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Many smaller wineries have outgrown their septic tanks, and larger wineries have outgrown their treatment ponds, a Bio-Reactor gives increased capacity at a fraction of the cost of conventional pond treatment systems.

TREATING WINERY WASTEWATER

WITHOUT PONDS

Wineries traditionally treat their wine process wastewater with aerobic (aerated) ponds to biologically degrade the biochemical oxygen demand (BOD). The treated wastewater from these ponds needs to have a BOD of 40 ppm or less (depending on the location of the winery) before the winery can discharge the water to the vineyards for irrigation. The discharge level of 40 ppm as well as the restriction of standing water in an irrigation field is regional dependent and is regulated by the Regional Water Quality Control Board (RWQCB) or the local County Department of Environmental Health. If the BOD is allowed to exceed the limits, the irrigation water can create an odor in the pond and irrigated fields, which is offensive to the wineries' customers and neighbors. If the discharge levels are significantly higher than 40 ppm BOD, the irrigation water can develop a slime layer just under the soils surface, which 'plugs' the field. This slime layer blocks the soil percolation of the water into the soil, creating standing water. Most wineries wastewater permits specifically state that no standing water is allowed from process water that is used for irrigation.

Winery ponds require a large surface area (detention time) to treat the winery wastewater usually between 60-90 days for conservative design. Since the ponds have a large surface area, they need to include the capacity to hold a prolonged rain based on a 10-year rainfall event. Most wineries process their grapes in the late summer and subsequent wine in the winter months, the addition of the rain can greatly add to the size of the pond. In addition, due to the potential for standing water to create surface water runoff, the regulations limit the amount of water that can be irrigated during the wet weather months,

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requiring even larger ponds to hold the process and rainwater.

In summary, the use of ponds for treating winery wastewater is an inefficient use of the winery property. Below is a comparative summary of the expenses of installing a pond treatment system (either clay or plastic lined ponds are required), the loss in vineyard grape production and other expenditures not usually accounted for by winery owners:

Pond Design Parameters

Daily Process Wastewater Flow	**25,000 gal/day**
BOD Loading	**5,000 ppm (1,042lb/day)**
Pond Detention Time	**60-90 days**
10 year rain, av. winter monthly	**4-inches (more in Northern. CA)**
Pond Depth, average	**10 feet**
Required Freeboard	**2 feet**

Engineering Design/Permits for Ponds

Engineering Design	**Design, permit application**	**$30,000.00**
Geotechnical Engineering	**Soils sampling, testing**	**$20,000.00**
Project Management	**Construction mgt, inspection**	**$15,000.00**
	Subtotal	**$65,000.00**

Pond Excavation Cost

Process Volume	**2,356,000 gal**	**315,000 cu ft**	**11,670 cu yds**	**$40,800.00**
Rain Volume (min*)	**103,000 gal**	**13,800 cu ft**	**511 cu yds**	**$ 1,800.00**
Req'd 2' Freeboard	**605,900 gal**	**81,000 cu ft**	**3,000 cu yds**	**$10,500.00**
1' Excavation for Clay Liner	**N/a**	**40,000 cu ft**	**1,480 cu yds**	**$ 5,200.00**
		Subtotal	**16,667 cu yds**	**$58,300.00**

* rainwater does not include any winery surface runoff into the pond treatment system.

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Berming/Compaction/Clay Liner Cost

16,667 cu yds	**Compaction @ $1.75/cu yd**	**$30,000.00**
3,200 yds, 16yd/truck load	**Imported Clay, $300/load inc. trucking freight**	**$60,000.00**
3,200 yds	**Compacted Liner, 2' thick**	**$ 5,600.00**
Subtotal		**$95,600.00**

Aeration Equipment Cost

Aspirating type Aerators	**(3) 10 hp, installed**	**$30,000.00**

Lost Acreage for Grape Production Cost

Total Surface Area including side berm	**53,200 sq ft**	**1.3 acres**	**$24,000.00**
Lost Grape Production	**$7,000/acre/year**	**10 years**	**$91,000.00**
		Subtotal	**$115,000.00**

Total $363,900.00

This pond treatment example does not take into account any surface water runoff from the wineries uncovered process areas, which can be equal or exceed the total volume required to process the wastewater. The pond still needs an irrigation pond, which is sized based on the irrigation water demand, the soil solids loading (TDS) and dilution with 'sweet water' (clean well water). The irrigation pond allows the solids to settle prior to pumping into the irrigation system. The irrigation pond still falls under the criteria of compaction, clay liner, and 2' of water freeboard making the irrigation pond expense equal to the process pond.

For ponds that have a large volume of surface water runoff due to the slope of the facility or uncovered process areas, then ponds provide a large volume of storage that meet these requirements.

