

Report as of FY2006 for 2006MO67B: "Low Rate Mixing & Struvite Precipitation: Paired Treatment for Swine Waste"

Publications

Project 2006MO67B has resulted in no reported publications as of FY2006.

Report Follows

Low Rate Mixing & Struvite Precipitation: Paired Treatment for Swine Waste

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Summary: The project was off to a slow start due to the difficulty of finding a promising graduate student at the timing when the grant was established. After a slow start, the project took a slight re-direction as it was determined that adding the a mixer to a new lagoon as proposed was cost-prohibitive under the limited funds available. Alternatively, the collaborating company, Absolute Aeration, offered to share data from a similar project with municipal wastewater in California. This data has served as a solid source of data, and takes the place of the second mixed lagoon. Struvite precipitation has been evaluated in the laboratory, revealing the base addition that is needed is reduced by aeration, and that solids in the wastewater does not inhibit struvite precipitation as was previously hypothesized. Overall, the project did get off to a delayed start, but now is generating solid data and will lead to one masters degree, and likely two publications. A No cost extension was request for the end of 2007.

Progress: Struvite precipitation was evaluated with swine waste solids at controlled levels. The tested levels of solids ranged up to 250 mg/l, Figure 1, and removal was not significantly different from earlier tests without solids. Struvite precipitation conditions were carried out at a pH of 8.5 to 9.0. Research also revealed that anaerobic lagoon wastewater can reach a pH of up to 8.0 to 8.2 through aeration alone. Aeration strips the CO₂ from the solution and increases the pH nearly to the pH values necessary for efficient struvite precipitation, shown to be near 8.7 in previous research.

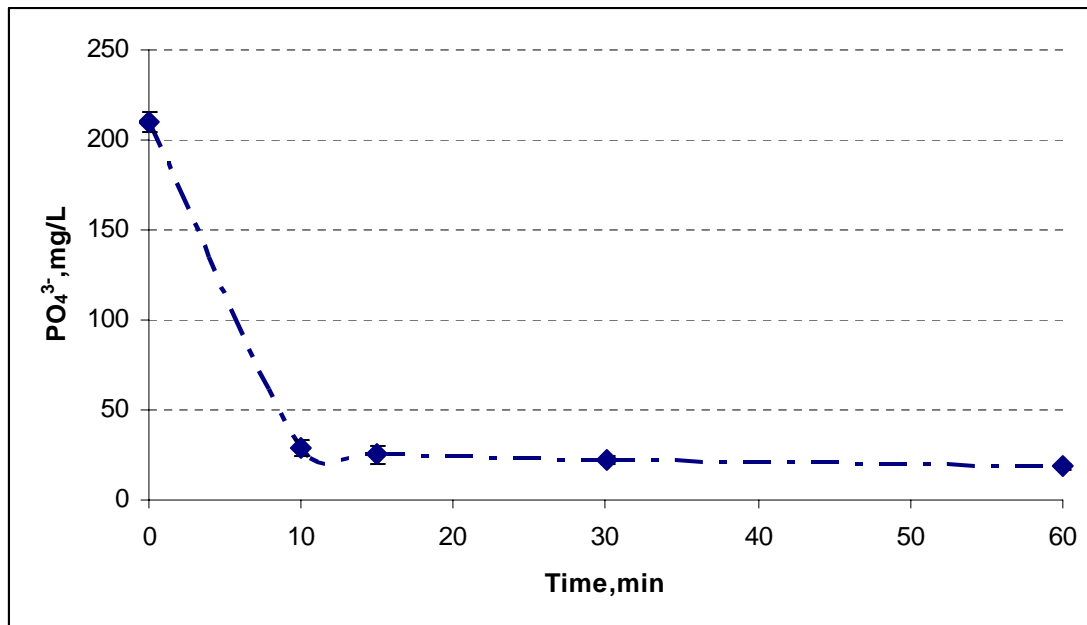


Figure 1 Phosphate removal over time with 250 mg/l swine waste solids in the wastewater.

