KU NATURAL HISTORY MUSEUM
& BIODIVERSITY INSTITUTE

Pop Up Science – Nature's Water Filtration System

Video Premieres
April 17, 2021
on Facebook!

What you need

- 1 coffee filter
- Elastic rubber band
- Clean plastic 2-liter soda bottle
- Scissors
- Large cup
- Mixing spoon
- 0.5 cup of gravel/pebbles
- 0.5 cup of coarse sand
- 0.5 cup of fine sand
- 1 cup of soil
- 1.5 cup of water

Follow the instructions below to create your own model for how surface water (e.g., rainwater) goes through a filtration process underground!

Preparation

1. Gather your supplies listed above.
2. Use the scissors to cut the soda bottle in half.
3. Use the elastic rubber band to attach the coffee filter to the neck of the soda bottle.

What to do

1. Place the upper portion of the bottle filter side down so that it sits inside the bottom half of the soda bottle. The bottom half of the soda bottle should hold the upper half of the bottle in place (see illustration). Note that this arrangement allows for the bottom half of the bottle to catch the filtered water.
2. Make sequential layers inside the soda bottle – first make a sand layer, then a coarse sand layer, and finally a gravel/pebble layer.
3. In the cup, mix the dirt and water together using the mixing spoon to make a mud-water concoction.
4. SLOWLY and CAREFULLY pour about two-thirds of the muddy water into the soda bottle with earth material layers. Leave some of the muddy water in your cup for later comparison.
5. Wait about 15-20 minutes for the dirty water to filter through the layers. Does the water that went through the filtration system look the same as or cleaner than the muddy water? (No matter how clean it looks, do not drink this water!)
6. How might the filtration outcome change if you changed the type or size of the earth materials?

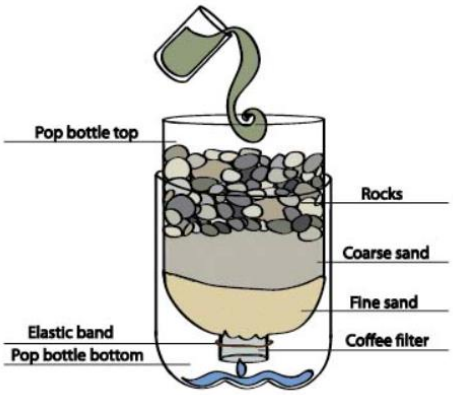

Illustration from the Ontario Ministry of the Environment (earthrangers.com)

What is happening?

When surface water – like rainwater – soaks into the ground, the droplets of water move through spaces between particles in the soil and they continue moving downwards through "pore spaces" between rocks and sand and any other earth materials the droplets encounter until they reach an underground aquifer. An aquifer is a body of rock or sediment that holds water, meaning very little water can seep below the aquifer layer. Some aquifers are shallow and some are very deep underground.

The more layers of soil and rock that water has to filter through to reach the aquifer, the cleaner it can become. This is because soil, sand, and other earth materials can hold onto pollutants, contaminants, and microorganisms - just allowing the comparatively clean water molecules through. This is an example of a natural water filtration system, and the experiment you conducted modeled how surface water can become cleaner as it travels through sequential earth material filters until it reaches an aquifer! Note, however, that while groundwater is cleaner than surface water, soils are not perfect filters. Some contaminants can still make their way through the soil and pollute the groundwater.

Scientific information from *Scientific American* "How Dirt Cleans Water" article: https://www.scientificamerican.com/article/how-dirt-cleans-water/