

Troubleshooting Aerated Lagoons for Winery Wastewater



Aerated lagoons or ponds evolved from facultative stabilization ponds when surface aerators were installed to overcome the odors from organically overloaded ponds.

The aerated lagoon process is trying to simulate the extended aeration activated sludge process, except that an earthen basin is used for the reactor, and the oxygen required by the process is supplied by surface or diffused aerators. In an aerobic lagoon, all the solids are maintained in suspension. In the past, aerated lagoons were operated as flow-through activated-sludge systems without recycle, usually followed by large settling ponds. Lagoons and stabilization ponds are currently out of favor due to:

1. Odors from algae blooms.
2. Groundwater contamination concerns because they are only clay lined.
3. Newer regulations require additional treatment and better effluent control as well as solids handling programs.
4. Reuse of water is critical. Irrigation of vineyards from recycled treated water from the lagoons requires significantly higher levels of treatment.
5. Lagoons and ponds require a large footprint. Land is valuable and could be put to a better use, such as production or growth of more vines.



Lagoons with proper attention to the “Critical 5” can produce a good quality effluent that can be used for Vineyard irrigation. See troubleshooting information for more details on the “Critical 5”

SIGNIFICANT OPERATIONAL CONTROL PARAMETERS

Aerated lagoons with sludge recycle are very similar to activated sludge systems with respect to operation and control.

An aerated lagoon is usually deeper than a facultative pond. Mechanical diffused aerators provide most of the dissolved oxygen required and also mix the lagoon contents. The turbulence levels should be high enough to ensure uniform dissolved oxygen and suspended solids concentrations throughout. The higher the rate of oxygen transfer to the system, the more intense the mixing in the pond, and subsequently, the less pronounced the tendency for sedimentation. Factors that must be considered in the operation of aerated lagoons are similar to those of the activated sludge process and include:

- Biological solids produced

- Solids retention time
- BOD removal
- Pond mixing
- Temperature effects
- Ammonia and o-Phosphate addition if required
- Bioaugmentation if no recycle of biosolids is present, especially during high BOD swings



Biological Solids

High rate aerated lagoons can generate 0.6-0.7 pounds (0.27-0.32 kg) of suspended solids per pound of BOD5 removed if properly controlled. If there is insufficient DO, mixing, nutrients or MLSS present filaments can grow and increase solids by 40-60%. This can mean shorter life of your ponds, poorer effluent quality or increased dredging costs. If properly operated, and no Sanitary waste is mixed in your ponds or lagoons, natural biosolids can be used for land application and produce better crop results. Beneficial reuse credits may also apply.

Use of biosolids on crops can reduce the cost of nutrient supplementation from \$60-\$140 per acre and provide most of the N and P needed. The biosolids are a great source of natural nutrients, minerals and can benefit your crop yield by up to 25%. Coming Soon- Biosolids reuse and Crop Benefits

Lees, Mach and biosolids can be mixed for better mulching and quicker degradation of solids to produce a better fertilizer that will slowly re-release nutrients with less run off and leachate than chemical fertilizers.



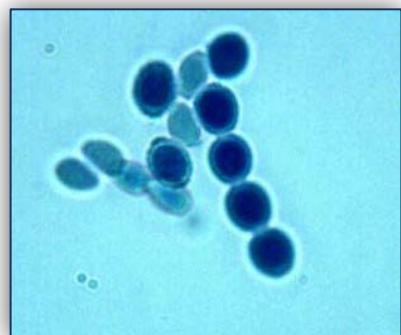
Solids Retention Time

The basis of operation for an aerated lagoon is the solids retention time, SRT. Typical SRT design values for aerated lagoons used for treating low strength industrial wastes vary from about 3 to 6 days. Aerated lagoons used in wineries can be simple, and used to store water for irrigation, or can contain multiple ponds, wetlands, and recycle loops.



BOD Removal

Aerated lagoons that are properly designed, operated, and maintained can produce an effluent that is low in solids and with effluent BOD5 concentrations of less than 30 mg/l. Solids concentrations in the effluent are variable (20-100 mg/l) and are affected by changes in season as well as during production or the Crush.



pH & Alkalinity Balance

In general, aerated lagoons operate most satisfactorily in the pH range of 7.5-8.5. To achieve the desired pH, the influent waste should be maintained from 6.5 to 8.3.

Wineries tend to have high levels of yeast in the process water. This can contribute to high TSS in the effluent. Just by raising the pH in the lagoons, you can help the bacteria outcompete the yeast, and thus reduce the amount of yeast growing in the lagoons. Yeast thrives at pH lower than 7 so raising the pH will accomplish two things.

Oxygen Requirement

Based on operating results obtained from a number of industrial and domestic installations, the amount of oxygen required varies from 0.7 to 1.4 times the amount of BOD5 removed.

Temperature

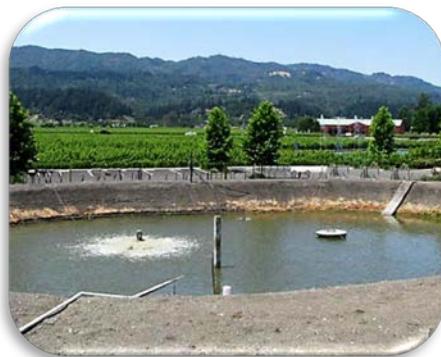
The two most important effects of temperature are (1) reduced biological activity and treatment efficiency.

