**Lab #7: Water Pollutants and Living Organisms**

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*Lab objectives: Understand the impact of water pollutants on marine animals and plants*

**Pre-lab assignment**: Read handout on Water Pollutants

|  |  |  |
| --- | --- | --- |
| Initial Observation | Control |  |
| Low |  |
| High |  |
| Final Observation | Control |  |
| Low |  |
| High |  |

**Task #1: Algal Blooms**

1. Your TA will assign you one of three pollutants (N, P, NP) and will let you know if you are doing ‘Cultured Algae’ or ‘Pond Algae’.
2. Add the correct amounts of pollutant and water sample to the containers labeled ‘Control’, ‘Low Concentration’ and ‘High Concentration’ as indicated in the Table below.

|  |  |  |
| --- | --- | --- |
|  | **Cultured Algae** | **Pond Algae** |
| **Container** | Amount of Pollutant | Amount of Aged Water | Amount of Cultured Algae | Amount of Pollutant | Amount of Pond Water |
| **Control** | 0 mL | 25 mL | 5 mL | 0 mL | 30 mL |
| **Low Concentration** | 1 mL | 24 mL | 5 mL | 1 mL | 29 mL |
| **High Concentration** | 3 mL | 22 mL | 5 mL | 3 mL | 27 mL |

1. Swirl each container thoroughly to mix. Cap the containers loosely so that air can pass into and out of the containers.
2. Record an initial qualitative observation in the space below. Qualitative observations are made in regards to color intensity and cloudiness.

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**One week later**: Label three slides with your treatments: Control, Low, High. Make a wet mount following the example given by your TA after gently swirling the container. Observe the slide under the microscope under low power.

1. Assuming the area in view is divided into four fields, count the number of algae in each field; begin at the top left and work clockwise (see figure below). Record your counts in the table below. Add the amounts in all four fields to determine approximately how many algae cells are in one drop of sample. One drop is equal to approximately 0.05mL; multiply by 600 for a rough estimate of the algal concentration in the entire container. Record these results and repeat for each treatment.

**1**

**2**

**3**

**4**

|  |  |  |
| --- | --- | --- |
| Pollutant Tested | Number of Cells per Drop Undiluted | Total Number of Algal Cells(total # of cells x 600) |
| Control | Field 1 | Field 2 | Field 3 | Field 4 |  |
|  |  |  |  |
| Low |  |  |  |  |  |
| High |  |  |  |  |  |

Class Data (total number of algal cells):

|  |  |  |  |
| --- | --- | --- | --- |
|  | Nitrogen | Phosphorus | Nitrogen & Phosphorus |
| Control |  |  |  |
| Low Concentration |  |  |  |
| High Concentration |  |  |  |

Questions:

1. How did the addition of nitrate affect the amount of algae in the sample? How about phosphates?

2. Did the combination of nitrate and phosphate yield a greater effect that either of the two alone? Why or why not?

3. How did an increase in the concentration of pollutants affect the amount of algae in the sample?

4. You are an environmental consultant hired by a small tourist town containing a number of resorts on a large lake in the center of the community. Recently, the resort owners have been complaining of large fish kills in the lake, which is bad for business. After running a series of tests, you have found no evidence of an increase in toxic chemicals in the lake but you have noticed a large increase in the population of algae in the lake even during the short time in which you have been performing your

study. How would you explain your findings to the town board?

What do you hypothesize may be possible causes of the problem?

What is a course of action for further investigation into the problem?

**Task #2: Vinegar Eels**

 1. Obtain two 3-well plates from your TA and be sure they are labeled A-F.

 2. Prepare a control by placing one drop of distilled water in depression A. Add one drop of the suspension of the living organism. Use the dissecting microscope to observe the normal movement of this organism (if you are unable to see the organism, use the compound microscope set to the lowest available power).

 3. Add one drop of distilled water and one drop of the suspension of the living organism to depressions B-F so all six depressions have both water and the organism.

