# Justification for the use of the PrO2 in phosphorus removal from supernatant

The PrO2 helps improve digestion of "volatile solids" in wastewater digesters due to increased oxygen delivery efficiency into wastewater. The improved oxygen delivery efficiency helps accelerate biological activity in a digester and thus improve performance.

There are a variety of applications for the PrO2 technology in wastewater, however a critical improvement that has been documented through independent testing is the **reduction of total phosphorus levels** in the decant water from aerobic digesters. Consequently, these results increased the concentration of total phosphorus in the sludge blanket at the bottom of the tank. Thus, while the chemical that is at once helpful to agricultural endeavors but harmful to watersheds, both goals are achieved. That is, the residual sludge has an agronomical incremental value while simultaneously improving waste water quality.

The theory behind this phenomenon is that typical wastewater contains approximately 20% organic phosphorus in the form of polyphosphate stored within the cell structure of the resident biomass in the wastewater. The balance of the phosphate is inorganic and water soluble orthophosphate. As respiration is enhanced, especially with the aid of the PrO2 system, the microorganisms consume volatile organic solids at a much higher rate, which will result in an increased number of microorganisms (biomass) and the production of carbon dioxide and water.

The increased microbial biomass results in the uptake of soluble orthophosphate to organic polyphosphate. The organic polyphosphate (now part of the microbial biomass) can more readily settle in the tank during tank settling. The result is a lower concentration of soluble inorganic orthophosphate present in the supernatant for decant. Below you will find data that substantiates this claim from a recent pilot study.

**Table 1.** Supernatant analysis: Indicates that the overall reduction of solids (inorganic and organic) was 84% and the phosphorus levels were reduced below detection levels. Also, the % volatile organic rose, which indicates increased microbial activity.

| Before PrO2 | After PrO2 |
|---|---|
| % Total Solids = 2.87 | % Total Solids = 0.47 |
| % Total Volatile Solids = 32.86 | % Total Volatile Solids = 77.53 |
| Total Phosphorus (ppm) = 381 | Total Phosphorus (ppm) = 0 |

**Table 2.** Sludge analysis from the bottom two feet of digester during settling. The results indicate that solids and phosphorus are thickening at the bottom of the tank producing higher quality sludge for land application, while at the same time producing a sludge that is more cost effective for the municipality for disposal.

| Before PrO2 | After PrO2 |
|---|---|
| % Total Solids = 3.16 | % Total Solids = 5.12 |
| % Total Volatile Solids = 33 | % Total Volatile Solids = 34.21 |
| Total Phosphorus (ppm) = 412 | Total Phosphorus (ppm) = 750 |

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