Research was also conducted to evaluate the mixing dynamics of the constructed struvite precipitation reactor. A reactor model will soon be completed and will be used in process

optimization and application. A possible test site in Idaho has been identified. The animal production facility has been cited for P problems in their lagoon effluent and may be closed without attention. Owners are considering a pilot struvite precipitation process.

Lagoon Monitoring: The existing mixed lagoon has continued to be mixed, although a mechanical problem had the mixer down for 2 months this fall. Data from the sampling is shown in Table 1. COD and Ammonia levels have reached all time lows since the mixing was initiated over 4 years ago. Mixing was halted for much of 2005. Consistent P levels have not been maintained. Struvite precipitation that had been observed is no longer occurring spontaneously. Monitoring is ongoing.

Table 1 Mixed lagoon properties.

Sampling date	COD (mg/L)	Ammonia (mg/L)	PO ₄ (mg/L)
5/9/2002	801 ± 208	231 ± 26	54 ± 3
9/5/2003	574 ± 77	150 ± 11	47 ± 7
10/3/2003	428 ± 219	170 ± 11	45 ± 33
10/24/2003	434 ± 231	170 ± 11	9 ± 3
11/20/2003	530 ± 240	173 ± 19	29 ± 8
12/17/2003	378 ± 87	168 ± 18	13 ± 3
3/22/2004	655 ± 92	200 ± 13	122 ± 21
4/20/2004	774 ± 559	217 ± 22	106 ± 30
5/20/2004	759 ± 323	233 ± 28	34 ± 2
6/23/2004	458 ± 104	237 ± 13	56 ± 7
7/24/2004	355 ± 168	213 ± 22	84 ± 29
6/27/2006	205 ± 10	139 ± 37	52 ± 4
7/20/2006	213 ± 11	88 ± 17	46 ± 7
8/31/2006	167 ± 30	77 ± 6	26 ± 3
9/11/2006			28 ± 3
9/12/2006			

* Values are mean ± standard deviation

Tulare Data: Data from municipal, aerated lagoons in Tulare California was offered from Absolute Aeration. Of the 5 ‘trains’ of lagoons, one was converted to similar low rate mixers analyzed in this study. The mixers were fitted aerators that injected micro-bubble aerators. An aerial figure of the site is shown in figure 2. In the figure, train B was down for maintenance. Train D was converted to use the mixer/aerators. Through the use, started in fall 2006, the BOD and SS levels appeared to fall or at least stabilize in the first 6 months. The level of sludge also is dropping, revealing that the lagoon aerator can lead to lower maintenance for the lagoons, as well as better effluent quality. The biggest benefit is an estimated energy savings of over 60% that could be nearly \$500,000 annually. UMR is serving to evaluate treatment quality in collaboration with Absolute Aerations. We are hoping to publish this work, and perhaps pursue a SBIR development grant.

