Case Study: A breakthrough in biosolids treatment.

Phosphorus and Pathogen Reduction in Biosolids

ElectroCell Technologies / Tri -Cities North Regional Wastewater Authority (TCA), Dayton Ohio

In May, 2012 Hazen and Sawyer conducted pilot testing of ElectroCell Technologies' BioElectric treatment technology on anaerobically digested biosolids from Tri-Cities North Regional Wastewater Authority (TCA) near Dayton, OH.

ElectroCell's BioElectric technology uses precisely managed electric pulses to break down liquid wastes. No chemicals or additives are used. The technology has been used to significantly reduce nutrients, odor and pathogens in livestock manure for several years. The objective of this pilot was to determine if similar results were achievable in biosolids.

Trial results exceeded expectations. After treatment and settling, total phosphorus (P) was reduced more than 80% and fecal coliform were reduced below laboratory detection limits.

Background

TCA pumps biosolids from their anaerobic digester to a series of sludge storage tanks positioned beside their municipally owned farm fields. Biosolids are injected twice per year to meet crop nitrogen requirements. Biosolids have a higher phosphorus to nitrogen ratio than crops require. As a result, each land application delivers more phosphorus to fields than crops can effectively utilize. Over time, phosphorus accumulates in soil and presents surface water pollution risks. This is a common phenomenon wherever biosolids or manures are used.

In an effort to protect surface waters and prevent excessive phosphorus from being applied to fields, Ohio is implementing new regulations based on actual soil phosphorus levels. Under these new regulations, phosphorus became a limiting factor on hundreds of acres of TCA's fields. Biosolids application rates would have to be significantly reduced, requiring TCA to acquire additional farm land or explore other, more costly biosolids disposal methods.

The challenge of matching the nutrient content of organic wastes such as biosolids and manures with the nutrient requirements of crops is one that wastewater treatment plants and livestock farms all over North America are struggling with.

The Trial

The primary objective of this trial was to reduce phosphorus levels in land-applied biosolids and preserve TCA's multi-million dollar investment in its disposal infrastructure. A secondary objective was to reduce fecal coliform bacteria levels significantly, in order to bring the biosolids from Class B to Class A.

ElectroCell treated the contents of TCA's sludge storage tank #7 in May of 2012 (see Figure 1), using a mobile BioElectric Treatment System. The 680,000-gallon contents of the tank were mixed continuously for several days prior to treatment using an in-tank blade mixer. Mixing was continued during treatment.

ElectroCell treated the tank contents at an average rate of 92 gallons per minute. In-tank mixing was turned off upon completion of the ElectroCell treatment.

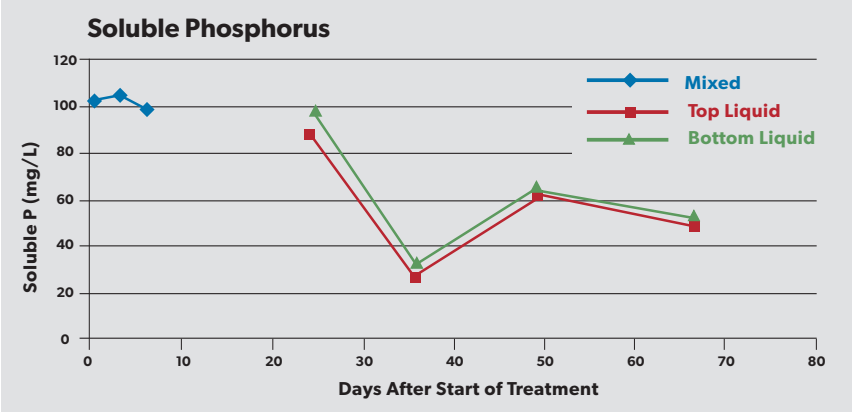
Mixed samples were collected pre-treatment, mid-treatment and immediately following treatment. Stratified samples were drawn every two weeks for eight weeks following treatment. During each stratified sampling event, one sample was drawn 1' below the surface and a second sample was drawn from 1' above the accumulating layer of bottom solids. The final sampling event also included a sample of solids taken from the bottom. This solids sample was subjected to the same tests as the stratified liquid samples.

Figure 1
This self-powered, BioElectric treatment system can be delivered by a pickup truck, set up in hours and it will process up to 6,000 gallons per hour unattended 24X7.

