Responses of Problematic Algae to Copper-based Algaecide

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Background Information

Eutrophication is the process by which a body of water acquires a high concentration of nutrients, especially phosphates and nitrates. These typically promote excessive growth of algae. As the algae die and decompose, high levels of organic matter and decomposing organisms deplete the water of available oxygen, causing the death of other organisms, such as fish. Eutrophication is a natural, slow-aging process for a water body, but human activity greatly speeds up the process (USGS.gov). Golf Courses are often fertilized numerous times a year and can be major problem in fertilizer runoff in ponds surrounding the course. In east Texas where rainfall is more abundant then other parts of the state, golf courses are often more affected by algae in their ponds. Our objective is to present algae and prevent future algae blooms caused by fertilizer runoff in the ponds at Woodland Hills Golf Club.

Approaches

Our group originally wished to treat two algal blooms present at the golf course using a variety of natural BMP’s. This included the planting of PhytoPhytes plants along the body of water and a reduction in the amount of fertilizer being used in the ponds’ watershed. Unfortunately this plan was scrapped as the golf course had already stopped applying fertilizer for the year, and the cooler weather would not allow for the desired plants to be successfully planted without many dying.

The second design plan involved the use of two different products, one on each pond, and measuring the relative effectiveness of each treatment. The products selected for use were natural barley-straw, and a mixture of barley-straw inoculated with bacteria. Alas, upon our second visit to the site it was discovered that one of the two algal blooms had completely died, meaning a new design plan was needed.

The third design plan created involved the use of a copper-based algaecide pond dye to remediate the remaining algal bloom. This product was available locally and the shipping time of needed materials was short allowing for the progression of the experiment. This design plan was implemented successfully.

Instruments and Supplies

- Mesh netting and PVC Pipe
- Sample bottles (5)
- YSI EXO Sonde
- Swing Sampler
- Cutrine-Plus Algaecide
- Nitrate and Phosphorus kits
- Chlorophyll-a kit

Data Analysis

Unfortunately due to a lack of analyzed samples we cannot support our claim of success with numerical data for a reduction of chlorophyll a. We are basing our success due to the overall decrease in nutrient concentrations and the fact that the algae are no longer blanketing the water’s surface. We can say however that the concentrations of chlorophyll a are much greater on the North-East side of the pond where concentrations exceeded 2.200mg/L. On the South-West area of the pond chlorophyll concentrations did not exceed .600mg/L. This difference in relative concentration may be due to the difference in depth, or possibly the amount of sunlight each portion of the pond receives.

Conclusions

The original and continuing goal of this experiment was to effectively remediate an algal bloom present at a local golf course in Nacogdoches. Thanks to the willingness of the owner of the Woodland Hills golf course our team was able to successfully accomplish this goal. Currently the pond which had once been completely covered in a thick mat of algae is now almost completely clear. The nutrient concentrations have shown an overall downward trend in concentrations. This is most likely due to the algae itself, absorbing the available nutrients in the pond before being killed by the product our group applied.

Acknowledgements

Thanks to Woodland Hills Golf Club for allowing us to remediate their pond and giving us all the access necessary to execute this project. Thanks to the Stephen F. Austin State University Environmental Assessment Lab and the Arthur Temple College of Forestry and Agriculture for the use of supplies needed for this project. Thanks to Dr. Mc Brooke for granting us use of a YSI EXO Sonde for measuring water quality.

Lastly, thanks to Dr. Jerez for her patience, time, and expertise.

Results and Image of the Remediated Pond

Table 1. Chlorophyll-a, Nitrate and Phosphorus levels at the North, East, South and West sides of the pond.

<table>
<thead>
<tr>
<th>Sample Trial</th>
<th>North</th>
<th>East</th>
<th>South</th>
<th>West</th>
<th>Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrate (mgl-1)</td>
<td>0.212</td>
<td>0.296</td>
<td>0.263</td>
<td>0.241</td>
<td>0.253</td>
</tr>
<tr>
<td>Phosphorus (mgl-1)</td>
<td>0.954</td>
<td>0.954</td>
<td>0.364</td>
<td>0.226</td>
<td>0.623</td>
</tr>
</tbody>
</table>

Table 2. Different variables measured taken over a YSI mini plus sonde in the course of the study.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Date</th>
<th>Temperature (°C)</th>
<th>Conductivity (μS/cm)</th>
<th>Turbidity (FNU)</th>
<th>T.S.S. (mg/L)</th>
<th>D.O. (mg/L)</th>
<th>Chl-a (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/9/15</td>
<td>14.97</td>
<td>13.35</td>
<td>27.69</td>
<td>4.57</td>
<td>2.60</td>
<td>3.10</td>
<td>9.48</td>
</tr>
<tr>
<td>11/16/15</td>
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<td>14.97</td>
<td>27.69</td>
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In an effort to remove the algal bloom, a copper-based algaecide was used the pond. The skimmer was then applied to the pond in order to remove surface algae.

After the skimming had been completed the necessary algae growth was retrieved from the ATWOODS in Nacogdoches to be applied after the initial samples had been taken. Next the following water quality measurements were tested: dissolved oxygen, nitrate, phosphorus, and chlorophyll-a by the methods provided by Dr. Jerez using a YSI EXO Sonde and a swing sampler. Water samples were obtained in four cardinal directions around the pond, and then averaged.

Following the collection of the water samples, we began to apply the CUTRINE-PLUS Algaecide pond dye. To do this a 32oz cup was obtained from the golf course’s main office. Group members would fill up the plastic bin in which the plastic bottles had been transported with pond water. The product was then added in small amounts to the pond water in order to dilute the solution. The mixture was then scooped up into the 32oz cup and propelled out into the pond at a distance of approximately 12 feet. Afterwards, measurements were followed by three sampling days on Monday of each week in November. Lastly, the results were tabulated and placed into graphical data.

The original and continuing goal of this experiment was to effectively remediate an algal bloom present at a local golf course in Nacogdoches. Thanks to the willingness of the owner of the Woodland Hills golf course our team was able to successfully accomplish this goal. Currently the pond which had once been completely covered in a thick mat of algae is now almost completely clear. The nutrient concentrations have shown an overall downward trend in concentrations. This is most likely due to the algae itself, absorbing the available nutrients in the pond before being killed by the product our group applied.

Instrument setup

- Swing Sampler
- Cutrine-Plus Algaecide
- YSI DO Meter

Removal of surface algae

Discovering aquatic organisms

First attempt to remove surface algae

Image of the pond before treatment

Image of the pond after treatment