How does washing affect the number of fibres released from a fleece?

Objective

This investigation tests the prediction that microfibres of plastic get released into the water when synthetic clothes are washed.

The experiment

In this practical, students are simulating washing a piece of fleece and looking at the fibres that get released into the water. They first do a control where they filter cold tap water to see what is already in the water or on the filter paper. They can use magnifying glasses or microscopes to look at the fibres. They wet the fleece and agitate it under the water, and then filter the washing water to see the fibres that get released. Students then have a choice to pursue an investigation into whether the type of fleece, the type of water (warm or cold, salt or fresh) or if soap has an effect on the fibres released by the fleece.

Introducing the experiment

Below are some questions that you could use to stimulate a discussion around the use of plastics:

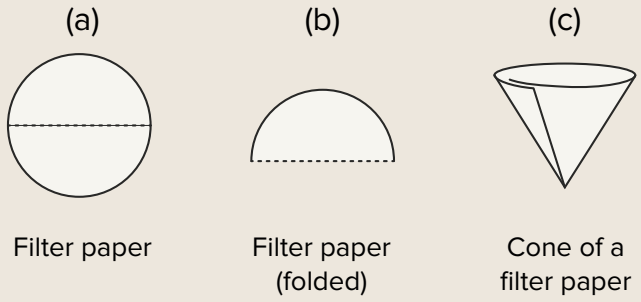
- How many things can you list in one minute that are made from plastic?
- What properties can plastic have that makes it a useful material?
- What would they be made from if plastic had not been invented?
- Do you think using plastic to make clothing is a good / bad idea? Why?
- Some clothing is made from natural materials. What natural materials are used to make clothes?
- Is it better to only make clothes from natural materials? And if so, why?

There are numerous animations and videos on YouTube about how microfibres are formed and their impact on the environment which might be useful.

During the experiment

Students may not know how to put the filter paper in the funnel properly. It may be useful to demonstrate this, or show students the image below which is also on the technician notes sheet.

How to fold the filter paper



Students will need a piece of control filter paper so that they can compare what is in the water before and after 'washing' the fleece.

Students may not see a difference in the water itself, but they usually see a few bits of debris on the control filter, with many fibres or debris (usually the colours of the fleece) on the second filter.

The extension part of the activity gives students the opportunity to investigate a question of their choice. Some suggested questions are:

- Do different types or ages of fleeces release different amounts of fibres?
- Does the temperature or type of water make a difference?
- Does soap make a difference?

Encourage students to design their experiments to ensure it is a fair test; this is a good opportunity to remind students of independent and dependent variables, and to compare their results with others (the concept of repeatable and reproducible).

Discussion points after the experiment

Explain why you can separate the microfibres from the water using filtration. Make sure to use the words soluble, insoluble, dissolve, residue and filtrate in your answer.

Based on your investigation, what recommendations do you have for a) consumers about the best temperature to wash fleeces and b) producers of fleece clothing?

The science behind this experiment

Plastic is a manufactured material. This means it is produced by humans, rather than by nature. It is a very versatile material and there are many different forms of plastic. Since it was first manufactured, the range of things made from plastic has increased massively. From its use for making everyday objects such as bottles, chairs and fabrics to its many medical uses, such as in the manufacture of replacement body parts, plastic has helped shape the modern world.

What we do with a plastic object once it is no longer needed is causing many problems. Not only does it form a large part of the rubbish that litters our streets, parks and beaches but it is the dominant material in landfill sites and often ends up dumped into the ocean. The fact that plastic is so durable contributes to the problem. It takes a very long time for plastic to break down. Not all plastic is easy to see as it can sometimes be in the form of microfibres.

BACKGROUND READING

- *Synthetic microfiber emissions to land rival those to waterbodies and are growing*, published in *PLOS ONE*.
- *Accumulation of Microplastic on Shorelines Worldwide: Sources and Sinks*, published in *Environmental Science & Technology* (acs.org).
- *Domestic laundry and microfiber pollution: Exploring fiber shedding from consumer apparel textiles*, published in *PLOS ONE*.

For more school experiments and to access the accompanying videos, visit **royalsociety.org/schoolexperiments**

THANKS

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How does washing affect the number of fibres released from a fleece?

Your task is to investigate the effect of washing conditions on fleece materials and how this may impact our water systems.

Instructions

Before you start read through the all the steps below.

Part 1

1. Line the funnel with a piece of filter paper. Make sure you fold it like a cone so all the water goes through the filter paper.
2. Half fill beaker 1 with warm tap water.
3. Hold the funnel over beaker 2 to catch the water. Pour the water from beaker 1 through the filter paper into the funnel.
4. Remove the filter paper from the funnel. Use the magnifying glass or a microscope to look closely at the filter paper.

This is a control

Why do you think a control is needed?

EQUIPMENT LIST

Materials for each group

- Piece of fleece
- 2 beakers labelled 1 and 2
- Warm tap water (can use cold)
- 2 times sheets of filter paper
- Funnel
- Beaker or flask to catch filtered water
- Jug
- Magnifying glass or microscope.

SAFETY PRECAUTIONS

- Avoid using very hot water which can scald.
- Make sure to clean up any spills immediately and to keep the water well away from any electrical devices.
- If you break any glassware, make sure to tell your teacher immediately. Do not try to clean up broken glass yourself.

Can you see anything on the filter paper?
Document your results by describing or drawing what you can see.

Part 2

5. Half fill beaker 1 again with the same temperature water as before.
6. Put the piece of fleece in the beaker so it is completely wet and agitate the fleece in the water for a set amount of time, eg, 1 minute.
7. Lift the fleece out of beaker 1 and squeeze the water from it back into the beaker. Get as much water out of the fleece as you can.

Look at what is left behind in the water.
Document your results by describing or drawing what you can see.

Part 3

8. Put a new piece of filter paper in the funnel and repeat steps 3 and 4.

Document your results by describing or drawing what you can see.

Part 4

Compare what you see on this filter paper to what is on the control paper.

I found that:

Extension

What factors might affect the number of fibres shed by a fleece?

Design an experiment to investigate one of these further.

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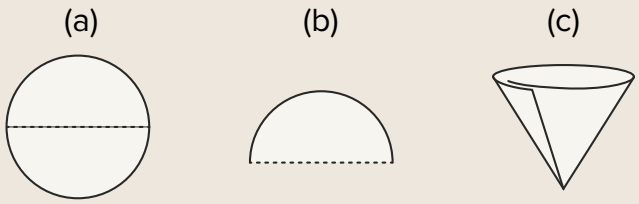
Helpful hints for doing the activity

If students find it difficult to fold the filter paper, you may want to share this image with them or do a demonstration.



EQUIPMENT LIST

Materials for each group

- Piece of fleece small enough to fit easily into the beaker or bowl for washing
- Beaker or bowl
- Cold tap water
- Two sheets of filter paper
- Funnel
- Beaker or flask to catch filtered water
- Jug
- Magnifying glass or microscope
- Camera to document results (optional).

For extension activities, you may need:

- Different samples of fleece, all cut to the same size.
- Thermometers for recording washing water temperature.
- Timers for recording time spent washing.
- Salt (small pots of sodium chloride for students to make their own saltwater) or premade jugs of saltwater (concentration of 35g / L solution).
- Dropper bottles of liquid soap.

SAFETY PRECAUTIONS

- Students should avoid using very hot water which can scald. Warm tap water is fine. If students are investigating the effect of temperature, they should use water no hotter than 60°C.
- There should be plenty of paper towels for students to clean up spills and a glassware disposal kit should be available in the classroom if glass equipment is being used.

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