

Chapter 1. What is Water Quality?

Lesson 5. Acute and chronic toxicity

Overview: To appreciate the importance of water quality, we must understand what water quality is. This lesson presents an overview and general principles of water quality.

Purpose: The purpose of these activities is to introduce students to water quality, and cause them to think about its importance.

Ideas Taught:

- Water quality depends upon three different factors: type of contaminant, effect of the contaminant on human health, and length of time it takes for that effect to become evident.

Materials Needed:

- Six mason jars or clean mayonnaise jars full of water
- Salt
- Goldfish
- Aquatic insects from local stream or brine shrimp
- Bleach
- Hot plate

Procedure:

1. ___ Add 1/4 cup of salt to one of the mason jars full of water. Add 1/4 teaspoon of salt to the other mason jar full of water.
2. ___ Hold the goldfish up and ask the students what is likely to happen if the goldfish were placed in the jars. Don't place the goldfish in the jars.
3. ___ Explain most likely the goldfish in the jar with the 1/4 cup of salt would die quickly.
4. ___ Explain to the students that this fish would likely die of acute toxicity. Write the words "Acute Toxicity" on the board.
5. ___ In contrast, if you add a little salt or a little salty water to the other jar each day, the goldfish will survive for a long time. The goldfish might

change color, might change its physical behavior, and eventually die. It would take a much longer time.

6. ___ Explain to the students that this fish would suffer from chronic toxicity. Write the words "Chronic Toxicity" on the board.
7. ___ Add brine shrimp or aquatic insects to 2 mason jars with clean water. Add 1 milliliter of bleach to one jar and 2 tablespoons of bleach to the other.
8. ___ Observe with the students what happens. You may see a rapid change in the insects' behavior in the jar to which the 2 tablespoons were added, followed shortly by death for oxygen deprivation.
9. ___ Continuing adding 1 milliliter of bleach to the other jar every day. Eventually the effect will show up on the insects in this jar, with some surviving and others dying.
10. ___ Talk to the students again about Acute and Chronic Toxicity.
11. ___ Temperature is another means of illustrating the effect of acute and chronic toxicity. Again, add aquatic insects or brine shrimp to 2 clean mason jars with clean water.
12. ___ Place one jar on a hot plate and begin heating the water on high. You will see a rapid response with near sudden death of the insects.
13. ___ Once the hot plate has cooled, place the other jar on the hot plate and begin heating the water on low. Observe the insect behavior. It is likely not as quick.
14. ___ Ask the students what other examples of acute and chronic toxicity they can come up with.

Lesson Learned: Contaminants can be defined based upon a living system's tolerance for the level of contaminant. Humans, plants, animals, and insects can often either adjust internally or withstand minor changes in water quality, if the change is gradual or of a low level that does not greatly affect our system. The change may eventually affect us, changing our health, life expectancy, reproductive capacity, or behavior. The effect may take a long time to show up. In contrast, some contaminants, when present at sufficiently high levels, exceed our capacity to adjust and the effect is immediate. Two of

the most commonly occurring contaminants that have immediate acute toxicity effects are: nitrate nitrogen, a plant nutrient responsible for chlorophyll and green plant production, and bacteria, which exist in nature.

The lesson above was adapted from "*What is Water Quality? A Resource Guide for 4-H Leaders and Teachers*," 80 pages of activities and experiments related to water quality. (\$5.00) Order from the Montana 4-H Program at Montana State University-Bozeman. Phone 406-994-3501.