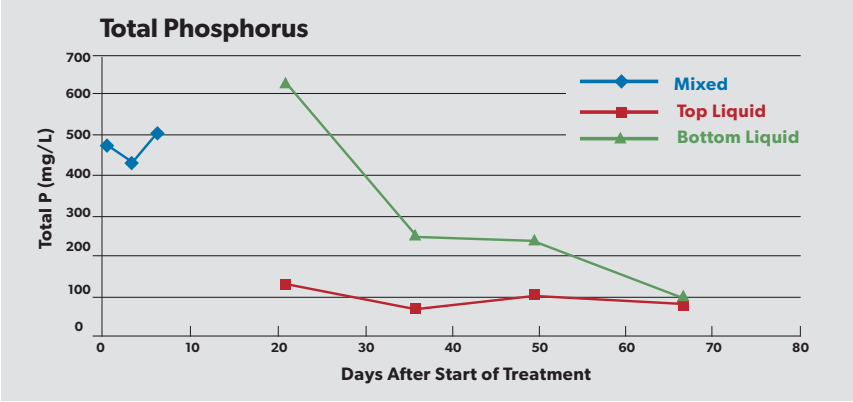
Results

BioElectric treatment achieved substantial phosphorus reduction and a number of other important changes in the biosolids including:

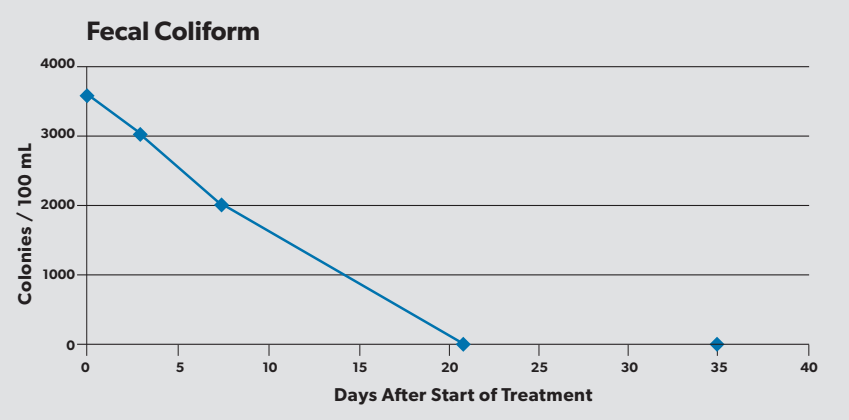
1. **Soluble Phosphorus,** which represented about 20% of the total initial mass of phosphorus, was reduced by approximately 50% in the supernatant layer.



2. **Total Phosporus** in the supernatant layer was reduced by more than 80%. Eight weeks following treatment, approximately 85% of the Total Phosphorus mass was concentrated in the bottom 25% of the tank volume.

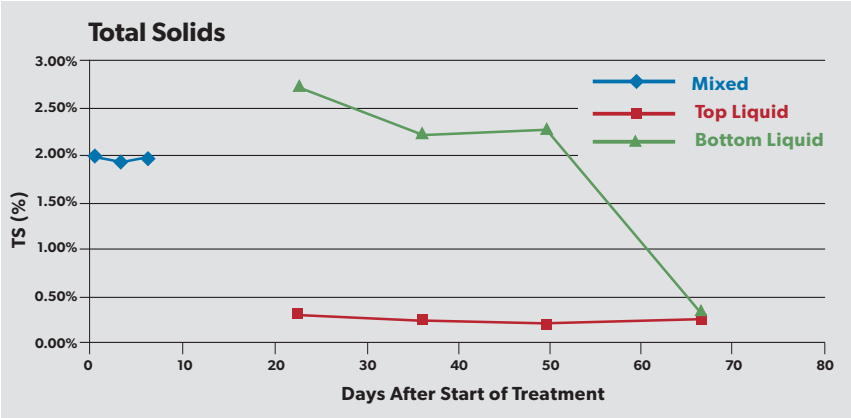


3. **Fecal Coliform** levels were rapidly reduced to undetectable levels at all sampling levels. Reductions began during treatment. From the first stratified sampling event through the end of the trial, fecal coliform remained undetectable throughout the tank.



NOTE: A final combined sample was tested for Enteric viruses and Helminth Ova. The results of these tests were inconclusive because neither the control material nor the treated material showed any biological activity

4. **Total Solids** were reduced by approximately 85% in the top supernatant layer over the trial period. Post-trial, TS concentration had been reduced to 0.3% in approximately 75% of the tank volume. A thickened sludge layer with TS of 6.5-7.0% was found in the bottom 25% of the tank volume. Overall, about 89% of the total solids were settled into the bottom 25% of the tank volume.



TCA Implementation

ElectroCell's BioElectric technology has provided TCA with a powerful tool for managing the nutrients in their biosolids and for preserving their disposal infrastructure. Low phosphorus supernatant will be land applied on phosphorus-restricted fields, and the high phosphorus bottom solids will be distributed to other fields that have the capacity to accept more phosphorus. Eventually, the phosphorus rich bottom solids may be processed to Class A, dewatered and sold as high nutrient fertilizer.

Environmental Benefits

When TCA applies the low phosphorus supernatant to meet crop nitrogen requirements, they will be applying less phosphorus than their planned corn crop requires. Agronomic calculations predict that each annual corn crop will remove approximately 48 lbs of phosphorus per acre from the soil. Over time, these phosphorus-saturated soils will be brought back into a more healthy balance. In this regard, BioElectric treatment is not only good for TCA's operational efficiency, it is good for Ohio's environment as well.

For more information on this case study, contact:

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