

ChemScan[®]

PROCESS ANALYZERS

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ChemScan[®] Application Summary #95 Nutrient Balancing

The Nutrient Deficiency Issue

Biological treatment of wastewater depends on several types of specialized microorganisms that metabolize carbon, promote the oxidation or reduction of nitrogen, or uptake and release dissolved phosphorous. These microbes require certain minimum concentrations of both phosphorous and nitrogen to maintain or expand their population within the treatment process. When the process is deficient in either nitrogen or phosphate, the necessary conditions may not exist for biological treatment. Although domestic wastes tend to contain sufficient nutrient balances, industrial wastes or municipal wastes that are heavily influenced by industrial contributions may have a nutrient deficiency.

The following are typical nutrient deficiency situations:

Process	Deficiency	Typical Wastewaters
Nitrification	Phosphate	Pulp & paper, food processing
Biological Phosphorous Removal	Nitrogen	Detergents, specialty chemical
Denitrification	Carbon	Domestic or industrial

Process Control Strategy

The obvious solution to a nutrient deficiency is to add a sufficient quantity of the deficient nutrient into the wastewater. The challenge is to determine and control the nutrient volume necessary to add a sufficient quantity of nutrient to the process, without either starving the process (and reducing process efficiency) or adding excessive nutrient volumes (which could result in adverse process consequences and wasted resources).

Apparatus

ChemScan Process Analyzers can be used to implement control strategies designed to correct nutrient deficiencies while avoiding adverse consequences from overfeed of the deficient nutrient.

A classic example is the use of ChemScan to detect nitrate prior to denitrification and/or after denitrification, with the nitrate concentration values used to pace the feed of methanol or other sources of carbon. (See the Application Summary #59, "Denitrification Process Control".)

ChemScan can be used to detect ammonia and total oxidized nitrogen (nitrate plus nitrite) in processes with a phosphate deficiency, thus allowing sufficient nutrient balance for nitrification, without producing excess oxidized nitrogen or discharging excess phosphate.

ChemScan can also be used to detect orthophosphate and the combined polyphosphate plus orthophosphate, thus monitoring the enzyme catalyzed conversion of polyphosphate to orthophosphate form. Phosphate concentration measurements can be used to control the feed of ammonia or other nitrogen sources to correct nutrient deficiency in biological phosphorous removal processes.

High organics and/or highly colored samples may be an issue for certain industrial wastewaters. Sample filtration and/or dilution may be required prior to analysis by ChemScan. Multiple sample point analysis is advisable for most nutrient balancing applications.