The mystery of why the fish tank is always clean

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ABSTRACT

Green algae have become the target of extermination, because they cause eutrophication and damage to aquatic environments. However, this group noticed that the fish tank in their biology laboratory containing green algae was cleaner than the one that did not. They decided to test whether green algae had a purifying effect on the water by measuring nitrate and ammonium levels in the water. They found that both ammonium and nitrate ion concentrations were significantly reduced by green algae and reached a level of equilibrium when growing with goldfish. Finally, they explored the idea of creating biofuel from green algae and concluded that it could be a useful resource.

Introduction

We noticed a difference between two fish tanks in the biology laboratory [Figure 1]. From the study last year, we found that green algae had a high purification capacity. However, green algae have become the target of extermination, because they cause eutrophication and damage to aquatic environments. So, we have considered how green algae could be used as a natural resource.

Methods and Results

The experiment on purification capacity

The tank on the left contains green algae and is always clean. We hypothesized that it had some purifying effect, which is working in the tank. We researched the changes in the concentrations of NO_3^- and NH_4^+ by putting green algae in tank A and putting *Egeria densa* in tank B [Figure 1], and putting no plants in tank C.

The results of this research are shown in Figure 2. We assumed that green algae have a tendency to absorb NH_4^+ before absorbing NO_3^- since levels of nitrate ions only start to significantly fall on the second day of observation by which time the concentration

Figure 1: The two fish tanks in the Biology Lab. The tank on the left contains green algae

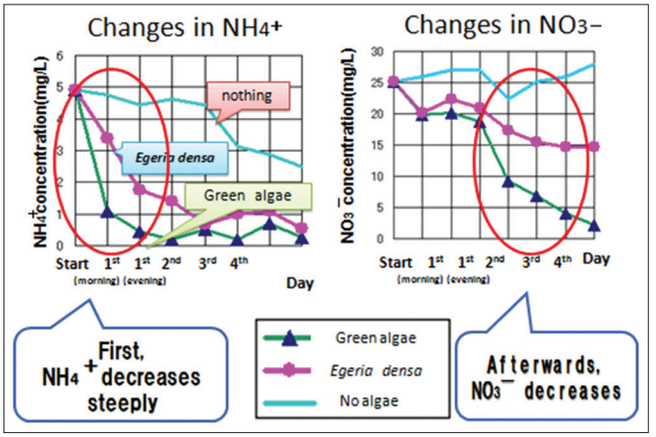

Figure 2: Graphs showing the change in concentration of ammonium and nitrate ions over time for the three tanks

of ammonium ions is negligible.

How to use green algae

Utilization for controlling water quality

Three tanks were again set up: One containing *Egeria densa*, one containing green algae, and a control tank of nothing except water. All tanks were in all other aspects identical and kept in the same controlled conditions. We had put two goldfishes in each tank. We examined the concentrations of NH_4^+, NO_3^-, and the results are shown in Figure 3.

As a result of this experiment, there was a significant decrease in the concentrations of NH_4^+ and NO_3^- in the tank containing green algae compared to the other two and this final concentration remained stable.

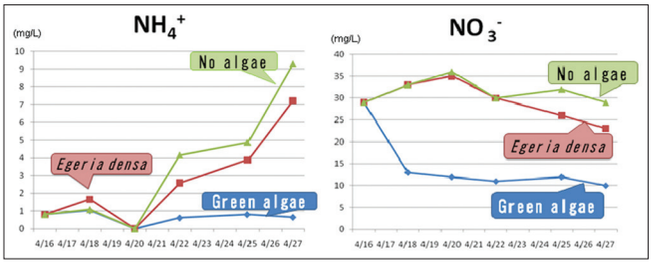

Figure 3: Graphs showing the changes in ammonium (left) and nitrate (right) concentration levels in the fish tanks over time with two goldfishes living in them

Utilization of green algae for bioethanol

We tried to synthesize some bioethanol using green algae. Green algae are broken down into sugar by cellulase, and the solution is filtered and fermented by using dry yeast. We measured the concentrations of CO_2 and ethanol by using a detector tube after the fermentation.

Conclusion

We have found that green algae have a high ability of water quality purification and that we can make use of green algae as a resource. The disaster of green algae is caused by the eutrophication of water, but water may be purified—thanks to green algae. The most important issue is how to dispose green algae. If we can use the green algae as a resource, we will find a major solution for environmental problems.

About the Authors

Megumi Muramatsu, Tomoya Shigyo and Karin Watanabe are a group of students who attended the Anglo-Japanese Science Conference at St. Paul's boys school London in March this year. They all attend Jishukan Senior High School and study Biology.