

Learning about complex ecological processes: Simple Water filtration



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1. Aim of the Experiment

The following experiment provides the participants with an opportunity to learn something about the process of water filtration in a hands-on way that gives them a first impression of how river water can be treated. This shows the students how complicated the process is by introducing one of the many steps of water filtration. Beyond this, the experiment offers a way to discuss the importance of clean water for society. What are the processes in nature where filtration happens? Why are these natural processes insufficient today? What can we do to improve the situation?

Context

With this experiment students can conduct the first steps of the water filtration process like it is conducted in big water filtration facilities and in natural filtration processes underground. For this task, the students will have to work with local river water or, if necessary because of health concerns, "artificially" dirty water. The students can learn about some of the scientific principles of water filtration and build an easy filter made out of materials that can be found in every household.

Below you will find a list of materials needed, a description of the steps to the experiment, and links to a pdf-document and a flash player, which explain the experiment in-depth and with visual aids.

This module is best conducted with the help of somebody with a background in biology or chemistry. If you do not have such a background, study closely the links provided below.

Keep in mind that the obtained water is not of drinking quality and by no means should this water be ingested!

1. Module Instructions

Prior preparation

You should first read the following information carefully before the activity is performed:

"Water: No Dirt, No Germs"

http://water.chemistry2011.org/c/document_library/get_file?p_l_id=16823&folderId=17501&name=DLFE-521.pdf (page 4)

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“EPA – Flash Filtration”

http://www.epa.gov/safewater/kids/flash/flash_filtration.html

Materials

These are the materials you will need for the experiment:

- 2 litres (L) of “dirty” natural water preferably obtained from the local river/lake (or you can add 1 cup of dirt or mud to 2L of water)
- One litre plastic bottle (can also use 2L) with its cap
- Two 2-litre plastic bottles (2L), one with its bottom cut off to use as a funnel and one with the top cut off to use for sedimentation
- 1 large beaker (with a volume of 500 ml, or 2 cups) or measuring bowl that will hold the inverted two litre bottle (you can also use another 2L plastic bottle with its top cut off so the other bottle will fit inside of it).
- 2 tablespoons of alum
- 1½ cups fine sand
- 1½ cups coarse sand
- 1 cup small pebbles
- 1 coffee filter
- 1 rubber band
- 1 large spoon
- A clock with a second hand or a stopwatch

Conducting the experiment (estimated two school classes x 45 minutes minimum)

1. Briefly introduce the topic of the importance of clean water. Ask participants what they know about the following key concepts:

- Water purification procedures
- Importance of clean water consumption
- Risks of polluted/untreated water consumption

2. Before beginning the procedure, show the materials involved and discuss how they could be used.

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3. Perform the water filtration procedure (see next page/preparation pdf). Perform one step at a time, briefly explaining the purpose of the step and letting the participants perform the step for themselves.
4. Discuss the general impressions of the participants. Explain that water in large-scale treatment facilities also undergoes further and more complicated steps of purification in order to produce drinking water. Put an emphasis on what cannot be filtered out, such as many residues of pharmaceuticals, which via our hygiene and canalisation systems typically ends up in rivers and lakes and are very difficult to filter out. At this point you can also invite a discussion of our responsibility as a society, consumers and producers, not to pollute rivers and lakes. What practical steps can your participants think of?

Keep in mind that the obtained water is not of drinking quality and by no means should this water be ingested!

5. Take photos of your filters and the different water types to send to the Big Jump Challenge Team to get your drops.

Note: Filtration experiments can be done in many ways. Feel free to conduct your experiment in a different way – this also counts as long as you document your way of doing it so that it can be shared with others.

Possibility for further activities: Organizing a visit to a local water treatment facility.

2. Attachment

Procedure of Water Filtration

1. Pour the dirty water in the plastic bottle and shake it for 30 seconds for the aeration process. Keep aside a separate sample of dirty water to compare with water obtained at the end of the procedure.
2. Pour the dirty water in the beaker and then pour it back into the plastic bottle. Repeat this step at least 10 times.
3. Put the aerated water in the cut off plastic bottle and add the alum. Stir for 5 minutes. After let the water stand in the bottle undisturbed for 5 minutes. Keep aside a separate sample of sedimented water to compare with water obtained at the end of the procedure.

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4. Construct a filter (as described in the supplementary information for the instructor).
5. Pour the top water out of the cut off plastic bottle into the filter.
6. Compare the three different stages of water (dirty water, sedimented water, filtered water)

Suggestions for general discussion topics for every step of building a filter:

- Step 1 and 2 - Discuss and explain the process of aeration and the importance of the amounts of dissolved oxygen in water.
- Step 3 - Discuss the process of sedimentation and its importance, and the role of alum in this particular step.
- Step 4 - Encourage a discussion on how a filter could be constructed with the available materials and how it could work. Assure that the participants build the filter step by step alongside yours.
- Step 5 - Encourage participants to closely observe the effect of filtration.
- Step 6 - Compare and discuss the physical characteristics of the three water samples (dirty, sedimented, and filtered).

This module was developed as part of a seminar on social entrepreneurship in the summer term 2014 at the University of Greifswald (responsible for the seminar: Dr. Rafael Ziegler). This module draws on ideas by Roberto Cruz Garcia (Mexico) and Nicolin Strubelt (Germany). The module was finalized by the CRESSI project team at the University of Greifswald, with support from the EU-project CRESSI.