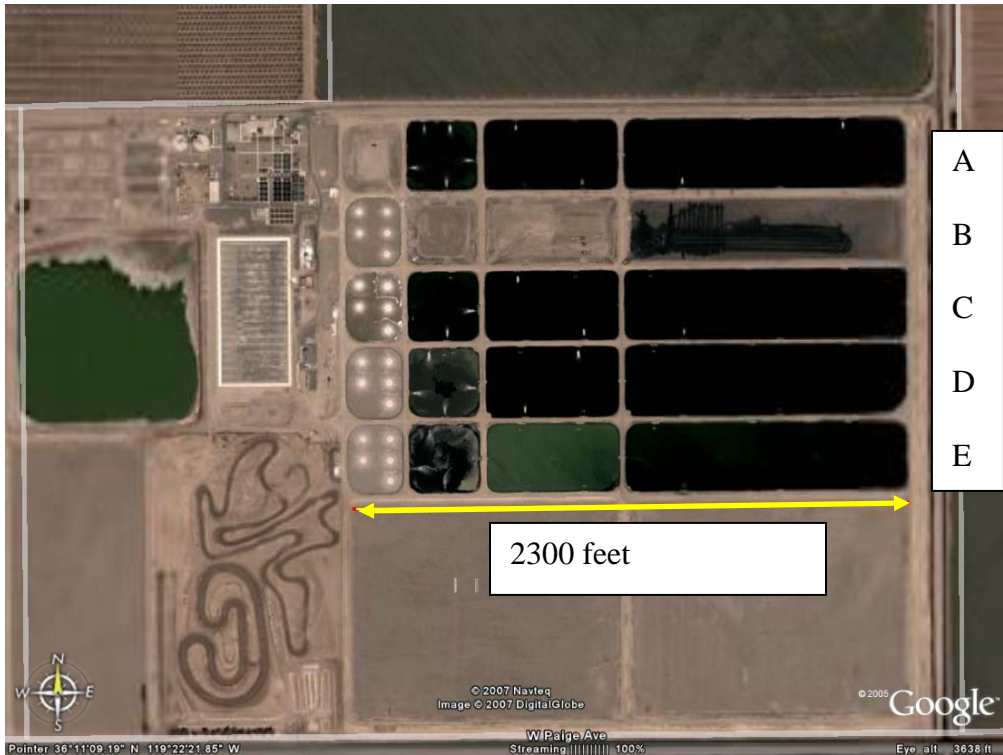


Figure 2 Aerial view of Tulare lagoons

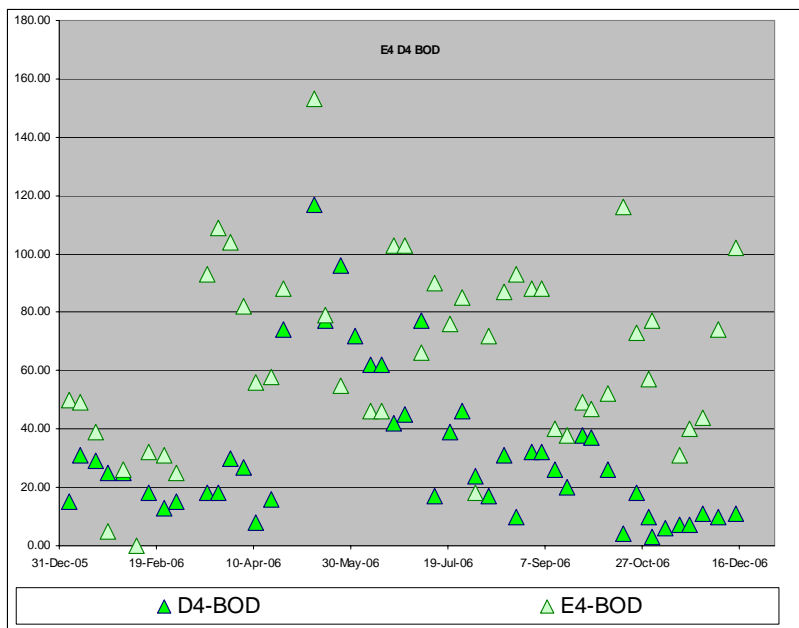


Figure 3 showing the BOD levels in lagoon E4 and D4 following the start-up of the aeration-mixers in lagoons D2,3,4. Lagoon trains E and D are closest in the characteristics of waste received.

Plans: The Tulare data for Jan – June 2007 is expected very soon and the treatment of actual waste from swine facilities is currently continuing. Full evaluation is planned for July – September 2007. Publications are in preparation and will be forwarded once finished.

Students trained:

- ◆ Sushmita Dhakal. Ms Dhakal is on target to receive her MS degree in Environmental Engineering in December 2007.
- ◆ Michael Pyles. Mr Pyles assisted with the project as an undergraduate and is currently on coop.
- ◆ Phillip McGee. Mr. McGee is currently assisting with this project, and will continue to assist through the summer.