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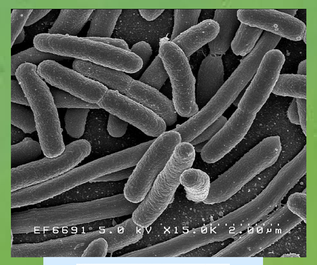
Can diatoms alone, with enough monosilicic acid, stop the growth of harmful algae blooms?



Silica solubilizing bacteria


More monosilicic acid

More diatoms


Less harmful algae

Introduction

We are wondering if diatoms can outcompete harmful algae if there is enough monosilicic acid present. Diatoms use monosilicic acid to grow their shells but monosilicic acid is rare in the environment, so there are fewer diatoms. If we could increase monosilicic acid in the environment, diatoms would also increase, which hopefully would outcompete the harmful algae. We are hoping to achieve this by finding a bacteria that could produce the monosilicic acid naturally.

Our research this semester was split up into two different sections. One section being, the growth of agar and how best to grow the bacteria. While the other section focused on the quantification of diatoms, which is what we focused on. Our primary goal this semester was coming up with a solid method for diatom quantification. We did this by sampling water from different ponds that we knew had diatoms in them and looking at those samples under the microscope. Once the weather got colder we set up an indoor tank with water from these ponds to sample water from.

Methods

For our first experiment, we collected samples from Mantua Reservoir, and Thayne Sweeten's pond. The samples were collected at different depths measuring at 3 inches, and 9 inches. We collected 10 ml of water in a test tube and used a few different methods of counting diatoms. First we added 2 ml of bleach to each sample. After adding bleach we centrifuged the sample at 2000 rpm for 5 minutes, then pipetted out all of sample only leaving 2 ml of sample remaining. Other than centrifuging the sample, we tried to gently shake the sample, or vortex the sample for 10 seconds. Few diatoms were seen with centrifuging, but we noticed as we used the vortex, the diatoms were being broken up and destroyed. The next experiment we tried was very similar to the first but samples collected were at 0 inches, 3 inches, and 6 inches. Bleach was added to all of the samples except for the 0 inch. Without the use of bleach in the 0 inch sample, there was a lot to be seen on the slides through the microscope such as bacteria, protozoa, and algae. Leading us to think that bleach was a good method to removing the "extra" bacteria to really examine, and isolate diatoms. We noticed that taking random samples wasn't consistent enough of a method to quantify the diatoms. We figured out a consistent method of counting, that being said, we put together a fish tank using water from the tank it self, Mantua Reservoir, a pond located in Nibley, and as well as a pond in Willard. The tank consisted of 2 goldfish (2 died), fish castle, rocks at the bottom, a bubbler to keep water moving, LED lights (on for 12 hours), and a water heater (heating the tank to 22 degrees Celsius). We collected the tank water with 4 different test tubes and let the tubes sit in a rack in water, each with a grid slide inside. (See Figure 1.) We let the samples sit for 5 days and checked for growth. There were few diatoms seen and documented, and let the samples sit for another 2 days (1 week of them being submerged). There were even more diatoms seen! With plenty of trial and error we are confident that this is one of the most consistent ways we found to quantify diatoms. While still using the same method, we collected even more test tubes (12 total). (See Figure 2.) We repeated the same experiment previous. Each test tube consisted of a grid slide. There was some evaporation of the water during our first experiment with the test tubes, so slides were placed on top to prevent that from occuring once more. Our final experiment this semester we continued with the same experiment with 12 test tubes and immersed them in the tank water, we added a pond and water clarifier called "Nualgi", that was diluted to 5, 10, and 20 micrometers and added it to our test tube samples. On the right are a few different graphs with the averages taken from the counts of the diatoms. (Figure 3A, B, C)

