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Abstract

This experiment analyzes the effects of heavy metal toxicity on algae growth. A total of 4 vials were used in the experiment, each containing different measurements of Alga-Gro® and various concentrations of zinc sulfate to obtain the following measurements: a control, 2.432 mg/L (EC50 concentration), 7.296 mg/L and 21.888 mg/L. Results showed that the control and EC50 concentration increased its population, mainly because it was less affected by heavy metal toxicity. The last two measurements were 2-3 times the EC50 concentration and were greatly affected by toxicity exposure, indicating that the more toxic the environment is, the more the population will die off, which was shown in Figures 1 and 2.

Objectives

The objectives of this assignment were to learn how to write a lab report while applying basic laboratory techniques on lab specimen that followed ethical and class guidelines. Although each undergraduate researcher worked together in obtaining results, we each produced reports on our own, to help demonstrate a blend of working independently and in teams.

Disclaimer

The purpose of this paper is to fulfill course requirements for BIOL 220W and for undergraduate research within Penn State University – Hazleton Biology Department. It is also used to stand out as a personal writing sample, but the findings should not be treated as generalizable research.
Effects of zinc sulfate on the growth of the green alga, *Ankistrodesmus Spp.*

Jennifer Ramon

i. Introduction

Heavy metals such as zinc, cadmium and aluminum are major toxicants found in industrial wastewaters in the form of industrial discharge and urban storm runoffs\(^1\). Exposure of sites to these metals can lead to risks, including toxic build-up in aquatic organisms, inhibition of algal growth\(^2\) and long-term adverse effects of biological treatment in wastewaters\(^3\).

Algae are ideal test organisms for assessing the impacts of metal compounds on water quality\(^4\). At the bottom of the food chain, green algae, like *Ankistrodesmus*, are photosynthetic phytoplankton that rapidly grow in abundance and produce food for the entire ecosystem. Should algae be eliminated by, or contain toxic build-up of zinc or other heavy metals, it will cause cascading effects up the food chain, eliminating species that rely on algae for consumption\(^2\).

The objective of this research was to determine the effects of zinc sulfate on the growth of *Ankistrodesmus*. To accomplish this objective, *Ankistrodesmus* was grown in several concentrations of ZnSO\(_4\) and growth was measured based on light absorption and cell density, using a spectrophotometer and a hemacytometer, respectively.

ii. Methods

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\(^1\) Britton, Gabriel. 2011. Wastewater Microbiology, 4\(^{th}\) ed. p. 536 in Heavy Metals.


A well-mixed culture of 0.03 mL of *A. spp.* was placed into 4 vials, each containing 20 mL of Alga-Gro®. One vial was used as a control with only *A. spp.* added, while the remaining 3 vials received various concentrations of ZnSO$_4$ to acquire the following concentrations: 2.432 mg/L (the EC$_{50}$ concentration)$^4$, 7.296 mg/L (three times the EC$_{50}$ concentration), and 21.888 mg/L (nine times the EC$_{50}$ concentration).

Algal growth was measured using a spectrophotometer to measure light absorbency at 750$^{nm}$. Samples were also placed under a microscope for cell density using a hemacytometer. Vials were vortexed before measurements. The vials were placed about 15 cm below 2, 30-watt fluorescent light bulbs that ran 16 hours a day in a 21 degrees Celsius room. Measurements were made almost daily, with the exception to weekends, starting on day zero, until 6 measures were made.

iii. Results

a. Spectrophotometer readings

![Spectrophotometer readings of Ankistrodesmus spp. exposed to various concentrations of ZnSO$_4$. Response of A. falcatus to ZnSO$_4$ is seen to have increased light absorbency in the first two concentrations whereas the remaining two have decreased.](image)

Figure 1: Spectrophotometer readings of *Ankistrodesmus spp.* exposed to various concentrations of ZnSO$_4$. Response of *A. falcatus* to ZnSO$_4$ is seen to have increased light absorbency in the first two concentrations whereas the remaining two have decreased.
Table 1: Spectrophotometer readings of *Ankistrodesmus* *spp.* exposed to zinc sulfate. Response of *A.* *spp.* to ZnSO₄ is seen to have increased light absorbency in the first two concentrations whereas the remaining two have decreased.

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<th>Days</th>
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<th>21.888 mg/L</th>
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a. Hemacytometer readings

![Graph showing Hemacytometer readings of *Ankistrodesmus* *spp.* exposed to various concentrations of ZnSO₄.](image)

**Figure 2**: Hemacytometer readings of *Ankistrodesmus* *spp.* exposed to various concentrations of ZnSO₄. Response of *A.* *spp.* to ZnSO₄ is seen to have increased cell density in the first two concentrations whereas the remaining two have decreased.

Table 2: Hemacytometer readings of *Ankistrodesmus* *spp.* exposed to ZnSO₄ in cells/mL. Response of *A.* *spp.* to ZnSO₄ is seen to have increased cell density in the first two concentrations whereas the remaining two have decreased.
<table>
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<th>Days</th>
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<th>7.296 mg/L</th>
<th>21.888 mg/L</th>
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v. Discussion

The results do not match what was expected. The control and EC\textsubscript{50} concentration increased greatly until days 7 or 8, at which point the rate dropped, then slowly rise up again. On the contrary, the remaining two higher concentrations grew even less until the 7.296 mg/L concentration was higher than the 21.888 mg/L concentration, which was expected. The device that gave better results was the hemacytometer because it provided a closer representation of what was expected. Thus, even though the hemacytometer takes more time than the spectrophotometer, it should be favored.

The reason for the results to disagree with what was expected may have been due to \textit{A. spp.} slowly dying off due to its exposure to heavy metal toxicity. The increase as indicated in Fig. 1 and 2 may have been due to the few surviving species who reproduced and helped the population slowly rise up. To further improve and build upon this study for future findings, it may be suggested to complete multiple trials for this experiment and carefully observe whether or not results would be similar or agree to the expectations.

vi. References

