Eco Oxygen Technologies Technical Bulletin

USING PURE OXYGEN IN WASTEWATER - AN OVERVIEW

The advantageous utilization of air as an oxygen source for water quality management is based upon low electricity rates as energy costs are dominant in the total life cycle costs. Conversely, the advantageous utilization of high purity oxygen (HPO) is based upon high oxygen absorption efficiency as oxygen cost is dominant in total life cycle costs.

The cost of HPO varies widely, e.g. $30/ton from an oxygen pipeline, $60/ton for large volume users such as paper mills, to in excess of $200 per ton for small volume users. On-site generation of HPO by PSA/VSA is available for total costs of less than $70/ton. Additionally the oxygenation system should manifest relatively low unit energy consumption per ton of D.O. added as well as being capable of producing a relatively high D.O. concentration in the discharge, e.g. 50 to 100 mg/L. The availability of such oxygenation equipment opens up niches in water quality management, which are not available using conventional aeration. With proper technology, oxygenation can be efficiently and economically used in open-topped tanks and lagoons for BOD removal, elimination of off-gas odor generation and avoidance of hazardous air pollutant stripping. HPO also opens up the possibility of H_2S elimination in gravity and force sewer mains. Odor elimination from primary clarifiers – the major odor source in POTW – can be achieved with HPO without the need for covering the tanks and treating the noxious off-gases. Oxygen supplementation of combined sewer overflow basins, rivers and reservoirs using HPO offers practical solutions not possible or economical using aeration techniques.

COMPARISON OF TWO ODOR MANAGEMENT STRATEGIES

The two approaches which may be taken for odor management in wastewater operations are to treat the noxious gases after they are formed or to prevent them from forming. The first methodology treats the symptom while the second cures the problem before actually occurring. The second approach, namely prevention of H_2S formation, would provide much more cost-effective odor management than off-gas scrubbing because maintaining sufficient D.O. easily prevents H_2S generation, thereby eliminating considerable operating expenses for noxious gas removal and treatment.

Many volatile organics are readily biodegradable if maintained in the aqueous phase long enough for the microbes to metabolize them. An efficient oxygen absorption system would therefore allow the volatile organics to be degraded rather than air stripped with little air pollution impact. Additionally covering of the activated sludge aeration tank is not necessary when there is negligible off-gas stripping of noxious volatiles.

THE USE OF ALTERNATIVE ELECTRON DONORS

The cost of oxidizing chemicals per pound of oxygen equivalent:

- O_2 - $0.04 to 0.06/lb
- $Ca(NO_3)_2$ - $0.60/lb
- H_2O_2 - $1.50/lb
- Cl_2 - $0.35/lb
- $KMnO_4$ - $1.50 / lb
- Iron salts – "pickle liquor". (Cost is variable depending on metal finishing industry, typically from $0.35-$0.85/lb.)

When HPO is used in place of these alternative electron donors, there is a very short payback period on the investment.

POTENTIAL APPLICATIONS

Superoxygenation technology may be used with great benefit in the following potential applications:

- H_2S formation in gravity and force main sewers
- Maintenance of aerobic conditions throughout the primary clarifier for odor control
- Maintenance of oxic conditions in the surface layer of open-topped wastewater treatment tanks or lagoons for odor control
- Activated sludge treatment of volatile organic solvents (HAPs) without air stripping
- Maintenance of aerobic conditions in combined sewer overflow (CSO) storage tunnels and basins
- Achieve D.O. uptake rates of >300 mg/L-hr in advanced aerobic processes with MLVSS concentrations exceeding 20,000 mg/L VSS.

For assistance with your specific needs in this application, please contact your Eco Oxygen Technologies representative.