Garlic Case Study

Utilizing Bio System's Microbes and Aeromix Systems to develop a stable biomass and eliminate odors from a food processing pond.

A California garlic processor had a persistent odor problem with their wastewater pond and had been under increased scrutiny from the Regional Water Quality Control Board (RWQCB) as well as the Air District to reduce the pond odors.

The odors emanating from this pond were due to insufficient biodegradation, low pH, and low dissolved oxygen. To compound the problem, the facility has increased production substantially over the years resulting in higher Biological oxygen Demand (BOD) loading to the pond. The facility found themselves limited in their ability to expand production by the local regulators as well as an inability to purchase more land from an adjacent farmer due directly to the odors.

System Evaluation:
Integrated Engineers was retained for consulting services by the garlic processor to reduce the chronically foul pond odors. The initial engineering evaluation determined the pond was aerated by a single 5 hp positive displacement blower with coarse bubble diffusers. The pH was being adjusted randomly by the addition of 50% caustic and some microbial cultures. Laboratory analysis determined the following water characteristics in the pond:

Dissolved Oxygen	0.0 - 0.2 ppm	pH	5.1
Alkalinity, Total	33 ppm	BOD	860 ppm
Kjedahl Nitrogen	78 ppm	Total Phosphates	6.3 ppm
Sulfides	6.0 ppm	Iron	0.17 ppm

Based on the data, some of the odors were a direct result of the low dissolved oxygen which allows the formation of sulfides. This was evident in the gas bubbles on the surface of the pond. The low dissolved oxygen allows the conversion of sulfates to sulfides and due to the low pH, the resulting sulfide gas comes out of solution and bubble to the surface. The low pH was detrimental to the formation of a biomass since the microbes that are responsible for carbonaceous degradation of the BOD start to die at a pH below 6.0. A pH of 5.1 is much too low to sustain the required biomass. A further step was taken to insure that there was a proper nutrient ratio of:

BOD = 100 : Nitrogen = 5 : Phosphates = 1 : Iron = 0.5

This ratio is important to insure there are sufficient nutrients for BOD reduction. For proper BOD reduction to occur, there needs to be sufficient oxygen (D.O.), alkalinity, pH near neutral (7.0 pH or slightly above), adequate mixing of the influent BOD with the microbes,

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and nutrients. It was determined that the lab results roughly followed this ratio and that there should therefore not be a nutrient deficiency that would hinder adequate BOD reduction.

The influent BOD loading and flow rate data were used to calculate the actual BOD loading in lbs/day. Based on this calculation and the size of the pond, it was determined that the three 10 horsepower aerators were needed. It is important to note that floating aerators with this tornado design were selected due to the fact that they provide superior mixing to the whole pond as well as injection of oxygen into the water. Mechanical type aerators (the splashing type) provide only localized aeration and mixing with dead zones at the edges of the pond. The goal was to eliminate all odors as soon as possible.

In addition to the mechanical equipment, microbes were needed to quickly increase the biomass (bacterial) population. A blend of microbes was selected for the degradation of BOD as well as decreasing the sulfates which are the source of the sulfides. The microbes were conveniently packaged in 1-pound bags that are made from starch. The starch bags quickly dissolve in water releasing the microbes. The starch bags are more convenient that other microbial supplied packaging.

Action:
After agreement with a game plan based on the laboratory information, the three 10 horsepower aerators were quickly delivered within 7 days. On the eighth day, the aerators were installed. Meanwhile, a caustic feed system was installed to start bringing the pH in the ponds up from 5.1 to 7.0+. The aerators were turned on and the pH was increased to the final pH of 7.5. The microbes were added at an initial dosage of 50 pounds with 2 pounds added each day thereafter. The caustic was added to maintain a pH of 7.0. and the dissolved oxygen levels were monitored daily.

Result:
Within 24 hours, the pond dissolved oxygen levels had increases from 0.2 ppm to 2.0 ppm, the odors had greatly decreased, and the pond went from a blackish to a brown color. Over the next few days the dissolved oxygen kept increasing and the pond was slowly changing colors to lighter shades of brown. After 7 days, the dissolved oxygen level was at 8.0 ppm and the pond was a medium shade of green. The result was that in 7 days, the ponds biomass was fully developed, no odors were evident, the sulfide gas bubbles were gone, and the BOD measured in the pond dropped from 860 ppm to 18 ppm.

Conclusion:
The plant now has the capacity to expand its production without increased odors and complaints. The project cost $45,000 to complete including the cost of engineering, lab analysis, all three aerators, installation, chemicals, microbes, startup, and training. By utilizing the existing pond, the facility saved a significant amount of money faced with other wastewater treatment alternatives. The pond capacity to degrade more BOD has increased, there will be no more capital costs to the operation when the plant expands its production.