How Ultrasonic Technology Kills and Controls Algae

Aquatic Weed Control Short Course
May 2013
Overview of Algae
Problems Caused by Algae

- Toxic Blooms
- Loss of Recreation
- Dissolved Oxygen Crashes / Fish Kills
- Clogging of filters, pumps, drains, etc.
- Odorous
- Expensive to treat all the time
Overview of Ultrasound

- Sound waves
- No permitting required
- Simple to install
- Inexpensive to run (draws 0.2 to 0.7 amps)
- Targets only algae
- Large bodies of water are no problem
- Easy to use with other control methods
Limits of Ultrasound

• Takes time to work – No silver bullet
  – Blue-green algae - see results in days
  – Green algae – see results in a few weeks
  – Algae bloom cycle

• Ultrasound does not control nutrient loading!
Ultrasonic Algae Control

Safe for everything...except algae

**Will not affect or harm**
- Animals
- Fish
- Birds
- Aquatic plants/weeds
- Pets

**Will Affect Algae**
- Blue/Green
- Green

**No Conclusive Results**
- Red Algae
- Golden Algae
How Ultrasound Works on Algae

- **Blue-Green Algae** – Ruptures Gas vesicles
- **Green Algae** - Vibration breaks bond between cell wall and inside of cell

Natural progression of algae death… expedited
Blue-Green Algae Can Have Hundreds of Gas Vesicles

Won’t break cell wall

Gas Vacuoles

Ref: “Gas Vesicles”, Anthony E. Walsby, Microbiological Reviews, March, 1994
Toxin Release Concerns

• Will NOT cause lysing of the cell:
  – Cells do not sense they are under attack
  – Does NOT break outer cell wall
Effects Of Ultrasound On Algae

Healthy Microcystis Aeruginosa after only 24 hours of exposure to ultrasound.

Effects Of Ultrasound On Algae

Healthy *Spirogyra*

*Spirogyra* after only 7 days of exposure to ultrasound.

Common Alga Controlled With Ultrasonics

<table>
<thead>
<tr>
<th>Alga Name</th>
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<tbody>
<tr>
<td>Aphanizomenon</td>
</tr>
<tr>
<td>Anabaena</td>
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<tr>
<td>Aphanochaete</td>
</tr>
<tr>
<td>Arcella</td>
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<tr>
<td>Botrycoccus brauni</td>
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<tr>
<td>Chlamydomonas</td>
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<tr>
<td>Chlorella</td>
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<tr>
<td>Chroococcus</td>
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<tr>
<td>Chloromonas botrys</td>
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<tr>
<td>Coelastrum</td>
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<tr>
<td>Cosmarium</td>
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<tr>
<td>Crucigenia</td>
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<tr>
<td>Cryptomonas erosa</td>
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<tr>
<td>Cyclotella</td>
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<tr>
<td>Dictyosphaerium</td>
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<tr>
<td>Fragilaria</td>
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<tr>
<td>Gloeocystis sp</td>
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<tr>
<td>Gomphonema sp.</td>
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<tr>
<td>Lagerheimia</td>
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<tr>
<td>Lyngbya</td>
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<tr>
<td>Merismopedia tenuissima</td>
</tr>
<tr>
<td>Micractinium</td>
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<tr>
<td>Microcystis</td>
</tr>
<tr>
<td>Navicula minima</td>
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<tr>
<td>Nitzschia sp.</td>
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<tr>
<td>Oocystis pusilla</td>
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<tr>
<td>Pseudanabaena</td>
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<tr>
<td>Phacus</td>
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<tr>
<td>Pinnularia sp.</td>
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<tr>
<td>Planktothrix</td>
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<tr>
<td>Rhodomonas minuta</td>
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<tr>
<td>Scenedesmus acuminates</td>
</tr>
<tr>
<td>Scenedesmus quadricauda</td>
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<tr>
<td>Sphaerocystis schroeteri</td>
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<tr>
<td>Spirogyra</td>
</tr>
<tr>
<td>Staurastrum</td>
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<tr>
<td>Tabellaria</td>
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<tr>
<td>Tribonema</td>
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<tr>
<td>Ulothrix sp.</td>
</tr>
</tbody>
</table>
Alga Not Controlled With Ultrasonics

- Chara
- Pithophora
- "Didymo" (Rock Snot)
- Oscillatoria
- Rhizoclonium
- Nitella
What To Do When Algae Dies

Bottom Aeration

Rake off what you can
How to Install & Use Ultrasonics

• Submerge transducer –
  – 2 feet minimum in earthen lined pond
  – Above first thermocline
  – Lined or hard bottom will result in signal bounce

• “Line of Sight” device
  – Flashlight analogy
How to Install

1 unit in small pond

2 units in large pond

Pond treated by a single SonicSolutions® ultrasonic unit

Area sonar waves do not reach

Pond treated by two SonicSolutions® ultrasonic units
Monthly Maintenance of Units

- It is important to clean the unit on a regular basis
  - Every 4 - 6 weeks
  - A hard water content will require extra care and maintenance.