Cold weather can sometimes be a problem for many plants due to permit restrictions and decreased biological activity. Many plants experience a significant drop in biological activity due to the temperature levels decreasing. Biological activity drops one log level for each 10-degree drop in temperature. This can significantly impact the amount of BOD loading that the biomass can handle effectively.

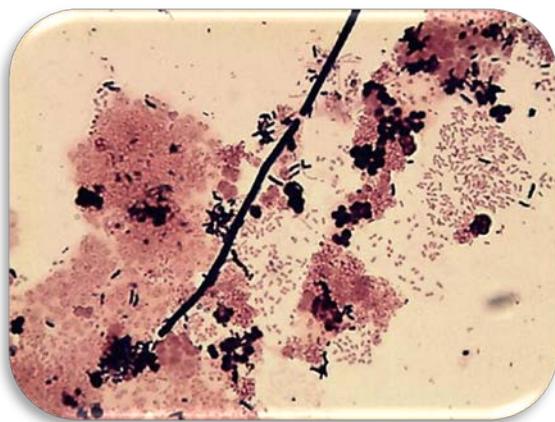
Icing effects may be minimized by increasing the depth of the lagoon or by altering the method of operation. Reducing the area by one-half increases the wastewater temperature. This action corresponds roughly to about a 50% increase in the rate of biological activity. Bioaugmentation can be supplemented during colder months, or during periods of high loading to help increase efficiency.

Nutrients are critical to the growth of bacteria in a wastewater lagoon.
Are you under dosing nutrients at your winery?

Here is a scenario we come across occasionally in many wineries where they have industrial pre-treatment. Almost all wineries have to add NH₃ and some levels of O- PO₄ for the carbonaceous bacteria to consume as a nutrient source because there are insufficient levels in the process water.



Sometimes plants under dose the nitrogen feed. They see residuals in the final effluent, so they decrease the ammonia levels. The plant then gets a wide swing in loading and of course it becomes nutrient deficient. Under doses are often common in this scenario. Nutrient dosing can be up to 17% of an operating budget at winery wastewater plants!!!

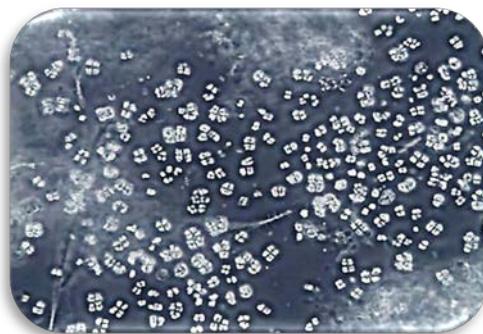


Typical dosing of nitrogen, many times for a rule of thumb, has been suggested that dosing of nutrients should be controlled so that there is a residual of 1-2 ppm in the final effluent. Part of the reason this rule of thumb guide is used is because final effluent residuals almost always have to be tested for permit levels. This saves on additional testing of influent parameters and the numbers are easily available.

The problem with this scenario is that sometimes, treatment plants are short on nutrients and create many problems in the system.

Another thing we see quite often at wineries that indicates this type of condition exists is the presence of tetrads. These little clusters of Gram negative and Neisser positive cells almost always indicate nutrient deficient. They can cause serious TSS problems. If you see these, it means again, you are usually under dosing nitrogen. Increase your nitrogen dosing.

An easier way to dose nutrients is to test influent COD loading. Then take influent flow times loading and calculate the exact dosing required. For every 100 parts of carbon, 5 parts of ammonia are needed and 1 part of ortho phosphate.



Bioaugmentation can be a way to help increase biological activity in your ponds and lagoon systems. When high swings in loading come through your system, and heavy foaming is present, this is an indication that you need more bacteria and more nutrients to handle the incoming load. Bioaugmentation can be a simple way to help when these situations occur. Environmental Leverage can provide products that simplify the ease of adding bioaugmentation no matter what type of large or small system you may have.

These products work in septic systems, non-aerated ponds, aerated ponds, treatment plants, lift stations, wet wells and drain systems. Our **MicroBlock™** can be very useful in situations with septic systems or pond systems for slow release of bacteria with 24/7 application. **MicroClear® 206** is packaged in convenient water soluble pouches.

Micronutrients also can help to increase biological activity at your facility. These can be supplements to any type of wastewater treatment system. Research & field tests have shown that inadequate micronutrients can lead to poor settling or high effluent suspended solids due to unhealthy floc. Addition of micronutrients **MicroClear® M100** may also increase the biological degradation rate in many situations that will allow the biomass to respond more quickly to sudden increases in loads or toxic shocks. By maintaining adequate micronutrient levels, the system

should also be more resilient
to load swings or toxic
shocks.



Please let us know if you need help with training, audits, troubleshooting and consulting.

We have Microbiology lab services available. Send us a sample for biomass analysis.

Extra services can be provided for operations as well as bioaugmentation. We carry a full line of bacterial products.



MicroBlock™
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MicroClear® M100