

Treatment Plants

How do plants receive nutrients? Demonstrate how plants absorb nutrients and pollutants with a celery model.

Concepts

- Plants absorb water that provides them with life-sustaining nutrients.
- Plants also absorb pollutants found in the water, providing a filter for the environment.

Standards –5A?

Objectives

Students will be able to:

- describe how plants remove pollutants from the water
- discuss the limitations of this ability when overburdened with pollutants from land

Duration

Set up a day ahead; 30 minutes for demonstration and discussion.

Method

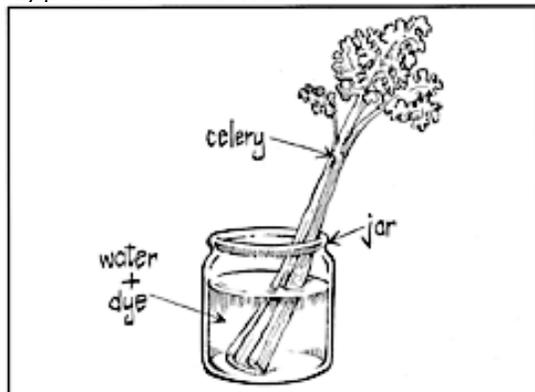
Demonstration of uptake of pollutants into plant tissues.

Materials

1. celery stalks
2. 2 beakers or jars
3. red food coloring
4. water
5. paring knife

Preparation

Collect materials, complete steps 1 and 3 of the activity one day prior to the demonstration.



Background

Many people do not realize that plants are vital to the health of our water supply. In fact, wetlands and their plants are an increasingly popular alternative for filtering wastewater from homes, schools, factories, and businesses. Why? Because the plants growing in a wetland filter pollutants out of rainwater, runoff (water flowing off of roads, sidewalks, gutters, buildings), and wastewater before it enters bodies of water.

This tangle of stems, leaves, and roots in a densely vegetated wetland trap particles of sediment and even trash – these things stay in the wetland, while the cleaner water moves on. And as water moves through a wetland, the plants remove and take up excess nutrients and toxic pollutants. Nutrients are used by the plant for growth and metabolism; other substances are simply stored in the plants' tissues.

In a natural system, plants are fairly efficient at keeping the system in balance, even when naturally occurring excess nutrients flow from upstream. But when human activities on land and in the water add sediment, nutrients, and toxic pollutants, plants cannot clean it all up, though they certainly do help. We need to be very careful that our activities will not send pollutants into the water; at the same time, we need to maintain and even add to the wetlands that help keep out those pollutants that we miss or can't control.

Activity

Important: Prepare the demonstration (steps 1 and 3) one day prior to the lesson. Repeat steps 1 and 3 in front of the class to show how the demonstration was prepared.

1. Prepare a solution in a beaker by adding several drops of food coloring to water. Explain that the food coloring represents pollution by a toxic substance (for example, a pesticide – or let students come up with examples).

2. Ask the students to imagine water flowing through a wetland with many plants. Tell them that the celery stalks are like the plants growing in a wetland (cattails, sedges, grasses, etc.)

3. Cut off the bottom half inch of the celery stalks and place them in the water overnight. Over time the colored water will visibly travel (via capillary action) up the stalks, showing how plants can absorb pollutants with the water they “drink.” The colored water may or may not be visible on the outside of the stalk. Cut off one-inch pieces of the celery and hand them out for students to study closely – they will see colored dots on the cut surface, which are water-filled channels in the celery in cross-section.

4. Ask the following questions:

- a. How do wetland plants help to purify water? (by taking up pollutants from the water)
- b. Why is the water remaining in the beaker still polluted? (Plants can only do so much. As new water (hopefully clean) flows into the system, the pollutants will be somewhat diluted and the water a little less polluted. If the water continues to flow on to other parts of the wetland, other plants will continue to remove pollutants; wetland soil also helps filter out some pollutants.
- c. Where does the water go after uptake into the plant? (It is transpired out through pores (stomata) in the plants' leaves and usually evaporates.
- d. What happens to the pollutants? (some are used in the plants' metabolic processes, some are transformed into less harmful substances, while others are stored in the plants' tissues and could be re-released into the environment if the plants die.)
- e. Why can't we dump all of our waste into the wetlands? (Wetlands can only do so much; many pollutants still end up in the water. Too many pollutants will harm or destroy a wetland. The best solution is to reduce the pollution.)

Extension

“Nature in your Neighborhood”

Lots of pollutants run off of the land from construction sites, streets, highways, and the communities in which we live. Sometimes ditches or ponds, called stormwater management ponds, are built to filter runoff from these sites. These ponds are often planted with wetland plants to aid with the filtering. This is also a place for rain and runoff to rest for a bit before flowing on – which means many that many of the pollutants, especially soil particles, settle to the bottom and the cleaner water drains off from the top. Is there a stormwater management pond near where you live? **

Find one that is in a safe spot, away from speeding cars. If it is fenced off, stay outside of the fence. Visit the pond on a dry day and just after a heavy rain. Is there a difference in the appearance of the water washing into the pond? Where is the water flowing from and where do you suppose it is going to? If you can see water leaving the pond, is it cleaner? It should be. This is how natural wetlands work. In fact, this is a wetland – a man-made one. With care, and if not overloaded with pollutants, it will evolve into a beautiful wetland for all to enjoy!

** For assistance in finding a pond, contact your highway department or office of public works.

Additional Resources

Constructed wetlands: www.rtis.com/reg/big8/cw

Wetland Fact Sheet: www.epa.gov/owow/wetlands/pdf/ConstructedW.pdf

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