What is Mycelium Fungus Foam's Effect on Temperature, pH, and Dissolved Oxygen and How Long Does it Stay Buoyant?

Controlled Research Experiment:

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Research Plan

Rational- Plastic debris in the marine environment has become an increasing threat to a vast amount of marine life. A great portion of plastic debris throughout the oceans of the world is fishing litter. In beaches away from urbanized areas, a great majority of plastic litter is comprised of fishing litter (Derraik et al., 2002). Discarded buoys are a major contributor to this fishing litter problem. Using a revolutionary new creation consisting mainly of mycelium and corn husk, mycologists at Ecovative DesignÔ have developed bio-degradable floatation devices that are meant as an eco-friendly substitute to the harmful Styrofoam buoys that the world has become accustomed to. This project will test the water quality effects and duration of buoyancy for Ecovative Design's mushroom material.

Hypothesis-

If Ecovative Design's mushroom material is comprised mainly of cornhusk and mycelium, then these biodegradable substances will have a fairly insignificant effect on temperature, pH, and dissolved oxygen. These parameters will most likely stay constant throughout the whole experiment. The buoyancy of the mushroom material will decay at a constant rate over an elongated period of time and will eventually dip to two inches above water level at about six months after the projects start.

Research Question-

What is mycelium fungus foam's effect on temperature, pH, and dissolved oxygen and how long does it stay buoyant?

Materials-

Material	Quantity	Function
10 Gallon Tank	3	Contain Water and M.M.

Hanna Combo Sensor	1	Detect Temp and pH
YSI Monitor	1	Detect Dissolved Oxygen
Mushroom Material	2	To Investigate Effect on Water Quality and Bouyancy
Bucket	4	Obtaining Water Sample
Rope	4	Retrieving Bucket
Computer	1	Gather Background Info
Data Table	2	Organizing Collected Data
Ruler	1	Measuring Bouyancy
Skewer	1	Measuring Bouyancy
Metal Rack	1	Supporting 3 10 Gallon Tank

Procedure-

Measuring pH and Temperature:

1) Take the cap off the meter
2) Place it in a safe spot.
3) Clean probe with squirt bottle in wastewater container.
4) Do not touch probe with the plastic tube of the bottle.
5) Turn on meter by pressing mode button firmly
6) Press set button until the meter displays the water quality parameter you aim on testing.
7) Place Hanna Combo Meter in the water without disturbing the foam.
8) Observe results.
9) Record results on Google Drive spreadsheet.
10) Repeat procedure three times to ensure accuracy.

If the data for pH is not within .5 units, and temperature within .2° C., then the data must be deemed inacurate and cannot be recorded.

Measuring Dissolved Oxygen With a YSI Sensor:

1) Moisten the sponge in the cal/transport sleeve with a small amount of water and install it on the probe. The cal/transport sleeve ensures venting to the atmosphere. For dual support and Quatro cables, place a small amount of water (1/8th of an inch) in the cal/transport cup and

screw it on the probe. Disengage a thread or two to ensure atmospheric venting. Make sure the DO and temperature sensors are not immersed in water.
2) Turn the instrument on. If using a polarographic sensor, wait ten minutes for the DO sensor to stabilize. Galvanic sensors do not require warm up time.
3) Press the cal button, highlight DO and press enter.
4) Place monitor into water without disturbing the foam.
5) Verify the barometric pressure and salinity displayed are accurate. Once DO and temperature are stable, highlight “accept calibration” and press enter.
6) Record Data of control and experimental tank.

If the data for dissolved oxygen is not within 3 ppt., then the data must be deemed inaccurate and cannot be recorded.

Measuring Buoyancy:
1) Take skewer.
2) With skewer push the foam to the edge of the tank. Be careful not to disturb the foam so its level in the water remains constant.
3) Take ruler.
4) Measure how far away the water line is from the top of the foam.
5) Record results on Google Drive spreadsheet.

Noting Results:
1) Observe water quality parameters being tested.
2) Record data on corresponding column on spreadsheet.