 4. Add one drop from Bottle A to depression A. Have one team member note the time when this is completed and use the microscope to observe again the swimming motion of the organism. Record how long it takes the majority of the organisms to lose their ability to swim in one direction and to begin to form coils instead. If this does not happen within five minutes, record a *negative result* for that pollutant. Repeat the above, rotating so each member of the lab group observes the organism, for the five other solutions and record the results in the table below.

 *Because there is only one bottle of each pollutant, you may need to go out of order. As long as you observe the organism’s reaction with all six pollutants, it does not matter which order you complete the task.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Distilled Water | Toxic Pollutants | Living Organisms | Time in Minutes Required for Loss of Directional Motion |
| Effect of Silver Nitrate | 1 drop | 1 drop Bottle A | 1 drop |  |
| Effect of Mercury (II) Nitrate | 1 drop | 1 drop Bottle B | 1 drop |  |
| Effect of Nickel Nitrate | 1 drop | 1 drop Bottle C | 1 drop |  |
| Effect of Lead Nitrate | 1 drop | 1 drop Bottle D | 1 drop |  |
| Effect of Aluminum Nitrate | 1 drop | 1 drop Bottle E | 1 drop |  |
| Effect of Copper (II) Nitrate | 1 drop | 1 drop Bottle F | 1 drop |  |

 Rinse both plates in the sink. The six chemicals used in this kit are furnished in dropper containers that permit each experiment to be completed with only one drop of the chemical. Thus the disposal of this tiny amount at the end of the experiment by flushing it down the sink is innocuous. The living organism used in the experiment, *Turbatrix aceti*, is harmless and has no parasitic tendencies. Dry both plates and return to your lab bench.

5. In depression A, place one drop of the solution in Bottle B and one drop of the solution in Bottle C. Add one drop of the suspension of living organisms and have a team member note the time when this is completed. Now use the microscope to observe how long it takes for the majority of the organisms to lose their ability to travel in one direction. Compare this with the time achieved in the first part of this exercise when only the solution in Bottle B was being used. Repeat using one drop of the solution in Bottle B with one drop of the solutions in each of the following bottles in turn: Bottle D, Bottle E and Bottle F. Record your results in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Drops of Bottle B | Drops of Other Pollutant | Drops of Living Organism | Time in Minutes Required for Loss of Directional Motion |
| Mercury (II) Nitrate & Nickel Nitrate | 1 drop | 1 drop Bottle C | 1 drop |  |
| Mercury (II) Nitrate & Lead Nitrate | 1 drop | 1 drop Bottle D | 1 drop |  |
| Mercury (II) Nitrate & Aluminum Nitrate | 1 drop | 1 drop Bottle E | 1 drop |  |
| Mercury (II) Nitrate & Copper (II) Nitrate | 1 drop | 1 drop Bottle F | 1 drop |  |

 6. Rinse and dry depression plates. Return to your TA.

Questions:

1. Which of the six water pollutants tested was most toxic in regards to making the organism cease its directional motion?

2. Which solutions showed no toxic effects within five minutes when used alone?

3. Which solution showed the phenomenon of positive synergy to the greatest degree when it was combined with the solution in Bottle B? Which other solutions also showed positive synergy to some degree with the solution in Bottle B?

4. Standards for various water pollutants are set to allow regulatory agencies, such as the EPA or State Departments, to issue permits to potential polluters in order to control the amounts of pollutants that can be released into a certain body of water. Ecologically, why is it more important to control such pollutants to prevent toxic effects on lower organisms, represented by the organism used in this exercise, instead of higher organisms such as birds or fish?

5. How does the phenomenon of ‘biological magnification’ complicate the setting of allowable levels of pollutants in an aquatic ecosystem?

6. Why is it important to take the phenomenon of positive synergy into consideration when setting pollution standards for a specific body of water?

**Post-lab assignment**: None. Submit this completed task sheet at the end of lab today.