Factors Influencing Air Requirements to Treat Wastewater

Aeration Systems

Bulletin Brief

Technical Presentation

When developing an aeration system design it is necessary to have sufficient data to allow the many factors, which influence process air (oxygen) requirements to be properly evaluated. Some of the factors to be considered including those listed below:

*Refer to EDI Technical Bulletin 128 to estimate your oxygen requirements.

1. Depth of bioreactor.
2. Type of diffuser (efficiency)
   a. Fine
   b. Medium
   c. Coarse bubble
3. Geometry of diffusers in aeration basin or bioreactor.
4. Energy level in the bio reactor(Hp/1000 Ft^3).
5. Organic Loading to the reactor:
   a. Type waste
   b. Concentration
   c. Total # or Kg Loading
6. Type of wastewater
7. Process to be supported by aeration i.e. extended aeration, actuated sludge, partial mix lagoon etc.
8. Site elevation
9. Waste temperature
10. Submergence depth of diffuser
11. Dissolved oxygen concentration to be maintained in the bioreactor

FACTS

1. Once the process oxygen requirements*for treating your wastewater are known, the air volume can be calculated to provide oxygen for your treatment system. Process oxygen may be reported as AOR (actual oxygenation rate or requirements).
2. All aeration devices measure performance under IDEAL conditions known as standard conditions. (SOR or Standard Oxygenation Rate).
3. It is much more difficult to transfer oxygen in to wastewater under field conditions vs. the IDEAL standard conditions.

4. Efficiencies of aeration devices under standard conditions are presented as SOTE (standard oxygen transfer efficiency).
5. SOTE can be presented as % oxygen transfer or as a SOR ie, #O2/Hp hr or (Kg/Kw hr).
6. To convert efficiencies measured under standard conditions to field or actual conditions, IDEAL or SOTE values must be reduced by a field correction factor. This factor is generally referred to as AOR/SOR or actual oxygenation rate/standard oxygenation rate = Field performance/clean water performance.
7. Typical adjustments for AOR/SOR are 0.3 to 0.6. i.e., field transfers for oxygen are only 30% to 60% the efficiency measured under standard or ideal conditions by the manufacturer. (See technical analysis of AOR/SOR computations below).
8. Caution - One of the greatest potential errors in estimation air requirements is the effect of elevation. Please note plants operating at more that 500 ft (155 m) elevation must have careful consideration of elevation effects on AOR/SOR - see attached analysis.

Adjust Clean Water Transfer Characteristics for Field Conditions:

$$AOR/SOR = a\left[B\frac{(Cs) - (Cmin)}{9.17}\right]1.024^{(T-20)}$$

where:

a= Alpha. Process water volumetric mass transfer coefficient/Clean water volumetric mass Transfer coefficient.

B= Beta. Ratio of solubility of oxygen in process water to clean water.

T= Wastewater temperature in degrees C. Calculate for both summer and winter conditions to determine controlling AOR/SOR.

Cs- Oxygen saturation in clean water at temperature and elevation.

Cmin= Minimum dissolved oxygen to be maintained in system.

Calculate Airflow Requirements:

SOR or #O2/AOR=SCFM (SOTE as decimal) 1.036

Or cfm=SOR as lb 02/hr/SOTE (1.036)

For questions regarding this technical reference document, contact Environmental Dynamics

For specific information on aeration system selection considerations, contact EDI at 573-474-9456.