There will be two data charts, one experimental, one control, which will have the following parameters:

· Time
· Date
· Temperature (C)
· pH
· Dissolved Oxygen (ppm)
· Dissolved Oxygen (ppm)
· Notes/Qualitative
· *Buoyancy of Mushroom Material (cm)

*To only be recorded on experimental chart

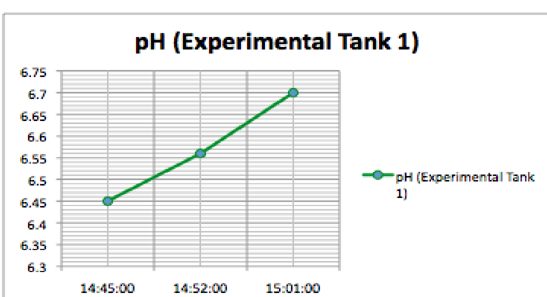
Safety and Ethics:

Heavy lifting is a major component of the beginning of the project.

Results-

Experimental Tank 1:

Time	Temperature (C) (Experimental Tank 1)	pH (Experimental Tank 1)	Dissolved Oxygen (Mg/L) (Experimental Tank 1)	Salinity (ppt) (Experimental Tank 1)
14:45:00	8.4	6.45	12.77	26.82
14:52:00	8.4	6.56	12.66	26.87
15:01:00	8.4	6.7	12.64	27.04



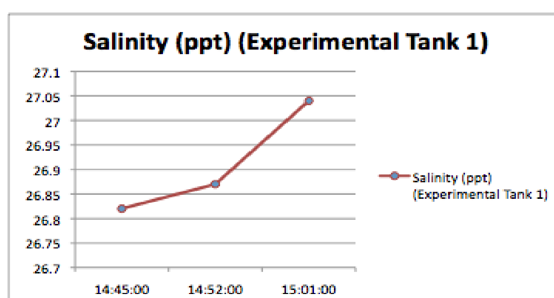
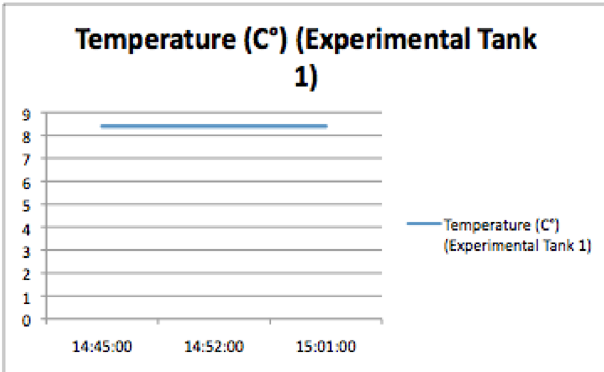


Figure 3- pH results for three trials on 02/24/15. Experimental tank 1.

Figure 4- Salinity (ppt) results for three trails on 02/24/15. Experimental tank 1.



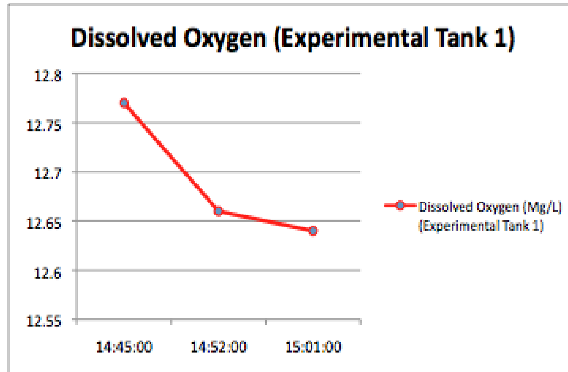
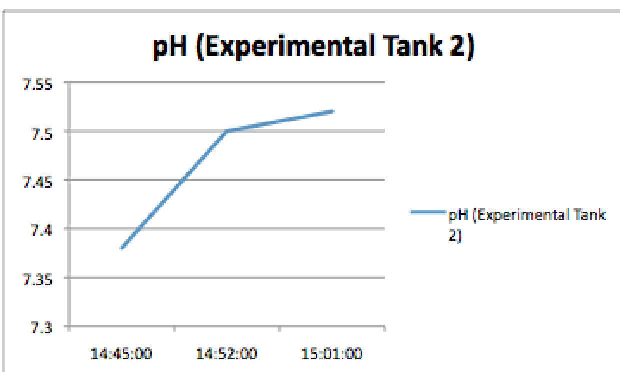


Figure 5- Temperature (C) results for three trails on 02/24/15. Experimental tank 1.

