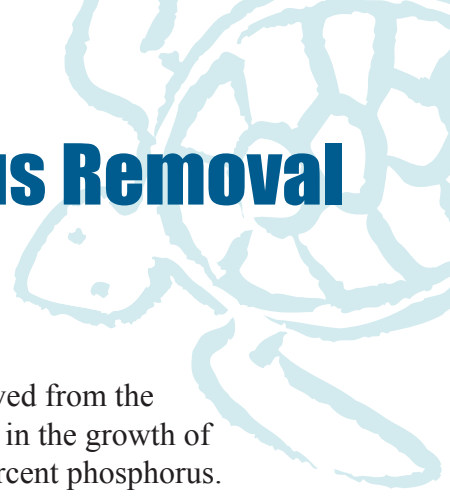


Enhanced Biological Phosphorus Removal



During conventional wastewater treatment, some 2 mg/L of phosphorus is removed from the wastestream and converted to bacterial mass. Phosphorus is an essential nutrient in the growth of bacteria and, for that matter, all living things. By weight, bacteria are 1.5 to 2 percent phosphorus. Meaning, for every dry ton of waste sludge, 300-400 pounds of phosphorus is biologically removed from wastewater.

“Enhanced” biological phosphorus removal increases the dry weight component of phosphorus to five percent or more. Wastewater professionals who understand the process can quadruple phosphorus removal without the use of chemicals.

Enhanced biological phosphorus removal is a two step process: a period of anaerobic treatment (zero oxygen), followed by aerobic treatment. Volatile fatty acids (VFAs) drive the process. VFAs are produced in anaerobic conditions. When VFAs are added to mixed liquor in an aeration tank, the bacteria take up large amounts of phosphorus. The phosphorus is removed with the bacteria as waste sludge. There is a temporary increase in phosphorus concentration in anaerobic tanks. While bacteria are making VFAs, they temporarily release phosphorus into the wastestream. Then, under aerobic conditions, bacteria take the phosphorus – and much more – back into their cells.

Municipal wastewater treatment plant staff can create volatile fatty acids in any number of ways. VFAs can also be imported; for example with septage.

The three textbook ways of creating VFAs are: (i) in a mainstream anaerobic tank located ahead of aeration, (ii) in a primary sludge fermenter, and (iii) in a return sludge selector. The biological process needs little to no attention. Simply allow moderate to high BOD to remain anaerobic for a period of an hour or longer. VFAs can be created in aerobic digesters by turning the air off, in sludge holding tanks, and by subjecting most any sidestream waste to anaerobic conditions.

Anaerobic digesters are NOT a good source of volatile fatty acids because digesters convert VFAs to methane. In fact, VFAs are the chemical compounds that cause digesters to go “sour.” VFAs are a major component of the volatile acids measured when determining the volatile acids/ alkalinity ratio for anaerobic digesters.

It is generally possible to attain effluent phosphorus concentrations of less than 0.5 mg/L using biological phosphorus removal. But, only when effluent suspended solids concentrations are very low. This, because a 10 mg/L TSS effluent contains approximately 0.5 mg/L of “suspended” phosphorus. In order to consistently meet permit limits of less than 0.5 mg/L, effluent filtration and/or chemical treatment is generally necessary.