An Alternative Solution

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Instead of ponds, there is another way to degrade the BOD down to the levels required for irrigation discharge. The solution is the use of a biological returned activated sludge system also called a BioReactor. A BioReactor is a more efficient biological process than a pond system. The higher efficiency from the Bioreactor is due to the ability to treat small volumes of wastewater (thousands of gallons) as opposed to the millions of gallons in a pond system. The difference is very apparent when comparing odor generation during process upsets. The large surface area ponds are uncontrollable in off-gassing the odor causing gasses during an upset. A pond takes 5-7 days to recover yet a Bioreactor requires only 4-8 hours.

The BOD degradation ion a Bioreactor process involves a series of tanks either in ground (concrete) or above ground (steel or polyethylene). The oxygen is supplied with blowers and a fixed grid aeration system located at the bottom of the tanks. The wastewater flows into the first equalization tank where it is pH adjusted with caustic to a pH of 8.0. Pre-aeration of the wine process water is important for converting any sulfur dioxide (used for stopping the fermentation process) to sulfates and off-gassing any overdosed chlorinated sanitizing chemicals prior to the biological process. Maintaining a pH of 8.0 is important for two reasons, first at this pH any free chlorine rapidly converts to total chlorine, which has 1/1,000 the oxidizing strength of free chlorine. Secondly, the degradation of the BOD requires alkalinity, which is generally available at a pH of 8.0

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in wine wastewater.

The EQ-Blower provides pre-aeration as well as mixing to the equalization tanks with coarse bubble diffusers. The second equalization tank is for further aeration and mixing as well as the reseeding of the activated sludge from the final clarifiers. Following the two equalization basins, the wastewater flows into the aeration basin for aeration with blowers and fine bubble diffusers for efficient oxygen transfer to the water. The aeration chamber provides the highest amount of BOD degradation due to maintaining dissolved oxygen around 2.0 ppm and a high concentration of microbial biomass. After a detention time of 24-36 hours, the wastewater flows into the clarifier for settling of the solids forming sludge (sludge settling). The sludge is important since it has a high concentration of the biomass (bacteria) that needs to be returned to the aeration process, hence the name 'returned activated sludge'. Depending on the effluent water quality required, there are further steps that can be added to further purify the water.

The sludge is ideal to be used as a soil amendment applied directly to the vineyard and the Regional Water Quality Control Board as part of the waste discharge permit readily permits this.

The performance of a bioreactor depends on the system design and the influent wastewater conditions. The cost of a bioreactor system can be less expensive than the conventional and over conservative pond design(s).

The state of California RWQCB requires that 'food' process wastewater can be discharged without regulation if the BOD is below 40 ppm. There are areas in the state that allow a discharge of treated process wastewater up to a permitted amount of BOD in Pounds/day/acre (i.e. 100 lb BOD/day/acre). Below is an example of the costs for a Bioreactor wastewater treatment system.

Bioreactor Design Parameters

Daily Process Wastewater Flow	**25,000 gal/day**

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BOD Loading	**5,000 ppm (1,042 lb/day)**
Bioreactor Detention Time	**24-48 hours**
10 year rain, av. winter monthly	**N/a**
Bioreactor Basin Depth	**10 feet**
Required Freeboard	**N/a**

Engineering Design/Permits

Engineering Design	**Permit application (est.)**	**$3,000.00**
Geotechnical Engineering	**Soils sampling, testing**	**$5,000.00**
Project Management	**Construction mgt, inspection**	**Included**
	Subtotal	**$8,000.00**

Bioreactor Cost

Bioreactor System, installed	**60,000 gal**	**$220,000.00**
Bioreactor Surface Area	**1,200 sq ft**	
Berming/Compaction/Clay Liner	**Not required**	**$0.00**
1' Excavation for Clay Liner	**Not required**	**$0.00**
Aeration Equipment	**Included**	**$0.00**
Lost Acreage for Grape Production	**0.03 acres**	**$210.00**

Total Cost $228,210.00

Either system will still require an irrigation pond, but there is a significant amount of money that can be saved with a Bioreactor system. The savings become significant when the internal winery process of wastewater generation is reviewed. These processes include cleanup/sanitizing, barrel washing, tank washing, Lee's filtrate handling, crushing operations, bottling operations and wash down.

Many wineries now have a choice between when their wastewater discharge exceeds the capacity of the existing pond system. Instead of excavating and creating additional ponding, a Bioreactor could be installed at a fraction of the cost. Ideally, a Bioreactor would be installed in the front of the pond system to perform the majority of the BOD reduction. The result: less capital cost, less lost grape production acreage, and increased wastewater capacity.

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Summary: The traditional pond systems to treat winery wastewater requires a good deal of acreage due to the long detention times required for the degradation of BOD to the levels required for irrigation. A Bioreactor can save a significant amount of capital costs, increase the wineries wastewater capacity at a fraction of the costs of conventional pond treatment methods. Existing wineries can easily adapt the Bioreactor system into their process and new wineries can greatly benefit by utilizing these advantages from the start.

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