Figure 6- Dissolved Oxygen (Mg/L) results for three trails on 02/24/15. Experimental tank 1.

Experimental Tank 2:

Time	Temperature (C) (Experimental Tank 2)	pH (Experimental Tank 2)	Dissolved Oxygen (Mg/L) (Experimental Tank 2)	Salinity (ppt) (Experimental Tank 2)
14:45:00	7.2	7.38	13.45	26.58
14:52:00	7.2	7.5	13.4	26.55
15:01:00	7.2	7.52	12.16	26.54



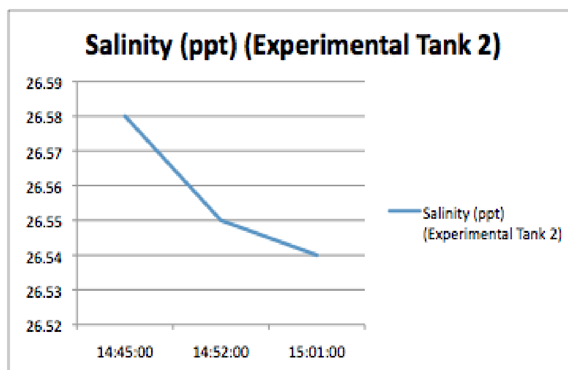
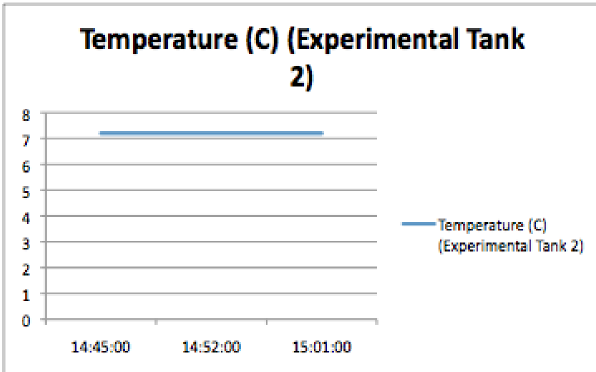


Figure 7- pH results for three trails on 02/24/15. Experimental tank 2.

Figure 8- Temperature (C) results for three trails on 02/24/15. Experimental tank 1.



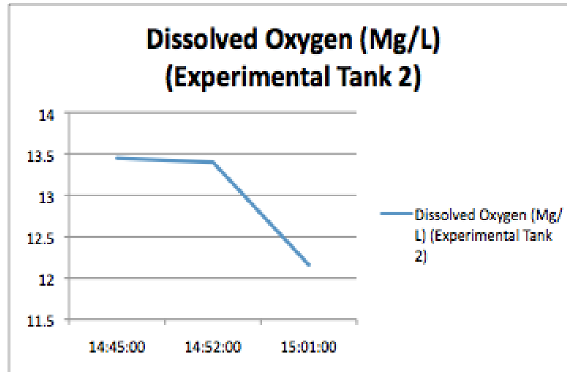
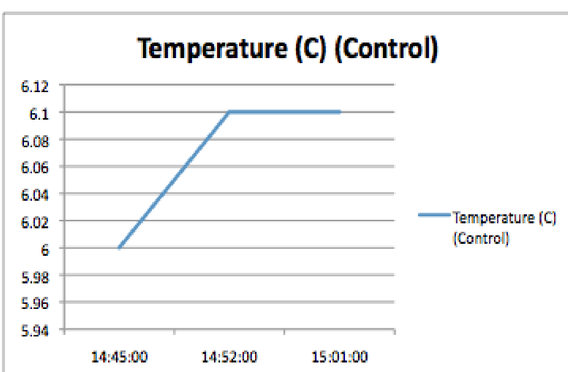


Figure 9- Temperature (C) results for three trails on 02/24/15. Experimental tank 2 **Figure 10-** Dissolved Oxygen (Mg/L) results for three trails on 02/24/15. Experimental tank 2.

