

pH Effects on Macroinvertebrates

Purpose:

The purpose of this lab is to analyze and compare the effects of lowered and raised pH changes on aquatic invertebrates.

Background:

According to the Texas Natural Resource Conservation Commission manual, A Guide to Freshwater Ecology (pages 100-101), one of the most common of the aquatic pollutants is ammonia (NH₃). The importance of ammonia is related to its highly toxic nature and widespread presence in surface waters. Ammonia is discharged in varying quantities from industrial, municipal and agricultural wastewater. Ammonia, nitrite and nitrate are related by the process of nitrification, which is the oxidation of ammonia and nitrate. In the presence of oxygen, ammonia is oxidized by Nitrosomonas bacteria to form nitrite. Not only is ammonia toxic it is also an oxygen demanding substance. Nitrite (NO₂), like ammonia is extremely toxic to aquatic life, but is not considered an environmental problem because it occurs in relatively low concentrations. Nitrate (NO₃) is relatively nontoxic to aquatic organisms and is not considered an environmental problem. It is important to note that in high concentrations over a short period of time or acute exposure to ammonia can cause death or at least damage to the organs and tissues of aquatic organisms. If the exposure to ammonia is chronic, aquatic organisms are more susceptible to disease, exhibit reduced reproduction/growth and several physiological functions show signs of deterioration.

Acid rain is precipitation with below normal pH, the result of industrial pollution and automobile exhaust emitted into the atmosphere. Sulfur dioxide and nitrogen oxide found in these pollutants combines with water vapor to form an acid. The accumulation of acid rain showers lowers the natural pH of lakes and ponds, often killing the organisms that live there.

Materials:

- Pond water or cultures of macroinvertebrates (i.e. Daphnia, Hydra, and Planaria)
- Dissecting scopes and microscopes
- Glass slides and coverslips
- Petri dishes (3)
- pH meter or paper
- Beaker or graduated cylinder
- Vinegar
- Ammonia
- Eyedroppers

Procedures:

1. Observe pond water or cultures under microscopes and record observations.
2. Label petri dishes A, B, and C.
3. Put 20 ml of pond water or culture water in each petri dish.
4. In petri dish A, add 10-12 drops of vinegar until the pH=4.0. Be sure to check with calibrated pH meter or pH paper.
5. In petri dish B, add 4-8 drops of ammonia until the pH=8.0. Again be sure to check with calibrated pH meter or pH paper.
6. In petri dish C, add nothing but check the pH with the calibrated pH meter or pH paper.
7. Let all three of the petri dishes sit for 30 minutes.
8. After 30 minutes, observe contents of petri dishes under the microscope.
9. Record the observations.

Results:

1. What effect did the vinegar (acid) have on the organisms?
2. What effect did the ammonia (base) have on the organisms?

Conclusions:

1. Would you consider all animals ,invertebrates and vertebrates, to be equally susceptible? Support your answer.
2. As an environmental biologist would you consider acid rain or nitrate based pollution to be a larger problem for the aquatic environment? Why?
3. The sudden large doses will seldom stimulate a natural process, but the high concentrations occur. Why?