- Winter Storage & Cleaning
  - Electronics
Power Options

• Units Run On 24volts DC
• Various Plug Options
  – 110volts AC and 24volts AC & DC plug
  – 250’ max from power supply to transducer head
• Solar Panel Option
  – For when Electric is not available
  – “Green Technology”
• 110volt AC UL approved for outdoor use (E322023)
• Safe to use – only 24volts DC to power transducer
Where Ultrasonics Used

- Large Lakes & Reservoirs
- Private & Recreation Ponds
- Pools
- Golf Courses
- Wineries
- Municipalities
  - WWTP, Raw Water and Process Water
- Home Owners Associations
- Storm Water Retention Ponds
- Aquaculture
- ....and many more.

Sterling Vineyards, CA
Installations

Aquaculture
  • Catfish farms in Mississippi
  • Fresh water shrimp study Virginia State University
  • Trout farm in Colorado

Golf Courses
  • Hundreds of golf courses in the USA and around the world

Drinking Water
  • Raw water reservoirs in the USA and Canada and process water in the USA and Canada
Installations and Results

- Installation – Eston, Saskatchewan Canada 2009 - present
- Raw water retention ponds
- Had been struggling with blue/green algae blooms causing taste/odor issues
- Testimonial “Eston has been using a couple of SS-500’s in their raw water retention ponds for three years. Previously spend $4,000/year on copper sulfate. Have spend $0 in the last three year, also noticed improvement in water turbidity. One time one of the SS-500’s came loose from it’s support and was pointing into the mud. Algae bloom! Very little maintenance required as well!”
Installations and Results

• Installation – Rochester NY 2007 - present
• Raw water retention pond
• Variety of alga causing filtration problems as well as taste and odor issues.
• Ultrasonic algae control devices installed to reduce algae growths
Installations and Results

- Installation – Syracuse NY 2009 - present
- Raw water retention pond
- Variety of alga causing filtration problems as well as taste and odor issues.
- Ultrasonic algae control devices installed to reduce algae growths
Installation at Lakeview Park Pond in TX

Evaluation of Sonic Solutions Ultrasound for Control of HABs
Paul V. Zimba, Center for Coastal Studies, Texas A&M University Corpus Christi
Corpus Christi, TX
Evaluation of Sonic Solutions Ultrasound for Control of HABs, Paul V. Zimba, Center for Coastal Studies, Texas A&M University Corpus Christi, Corpus Christi, TX
By the end of ultrasound experimentation, cell densities of *Microcystis* declined to levels below detection (<1 cell/mL).

*Pediastrum* spp. were not controlled by ultrasound treatment.

*Euglena* spp. were not controlled by ultrasound treatment.
Installation at Vaughn MT WW Lagoon

- Installation – Vaugh MT April 2012 - present
- Waste water treatment plant using lagoons
- System never in compliance that anyone can remember
Vaughn MT WWTL 2012

TSS Reduction using SonicSolutions

TSS Numbers

Non-algae organics introduced from nearby RV park waste dump

SonicSolutions installed

Laboratory work performed by Montana Environmental Laboratory LLC, 1170 N. Meridian Rd, Kalispell MT
SonicSolutions installed

Non-algae organics introduced from nearby RV park waste dump

BOD Reduction using SonicSolutions

Laboratory work performed by Montana Environmental Laboratory LLC, 1170 N. Meridian Rd, Kalispell MT
Summary of Installation at Vaughn MT WW Lagoon

Before the end of ultrasound experimentation, Vaughn was easily in compliance with state and federal requirements for TSS and BOD.

State of Montana looking at having all non-compliant lagoon systems in state examine ultrasonic algae control.
Installations and Results

Issues with boulders and line of sight to kill algae
Installations and Results

• Homeowners Association pond in Florida
• Suffering from Lyngbia
• Chemical treatments proved costly and largely ineffective
Installations and Results

- Rockland County Club, Sparkill NY
- Chronic algae problems
- Helped to achieve Audubon Certification
Installations and Results

- Shadow Ridge Golf Club, Vista CA
- Chronic algae problems
- Have used no chemicals in ponds for 7 years now
Installations and Results

- Wilding Acres West Virginia waste water lagoon
- 4 weeks
Installations and Results

• Small 2 acre retention pond
• Approximately 18’ depth in middle
• Aeration and pond dye used in previous years
• Installed SS-400 in April 2011.
Safety, Registrations and Certifications for SonicSolutions

- UL Approved Power Supply (E322023)
- EPA Registered (074929-MA-001)
- National Sanitary Foundation (NSF61) Certified (3E370)
Questions?