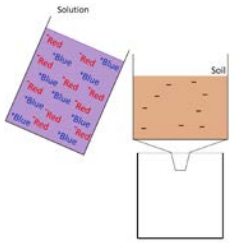
LEARNING ACTIVITY:

Nature's Water Filter



GRADES 6-8

MATERIALS

- 4 3-oz clear solo cups
- 4 5-oz clear solo cups (with 3–5 small holes in the bottom of each cup)
- 4 funnels
- Play sand
- Topsoil
- Planting mix or peat moss
- Fine gravel
- Grape drink mix packet, e.g., Kool-Aid®
- "Floaties" such as leaves, tea leaves, or grass clippings
- Water
- Pen and paper for recording

Soil Science Society of America

Source: Soil Science Society of America. Adapted with permission.
Credit for the lesson plan, activity, and video belongs to Drs. Clay Robinson, Michelle Blumer, and SSSA.

Soil is a filter that helps maintain a clean environment and safe drinking water.

When rain falls on a soil surface, or when contaminated water is introduced to a soil surface, it infiltrates into the soil. As water moves downward, the soil acts as a natural water filter, removing harmful contaminants and delivering clean water to rivers, lakes, and underground water reservoirs called aquifers.

Two types of filtration occur during this process — physical and chemical. Physical filtration happens when large particles are physically prevented from traveling through small soil pores and are therefore removed from water. Chemical filtration happens when contaminants dissolved in water are attracted and held to the soil itself. This process is called sorption.

This activity demonstrates how soil acts as a physical and chemical filter for contaminants.

PROCEDURE

For the teacher: Before doing this activity, visit **www.soils4teachers.org/esw** and review the set-up video. To set the stage for the following activity, play the "Soils Clean and Capture Water" video for students.

1. Ready to explore physical filtration? Fill a 5-oz cup half-full of gravel. Add "floaties" to the top. Put the cup over the funnel. Slowly pour about 100 ml (3 oz) water over the gravel/floatie mixture. Observe. Discuss:
   - Did the floaties end up in the bottom cup? Why, or why not?
   - What is this type of filtration?
2. Ready to explore chemical filtration? Create three more cups — one with fine sand, one with topsoil, and one with potting soil or crushed peat moss.
3. Mix 0.5 g grape drink powder into 1 liter of water.
4. Slowly pour 50 ml grape drink into each of the four cups. For each cup, observe and record what happens:
   - What color is the grape drink that goes into each cup?
   - What color is the water that collects in each of the bottom cups?
   - Is the color of the water the same in the three cups?
   - How much time does it take for water to drain out of the top cup?
5. Set aside the bottom cups (keep the water in them). Pour the grape drink mix into the gravel a second time and collect the water in a new cup. Repeat the process three times for the sand and six times for the soil, and collect the water in new cups each time. Observe and record:
   - Is the color different for the gravel cup on the second try?
   - What about for the sand and topsoil?
   - Has the water in one of the cups turned red? Why? Blue and red dyes make purple, so the blue dye was pulled out by the soil. Why?
6. Opposite charges attract and like charges repel. The smallest soil particles are clay, which have a negative charge. If the red dye goes through the soil, it must also have a negative charge; the blue dye has a positive charge which attracts and binds it to the clay (sorption). Discuss:
   - As more of the drink mix is poured through the soil, does the water in the bottom cup get progressively more purple? Why? The clay in the soil has reached its capacity to capture the positively charged blue ions.
   - Did the water in the sand change color? Why or why not? Likely, it stayed purple, which means that there is not any clay in it to attract the blue dye. What about the gravel?

Supplemental materials, videos, and worksheets are available at **www.soils4teachers.org/esw**.

NGSS CONNECTIONS

- Science and Engineering Practices — Analyzing and Interpreting Data
- Disciplinary Core Ideas — Earth Materials and Systems
- Cross-Cutting Concepts — Cause and Effect: Mechanism and Explanation