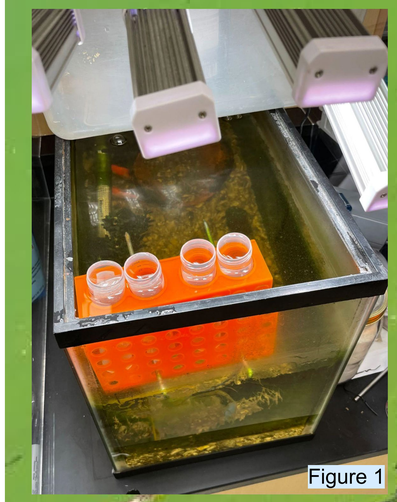


Figure 1


Figure 2

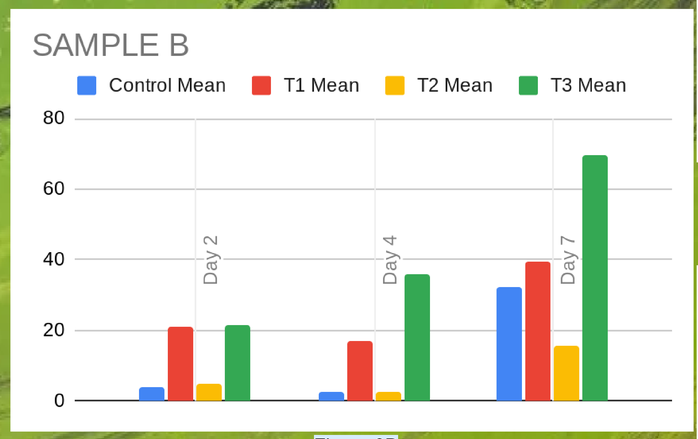


Figure 3B

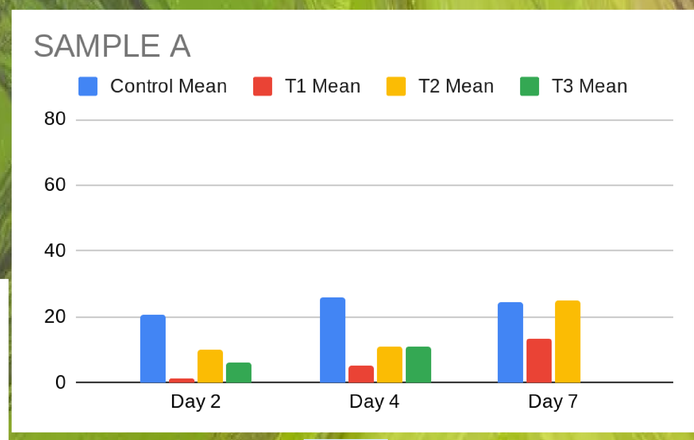


Figure 3A

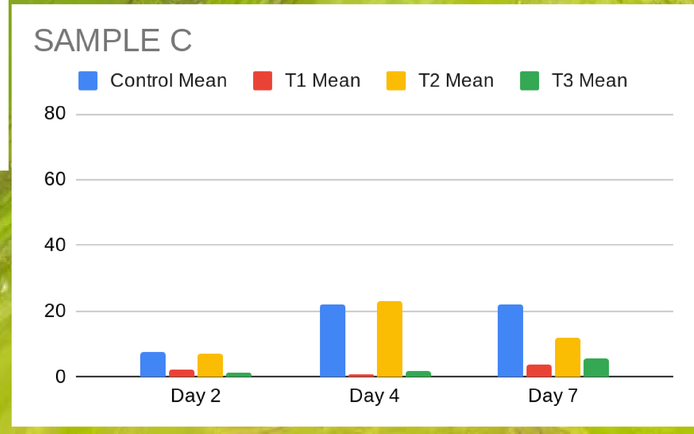


Figure 3C

Key Takeaways

It took us awhile to come to a solid method when quantifying diatoms due to complications we ran into with our experiments. For example in our first experiment when we vortexed the samples we broke apart the diatoms, making it impossible to quantify them. We finally found a solid method with our indoor tank set up. After submerging grid slides in the test tubes we would count 5 columns from each slide and count all the diatoms seen in one column. We then took the average and standard deviation from that data. That method showed the best results for us. Sampling from different areas in the tank could have skewed our results so if we had more time for another experiment we would have gotten water for the test tubes from a source that would have less variation.

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