How can algae serve as an indicator of water quality?

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Right Side

Introduction

Water pollution is a major issue for the world right now and it's a problem that affects many impoverished countries due to their lack of treatment. Wastewater is defined as water that has been used at home, a business, or in an industrial process. Many pollutants accumulate in the water after usage, which is then transferred to a wastewater treatment facility. However, it doesn't always make it to the wastewater treatment facility. Wastewater can end up in a variety of locations such as in soil or in a body of water. This can introduce very harmful chemicals and pollutants into the food supply, water supply, and anywhere else that water is utilized. Wastewater treatment effectively solves this issue by reducing the contaminants in the polluted water. Algae can contribute to wastewater treatment by metabolizing the contaminants. Algae is an aquatic, photosynthetic eukaryote that can take the form of a multicellular or unicellular organism. Algae is the ideal organism in that it can be cultured easily, is relatively small, and it isn't harmful to humans as long as it's in small doses. In this study, a correlational relationship between the biodiversity of algae and water quality is investigated. The independent variable is the type of water/where it was found and the dependent variable is the species of algae. The null hypothesis is that there is no correlation between diversity of algae and water quality. The alternative hypothesis is that a correlation between high diversity of algae and the quality of water is to be expected, with a high quality of water to be expected to be linked to the presence of multiple different algae species. The expectation of this study is to explore the potential uses of algae for wastewater treatment.

Methods

The algae was collected in Kissena lake and Meadow lake, both of which are found in Queens, New York City. Algae was collected using a plastic bag from the surface of the lake. Four samples were collected, two from each lake. Each sample was contained with a different plastic bag to prevent contamination. Samples were hard to identify because they were under water and algae are extremely small. Algae was identified with a microscope in the lab after they were collected. Algae was thought to be found because of what seemed like green cells. After the samples were collected, they were stored in a freezer until extraction. Algal DNA was then extracted via centrifugation

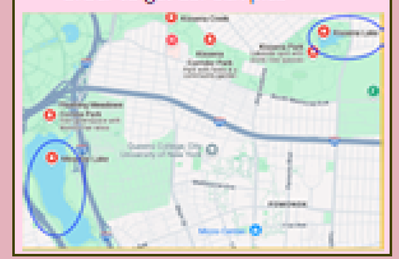
Materials

The materials used were: Barcoding wash buffer, GuHCL B-0038, MQ H2O, 100 BY ladder, 1 plant + control DNA, TufA B-0029, RBCL Bead, Silica Resin, 100ml TBE Buffer, 2% Agarose with Gel Green, Multiple clean pestles, Gel Electrophoresis kit, PCR rack (yellow), DNA LC (red) pipet size red, DNA LC (yellow) pipet size yellow, DNA LC (blue) pipet size blue, Pipet storage rack, Sharpie, Test tubes, Pink cup, 2 pipettes from (yellow, blue, and grey) respectively, Microcentrifuge Algae Tufa, PCR machine, and PuReTaq Ready to go PCR Beads

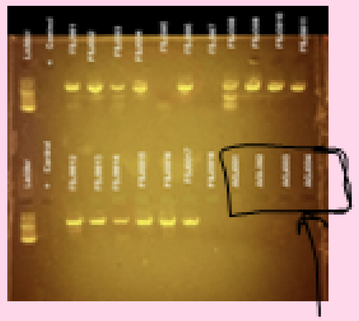
Tables and Figures

Water from Meadow Lake	
Lead	0 ppm
Nitrate	0 ppm
Sulfate	0 ppm
Iron	0 ppm
Mercury	0 ppm
Chlorine	0 ppm
Zinc	0 ppm

Water from Kissena Lake	
Lead	0 ppm
Nitrate	0 ppm
Sulfate	0 ppm
Iron	0 ppm
Mercury	0 ppm
Chlorine	0 ppm
Zinc	0 ppm



The different lakes we used in order to get our samples



The four samples shown have not lightened up, showing that no DNA fragments have been found, making us draw no conclusions about water quality and biodiversity of algae

Results

No DNA fragments were found in the gel electrophoresis process, which indicates a lack of algae. No algae was found in this experiment which indicates that there is no correlation between water quality and biodiversity of algae. The water quality from both lakes was largely the same, with similar concentrations of pollutants.

Left Side

Discussion

The results indicate that there is no correlation between biodiversity of algae and quality of water, but it is more likely that our sample wasn't large enough for the polymerase chain reaction process. Although we were not able to identify the specific pollutants as the water quality tester was not able to discern the different pollutants. Also due to the zero amount of algae found and by extension, no biodiversity, even being able to discern what the pollutants were in the water would not matter as we would not have been able to find the correlation between the biodiversity of algae and also the cleanliness of the water and the amount of pollutants. In future experiments, a larger sample should be used and multiple ways of confirming the presence of algae should be conducted, including microscopic examination, spectrophotometry, and a fluorescence test. There should also be more samples to ensure
a statistically significant result. Even if algae species were found, it can't be determined that it was a cause and effect relationship, as this study was purely correlational. Future experiments that can be done on this topic include investigating the metabolism of algae in the presence of pollutants such as heavy metals or investigating concentrations of pollutants after the introduction of algae in a water sample.

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