The Effect of Microgravity on the Purification of Polluted Water by a Hornwort Plant

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Introduction

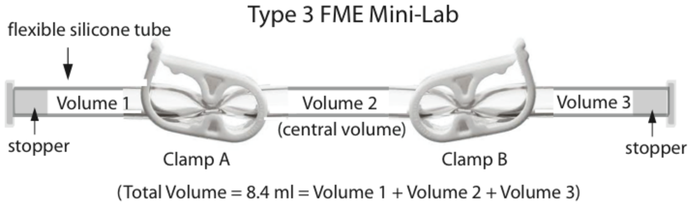
This project will help develop the knowledge of space for humans, and will happen aboard the ISS. Our experiment is the study of water purification by a hornwort plant in microgravity. We are testing the variable of microgravity on this plant and bacteria so we know if experiment can work in space.

Hornwort is the best candidate for this experiment because it grows extremely well even in the worst conditions. For example, hornwort plants do not need very much light to grow. We are also going to use a bacteria strain called Cyanobacteria. Cyanobacteria can do a great deal of damage to human health. Hornwort will purify this bacteria from the water it is growing in. Our experiment will be conducted in a type 3 FME (Fluid Mixing Enclosure) and will follow a strict procedure to make sure

Required Materials

To complete our experiment we will need two type 3 fluid mixing enclosures, two hornwort seeds from a store that takes care of and studies plants. We will also need purified water, contaminated water containing 7 cells of cyanobacteria and formalin found in the Kerr Middle School science laboratory.

The hornwort seed is what we are testing to see if it will purify the water. The formalin is needed to kill the plant so the hornwort can't grow or purify anymore water on the way down from the ISS.



1	Unclamp Clamp A and shake for 20 seconds gently	A=0
2	Unclamp Clamp B shake for 20 seconds vigorously	A+2

Example of a type 3 FME and a crew interaction table, used to give astronauts specific day by day directions.

Our research team being recognized for being a finalist in Burleson ISD's SSEP contest. Out of 240 teams, we were chosen in the top 3. Also pictured, our science teacher/ facilitator Megan Adams and BISD Superintendent Dr. Bret Jimerson.

Proposal Summary

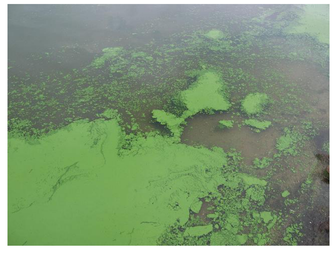
Our experiment will test how well a hornwort plant can purify polluted water in microgravity. We will compare of the purification of water in microgravity and the purification of water on Earth. The experiment will purify the polluted water in 5-6 days. Then the formalin will be added to stop and preserve the plant and its sample of water. We are polluting the water with Cyanobacteria, more commonly known as blue green algae. We will know if the experiment worked if we get a sample of purified water in the tube.

Background Information

This experiment will be conducted on Earth and aboard the International Space Station. This will allow us to examine the effect that gravity has on the hornwort plant's ability to purify water. All the variables, except for gravity, will be the same in both locations. This allows for comparable and reliable results.

Hornwort, known by the latin name of Ceratophyllum demersum, is a very low maintenance plant. The hornwort cells are typically filled with cyanobacteria also known as blue-green algae. The plant traps cyanobacteria in air bubbles on itself, thus purifying the surrounding water. Hornwort plants grows to approximately 4.6 meters tall. The plant can adapt to almost any water type, or lighting, and can tolerate a wide extreme of temperatures. Hornwort plants do not have roots, some can even float and the plant can be found on both land and water. The kingdom hornwort is in is Plantae. Coontail also know as hornwort, has sturdy, layered hair-like foliage that helps oxygenate and clarify the water as well as keep the algae growth rate to a minimum. Hornwort can be mainly found in the bottom of muddy rivers. The hornwort leaves are not edible since they contain to much silicium. For medical uses they are useful in the treatment of biliousness, liver problems, and scorpion stings.

Cyanobacteria is naturally occurring in fresh water ecosystems. When water conditions contain an unbalance of nutrients, such as phosphorus, nitrogen, and oxygen, the cyanobacteria can flourish in blooms. The blooms can often be identified as floating mats of bad smelling, decaying, jelly-like scum. If a cyanobacteria bloom is not treated they may release algal toxins that are harmful to aquatic and human life. Exposure to cyanobacteria or their toxins can produce allergic reactions such as skin rashes, eye irritations, respiratory symptoms, and in some cases stomach flu, liver and kidney failure or death.
Cyanobacteria creates its food from photosynthesis, using chlorophyll. The cells need a continuous supply of water and light.



We will also be using formalin as a fixative. The use of a fixative preserves the plant when our experiment comes back down to Earth from the ISS. This will ensure that anything that happens with our experiment occurred while it was microgravity, and not when it re-entered Earth.

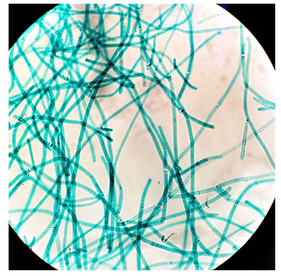
The main analysis we conduct will be through a process called direct cell count. We will physically count the number of cyanobacteria cells present in the sample using a microscope when it

Hypothesis and Expected Results

Our hypothesis is that the hornwort plant will purify water at the same rate in microgravity as it does on Earth.

We expect that microgravity will not impact the rate that a hornwort plant will purify the water. This experiment is important because it can further NASA (National Aeronautics and Space Administration) studies of purification of water in microgravity. Knowing that this is a reliable option for water purification, we can colonize space quicker and easier. Hornwort can help astronauts because if they run out of clean water they will know a purifying plant to purify the water with. This could also be beneficial when colonizing other planets because if astronauts encounter icecaps and the icecaps are polluted hornwort can be used to create safe drinking water. There are other plants that are related to hornwort such as iris, water lilies, and liverwort that can purify water like hornwort, and would be worth studying when our experiment is successful. Plus, hornwort can be used to pull out carbon dioxide in the water that is polluted by non-renewable resources. Another benefit is that scientific studies are proving that sulfuric acid could be used as a fuel source. And hornwort plans have sulfuric acid on them because of cyanobacteria.

A microscopic view of Cyanobacteria.



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