Control Tank:

Time	Temperature (C) (Control)	pH (Control)	Dissolved Oxygen (Mg/L) (Control)	Salinity (ppt) (Control)
14:45:00	6	7.64	12.95	26.39
14:52:00	6.1	7.68	12.87	26.34
15:01:00	6.1	7.7	12.63	26.33



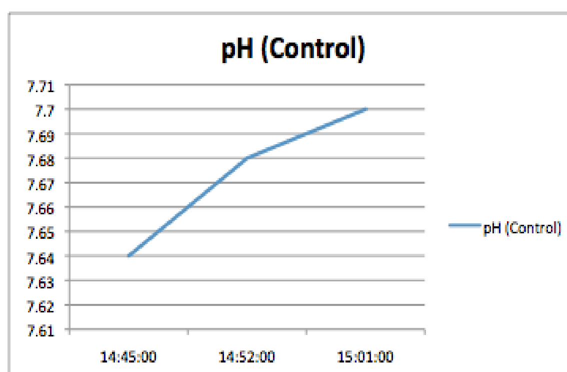


Figure11- Temperature (C) results for three trails on 02/24/15. Control Tank.

Figure 12- pH results for three trails on 02/24/15. Control Tank.

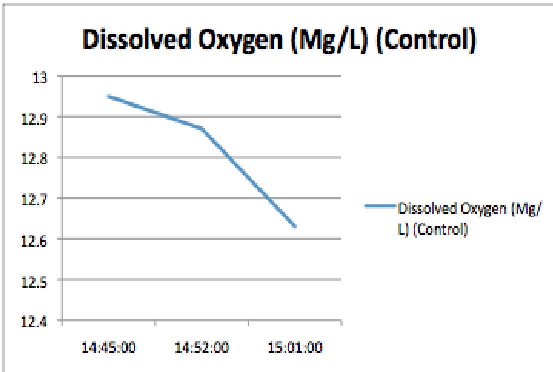


Figure 13- Dissolved Oxygen results for three trails on 02/24/15. Control Tank.

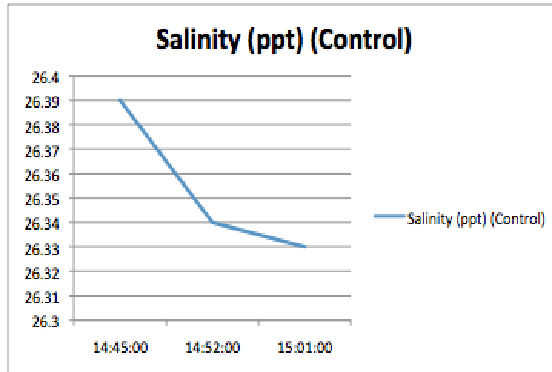


Figure 12- pH results for three trails on 02/24/15. Control Tank.

<u>Participants-</u>

Sue Van Hooke- Scientific Mentor

Mauricio Gonzales- Instructor

<u>Peer Reviewed Journal Articles:</u>

1. Mycelium cultivation, chemical composition and antitumor activity of a Tolypocladium sp. fungus isolated from wild Cordyceps sinensis (Journal of Applied Microbiology).

2. Optimization of submerged culture requirements for the production of mycelial growth and exopolysaccharide by Cordyceps jiangxiensis (Journal of Applied Microbiology).

3. Nutritional requirements of mycelial growth of Cordyceps sinensis in submerged culture (Journal of Applied Microbiology).

4. The pollution of the marine environment by plastic debris: a review (Marine Pollution Bulletin).

5. Microplastics in the marine environment (Marine Pollution Bulletin).