MOLEAER NANOBUBBLE TECHNOLOGY DESTROYS BLUE-GREEN ALGAE AND DEGRADES ALGAE TOXINS

Client:
Lake Elsinore, CA

Type:
Aquatic Management

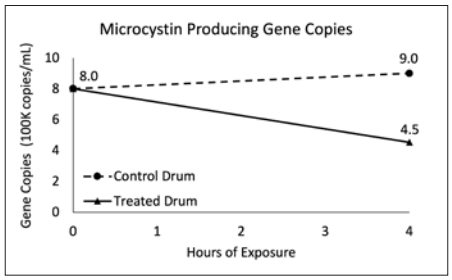
Results in 4 Hours of Nanobubble Treatment:
- 40% lysis of cyanobacteria
- 76% lower net increase in microcystin

Located at the mouth of the San Jacinto river in Riverside County and spanning more than 3,000 surface acres, Lake Elsinore is the largest natural freshwater lake in Southern California and is a popular attraction for water sports, bird watching, and fishing. Other than evaporation, the lake has no outflow and relies solely on rainwater and runoff to maintain water levels. During the summer months, when rain is scarce and water temperatures are high, nutrients in the lake concentrate and dissolved oxygen levels drop, making the lake extremely vulnerable to algae blooms. Despite implementing several strategies to mitigate algae, including floating aquatic plant islands and conventional aeration, the lake chronically suffers from harmful algae blooms (HABs) and fish die-offs.

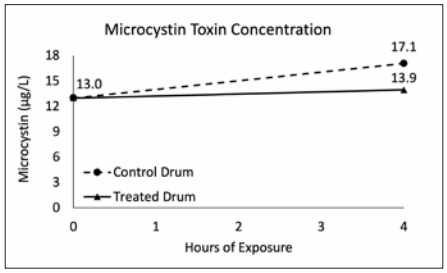
In July 2016, the lake was closed to the public due to high levels of toxins from blue-green algae known as cyanobacteria. Less than two years later, the lake experienced a Threadfin Shad die-off, largely attributed to an algae bloom. In August 2019, shoreline samples exceeded the threshold for the cyanobacteria toxin, microcystin, and recreational advisory signs were posted to warn visitors of the possible health risks associated with lake recreation.

In the fall of 2019, lake management staff collaborated with Moleaer to evaluate the use of air nanobubbles for treating Lake Elsinore water containing high levels of live algae and toxins. The experiment was performed using two 55-gallon drums of Lake Elsinore water. The water in the control drum was circulated through a Moleaer 25 XTB with the compressed air supply off (i.e., without nanobubble treatment), while the water in the second drum was circulated through a 25 XTB with the compressed air supply on (i.e., with nanobubble treatment). The water was circulated through the 25 XTBs for 30 minutes and then allowed to settle for 30 minutes. This cycle was repeated 4 times for a total of 2 hours of circulation and 2 hours of settling.

Lake Elsinore has poor water clarity due to blue-green algae , Secchi Disk readings are ~6".



A 40% reduction of microcystin producing cyanobacteria was measured in the treated sample versus a 12.5% increase in the control drum.



A 7.5% increase in microcystin toxin was measured in the treated drum versus a 32% increase in the control drum, a 76% lower net increase with nanobubble treatment.

Samples were collected and analyzed using microscopy for species identification, ELISA testing for toxin concentration, and filtered-qPCR for toxin producing gene concentration. The results show that within 4 hours, the drum that received nanobubbles experienced 40% cyanobacteria cell destruction with a minimal increase in microcystin. The control drum experienced a 7.5% increase in cyanobacteria and a 31.5% increase in microcystin.

Based on these results and more than 200 field observations, the latest understanding of algae nanobubble treatment is that nanobubbles provide a multifaceted solution for algae prevention and mitigation. Upon introduction of the air nanobubbles, algae cell destruction (lysis) and toxin degradation occurs through oxidation. Long-term algae mitigation is sustained through improved aeration that provides a number of ecological benefits, including a reduction in sediment nutrient cycling. The potential for this solution to control algae is impressive and is directly attributed to the unique properties of nanobubbles, specifically their neutral buoyancy, Brownian motion, and oxidative impact.

www.moleaer.com

Rev 120619