WASTEWATER APPLICATION: Clarifier Superoxygenation

Allow Clarifier to Operate as an Oxic Bioreactor

Secondary Clarifier Super-Oxygenation

Allowing your plant to utilize more "solids under air"

ECO$_2$
www.eco2tech.com

Does your WRF have process challenges?

…violations or consent decree?

…operating in the "red-zone"?

"RED-ZONE" VIOLATIONS

Common Process Challenges:

- Rising Sludge? …denitrification in the sludge blanket?
- Restricted by Capacity? …landlocked with no room for expansion?
- Need Lower F:M or Longer SRT? …insufficient BOD removal or nitrification?
- Difficulty Meeting Nutrient Limits? …winter changes or future permit?

Adding pure dissolved oxygen may be the solution.

The aerobic microbial sludge inventory can be increased up to 60% simply by superoxygenation of the influent to the secondary clarifier, allowing the sludge blanket to support aerobic metabolism throughout the settling process.

Aerobic Sludge Blanket in the Clarifier has the following benefits:

- Increased "solids under air" for a lower F:M ratio, and longer SRT
- Additional BOD removal for plants lacking physical space to expand
- Prevents rising sludge from denitrification in the sludge blanket
- Will not disturbing settling characteristics.

Wastewater superoxygenation is a process to dissolve pure oxygen to maintain oxic (or aerobic) conditions without disturbing quiescent settling conditions.

The level of dissolved oxygen (D.O.) required to support aerobic metabolism in a secondary clarifier is relative to its hydraulic retention time and oxygen uptake rate (HRT x OUR). Typical secondary clarifiers have a D.O. demand of 40 mg/L.

By using pure oxygen, 40-60 mg/L D.O. can be dissolved in the clarifier influent without exceeding the saturation level[1,2,3]. Thus, D.O. level of up to 60 mg/L will not cause effervescent loss of D.O. **and will not change the settling characteristics**. This makes secondary clarifier superoxygenation an ideal solution for plants facing certain operational challenges listed above.

The concept of Secondary Clarifier Superoxygenation is similar to the well-known principle of "Contact Stabilization" yet requires no additional tank volume. Both provide additional time for the bacteria to aerobically metabolize their internally-stored BOD before being recycled back to the aeration tanks. This ensures the RAS is "hungry" and therefore able to metabolize a new cycle of BOD when re-introduced into the plant flow. Superoxygenation allows this to occur inside the secondary clarifier, along with preventing rising sludge.

Notes on D.O. Saturation:

[1] The DO Saturation level with pure oxygen is 40 mg/L @ 0 ft head (STP)
[2] The DO Saturation level with pure oxygen is 60 mg/L @ 15 ft head
[3] The DO Saturation level with air is 8 mg/L @ 0 ft head (air=21% O_2)

Secondary Clarifier Super-Oxygenation

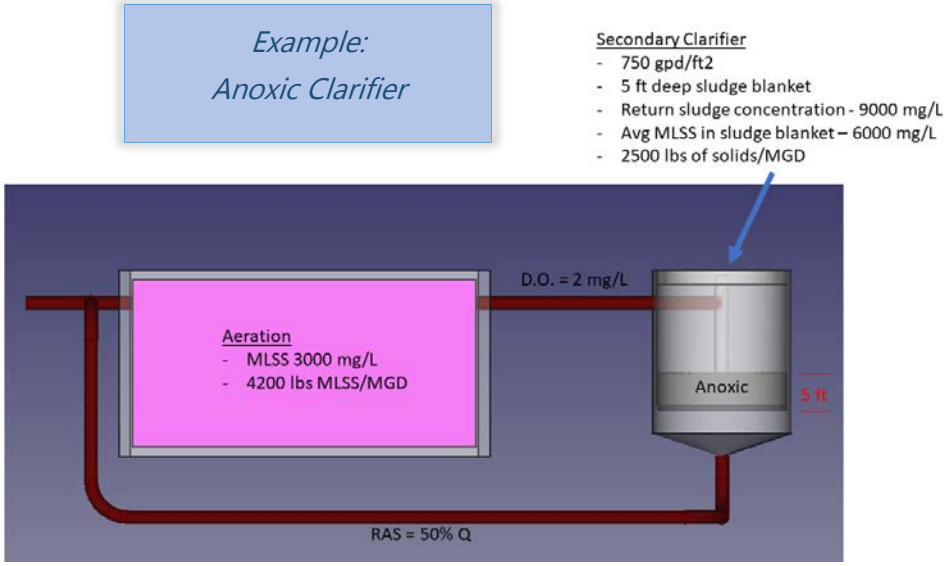
Allowing your plant to utilize more "solids under air"

ECO$_2$
www.eco2tech.com

The first diagram below shows a conventional secondary clarifier, where the entire mass of solids in the clarifier has zero D.O. content. During such conditions, these solids are unable to continue aerobic metabolization of BOD; and may be subject to denitrification which causes rising sludge. Maintaining a shallow sludge blanket, however, makes increasing MLSS and RAS concentration difficult to achieve.

Note: In the example below, the total mass of "solids under air" is equal to the solids in the aeration basin = **4,200 lbs / MGD**.

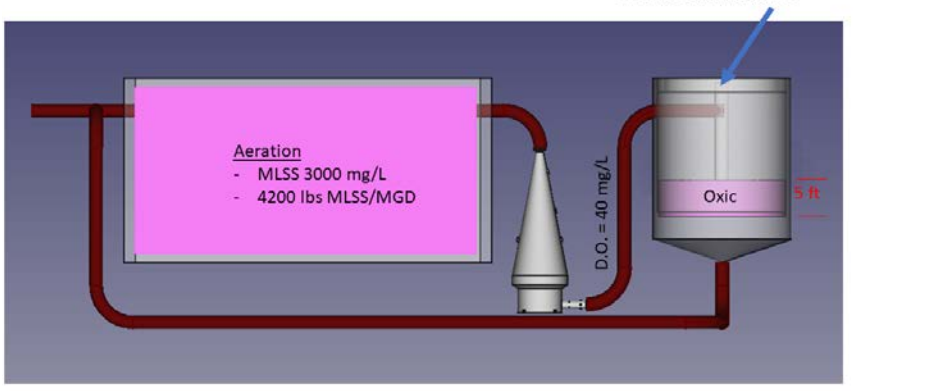
Example:
Anoxic Clarifier



Alternatively, as shown in the diagram below, superoxygenation of the clarifier influent greatly increases the mass of "solids under air" – without additional tank volume, and without changing the settling characteristics.

Note: In the "Oxic Clarifier" example below, the total mass of solids under air equals A-Basin Solids + Sec. Clarifier Solids = (4200 +2500) = **6,700 lbs / MGD**. This is an **increase of 60% more aerobic biomass**.

Example: Oxic Clarifier
(60% More Aerobic Biomass)



Food-for-thought: Without rising sludge in the clarifier, superoxygenation provides an opportunity to maintain a thicker sludge blanket and develop an even greater active biomass and higher sludge concentration.