

Water Filtration

Middle School / High School

Introduction

Water is an important commodity in the American culture. The U.S. Department of Agriculture estimates that agriculture accounts for approximately 80 percent of the nation's water use. In agriculture, water is used to grow fruits, vegetables and crops as well as raise livestock. Even further, water in agriculture is used for irrigation and the application of pesticides and fertilizers. In Kansas, 29 percent of corn acres are irrigated.

Maintaining good water quality is something farmers strive for to help maintain a healthy ecosystem and to preserve the water that we drink. Farmers practice proper natural resource management to meet domestic water quality standards. Cooperation between agriculture and domestic water users is necessary to provide adequate water quality for both parties.

Activity

In this lab, students will test their own water filtration systems. They will use different materials to see which ones remove the most pollutants from their water. They can test different materials separately or combine multiple way to find the best water filtration methods.

Materials

- Plastic Water Bottle (to be cut horizontally) 2-Liters work well or multiple 16oz water bottles
- 3 inch square of cheese cloth, coffee filters, or some other mesh like material
- 1 rubber band (could use a hair tie)
- I spoon for stirring (could also use a stick or straw)
- Other filtering materials: more coffee filters, sand, soil, cotton balls, different sized rocks, paper towels, uncooked pasta, anything else that might spark scientific discovery.
- Polluted water how to make below
 - Pollutants- food coloring, soil, grass clippings, food peelings, dish soap, vinegar, baking soda, salt, pepper, small pieces of newspaper, dirt/ dust from the floor, pet hair, any other ideas that you might have. You DO NOT need to include all these items in your polluted water. Choosing three or so should give you a great "polluted water sample", but you can add as many as you'd like.
- Optional: pH strips if you happen to have them for testing pool water or something along those lines.

Directions

- 1. First you will want to make your polluted water.
- a. Fill a large container about ³/₄ full of water. If your student is planning to do multiple tests, you can always add more. If you happen to have an empty laundry detergent bottle or pitcher, they are great for mixing your polluted water in.

- b. Add in 3 or more "ingredients" from the polluted water materials list. Feel free to use things that are not on the list if you have them handy in the house (there isn't much you can do to not have success here).
- c. Once everything is in the container give everything a good shake or stirring to mix everything together. You will want to do this again before adding water to your filtration system.
- Next you will want to cut any water bottles you are using for filtration horizontally, like the image below. Again, 2 Liter bottles are great, but a smaller 16 oz bottle will also work and can be helpful for running multiple tests if you run them at the same time.



- 3. Have students fill out the Pre-Filtration section of their "Water Filtration Worksheet".
- 4. Once they have drawn what they feel like their system will look like, they are welcome to start building their filtration system.
- a. Option 1: At the opening of the bottle students will add cheese cloth, a coffee filter, thin piece of mesh, or another small porous item. They will attach this item with a rubber band or hair tie. Use the other half of the bottle as a stand.



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Option 2: Students can set up their filters by placing the filter material into the inverted bottle top, as shown. Place the filter in the end of the bottle with the neck, so it functions like a funnel. Use the other half of the bottle as a stand.





- b. Have students add whatever filtering materials they're choosing. Remember this could be more coffee filters, sand, soil, cotton balls, different sized rocks, paper towels, uncooked pasta, anything else that might spark scientific discovery.
- c. Once their system is built have students check to see if they need to add any notes or additional details to their Pre-Filtration drawing.
- d. Give the polluted water a good stirring or shaking and then slowly pour an amount into the filter. Slowly is key here so they don't overfill their inverted water bottle top.
- e. Have students observe as their water is filtering. They are welcome to time during this stage if they want or make notes on what they're seeing.
- f. Depending on the materials used some filtering will take longer than others.
- g. Direct students to record their results and answer the worksheet discussion questions.
- h. Have students work through a redesign if they so choose. This would involve them making changes to the filtering material and trying again. They can use the same bottles and get more polluted water from the main container.

Extensions

A great addition would be to time the filtration processes. A student might go with a different filtration system if they need the water filtered more quickly.

The last question asks how polluted water affects life on our planet.

Questions

- Did your filter work as you expected it to? Explain why or why not.
- Do you think the filtered water is clean enough to drink? Explain why or why not.
- Do you think your filtered water is clean enough to put into a larger water source like a stream, river, lake, or ocean? Explain why or why not.
- How do you think polluted water affects life on our planet?

Sources

- https://www.jpl.nasa.gov/edu/teach/activity/water-filtration-challenge/-This one has a larger focus on testing pH. If you happen to have pH strips at home, you could continue learning using the steps in this NASA lab
- https://www.waterfiltermag.com/diy-water-filter/ This has great information on real world examples of other reasons that you might filter water.



Pre Filtration

Describe the polluted water before filtering.

Drawing of Polluted Water	Obersvations of Water (What I see and smell)

Hypothesis (Guess about outcome)

I believe that	_ will filter	_ when we pour
the polluted water through it because		
1 5		

Drawing of Filter System:



Post Filtration

Describe the polluted water after being filtered.

Drawing of Filtered Water	Obersvations of Water (What I see and smell)

Results

My hypothesis was (correct / incorrect) because _____

Redesign - Use the information gained to test more items or combine items for the best filtration.

- 1. Did your filter work as you expected it to? Explain why or why not.
- 2. Do you think the filtered water is clean enough to drink? Explain why or why not.
- 3. Do you think your filtered water is clean enough to put into a larger water source like a stream, river, lake, or ocean? Explain why or why not.
- 4. How do you think polluted water affects life on our planet?

