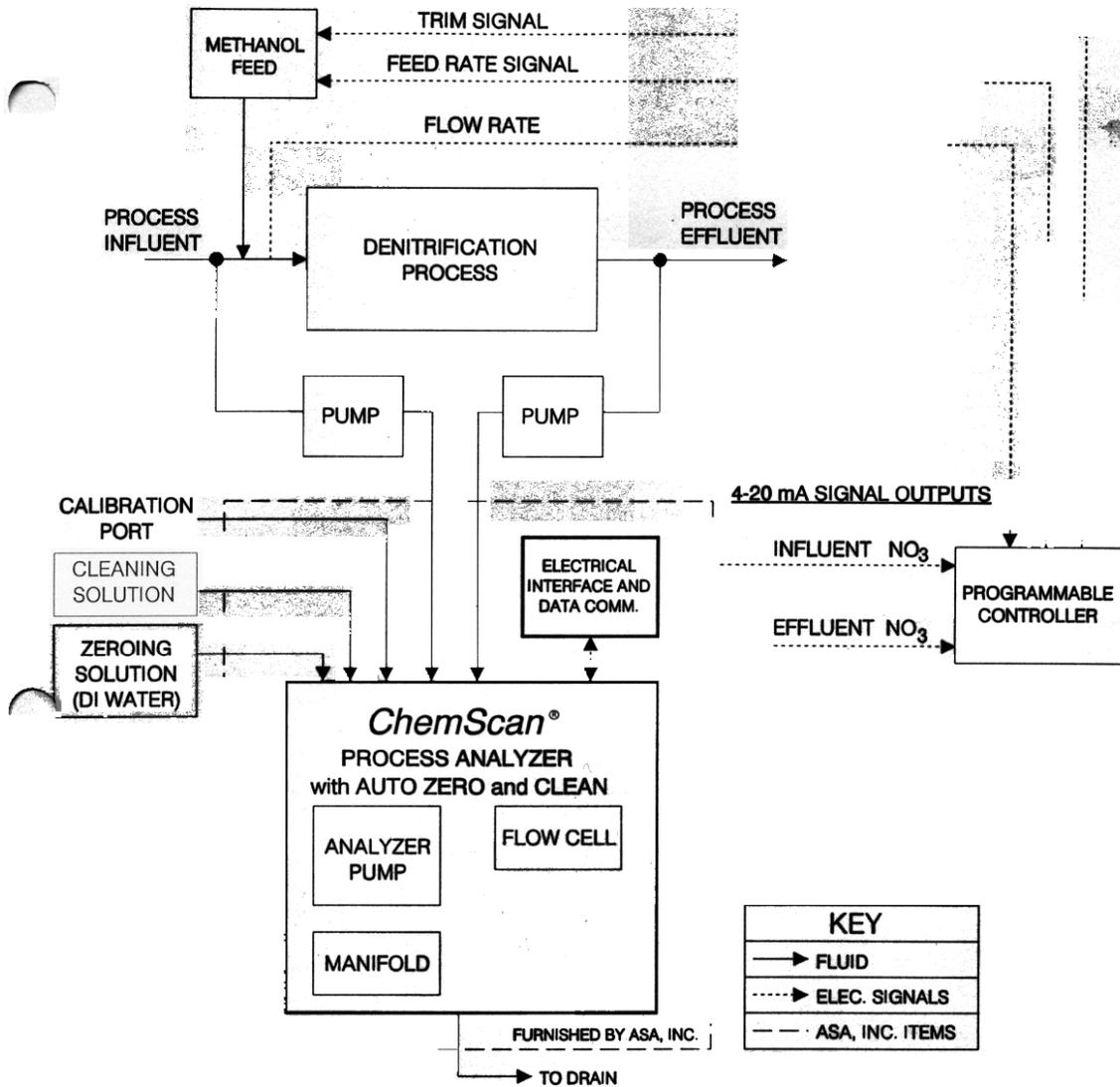


Figure 1
Functional Block Diagram of
Denitrification Process Monitoring System