

STEM in the lab

.....● Inspiring Idaho's future STEM workforce

WATER FILTRATION



GRADE LEVELS

This activity is appropriate for grades 1-8.



VOCABULARY

COAGULATION: the process by which dirt and other suspended solid particles chemically “stick together” into floc so they can easily be removed from water.

CAUSTIC: able to burn or corrode organic tissue by chemical action.

FILTER: a porous device for removing impurities or solid particles from a liquid or gas passed through it.

FLOC: clumps of alum and sediment.

SEDIMENT: the product that settles when gravity pulls the particles of floc to the bottom of the jar.

WATER TREATMENT: any process that improves the quality of water to make it more acceptable for a specific end use. The end-use may be drinking, industrial water supply, irrigation, river flow maintenance, water recreation, or many other uses, including being safely returned to the environment. Water treatment removes contaminants and undesirable components, or reduces their concentration so that the water becomes fit for its desired end use. This treatment is crucial to human health and allows humans to benefit from both drinking and irrigation use.



MISSION

Make your own water filter.



MATERIALS

- » Glass jar or Mason jar with a lid
- » Alum (*available in the spice aisle at grocery store*)
- » Tablespoon (*for the alum*)
- » Bowl (*big enough for the colander to fit inside*)
- » Spoon
- » Colander or strainer
- » Coffee filter
- » Gravel or small pebbles

ABOUT THIS ACTIVITY

The global availability and quality of water, especially for large economies like America, is a serious issue. A worldwide market for water recycling and reuse is growing rapidly. The Water Technology Innovation Program is a coordinated Idaho National Laboratory effort to create an environment that nurtures innovation in water contamination. INL's multifaceted capabilities are focused to bring improved, innovative and cost-effective water processing technologies to the energy, manufacturing and agricultural industries. Seventy percent of the Earth is covered with water. However, only about 3% can be used for drinking water. While many people in the United States have clean, drinkable water from their kitchen sink, most of the people around the world do not have access to clean water and must boil or filter their water. In this activity, students will experience the difficulty of filtering their own water. They will use gravel and coffee filters to make their own water filter.

INSTRUCTIONS

- 1 Fill a jar full of water obtained from a source outside your home. This source could be a puddle, stream, or some dirt mixed with water from the hose.
 - 2 Add a couple of tablespoons of alum to the dirty water in the jar. Slowly stir the mixture for five minutes. You will see particles in the water clinging together to make clumps. This process is called coagulation.
 - 3 Let the jar sit until all the dirt (floc) is at the bottom of the jar.
 - 4 Fill a colander with clean gravel or small pebbles. Place the colander in a bowl. Slowly pour the water out of the jar over the rocks in the colander. Pouring slowly will ensure that the floc stays at the bottom of the jar. The water will pass through the rocks, through the colander and into the bowl.
 - 5 There might still be some particles left in the water that were able to pass through the rock filter. Pour the floc out of the jar into the trash. Make sure that your jar is clean. Then pour the water from the bowl back into the jar.
 - 6 Place a coffee filter over the opening of the bottle. Screw the lid onto the bottle. Tip the bottle upside down over a bowl. The coffee filter should catch the small particles as the water passes through it into the bowl.
 - 7 The final step at a treatment plant is to add disinfectants to the water to purify it and kill any organisms that may be harmful. Because disinfectants are caustic and must be handled carefully, they are not in this experiment. The water that was just filtered is therefore not fit to drink.
- !** *Do not drink the water you have filtered!*

THE SCIENCE BEHIND IT

Water filters remove particles and impurities from water. Filtration is any of various mechanical, physical, or biological operations that separate solids from fluids by adding a medium through which only the fluid can pass. During the filtration process, particles or impurities such as chemicals and bacteria are separated from the solution that is filtered.

To find out how water filters work, it is probably best to have a look inside the filter. Most of the filters that are used for home water treatment are carbon filters. That means the material inside the filter is carbon or a special form of it, called activated carbon or activated charcoal. In nature, water is filtered through sand, soil, gravel, and even beneficial bacteria!



EXTENSIONS

- » Try different materials as filters, such as paper towels, sand, or cotton balls.
- » Expand the experiment by making dirty water with different types of contaminants like oil, food coloring, or spices. Which materials work the best to clean the water? Which contaminants are the hardest to remove?
- » Try adding contaminants to different liquids. How well do they filter compared to water?

RESOURCES

- » **EPA Water Filtration Lesson for Grades 4-8:**
https://www.epa.gov/sites/production/files/2016-03/documents/activity_grades_4-8_waterfiltration.pdf
- » **Children's Science Center:**
<https://www.childsci.org/test/water-filtration>
- » **INL Water Technology Innovation:**
<https://factsheets.inl.gov/FactSheets/4WaterTechnologyInnovationProgram.pdf>

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