EXPERIMENT 1

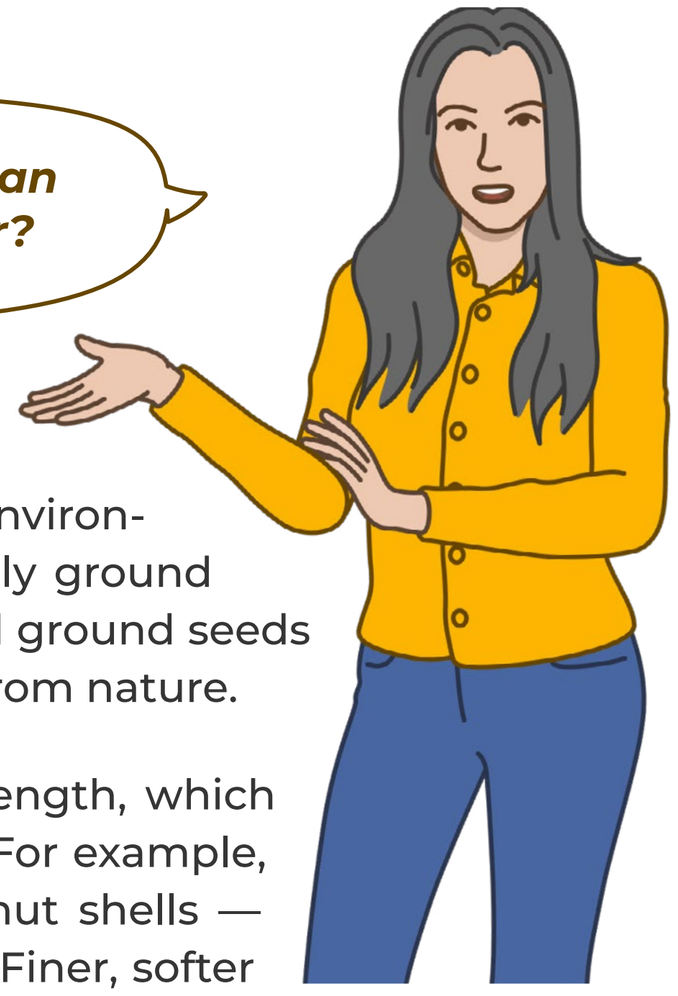
MAKING NATURAL SOAP AND BODY SCRUB

DIY with natural abrasives as alternatives to microplastics

BACKGROUND

Cosmetic products are personal care products we use to take care of our skin and body. They help us clean, protect, moisturize, and sometimes improve the way we look. One important group of cosmetics are exfoliating products, like scrubs and soaps, which remove dead skin cells. This keeps our skin feeling soft, looking healthy, and allows new skin cells to grow. It also helps other skincare products — like lotions or creams — work better.

To **exfoliate** the skin, many products use small, gritty particles called abrasives. These **abrasives** scrub away old, dead skin from the surface. In the past, many cosmetics used plastic microbeads for this purpose. But microplastics are harmful to the environment and have been banned in many countries.



As an alternative, there are many natural abrasives that work just as well — and are much better for the environment. These include sugar, salt, coffee grounds, finely ground walnut shells, volcanic ash, bamboo powder, clay, and ground seeds or plant fibers. They are all biodegradable and come from nature.

Each of these materials has its own texture and strength, which makes them suitable for different parts of the body. For example, larger and rougher particles—like raw sugar or walnut shells — are better for rough areas like feet, knees, or elbows. Finer, softer particles — like bamboo powder, clay, or volcanic ash — are gentler and better for the face or sensitive skin. Choosing the right particle size helps avoid irritation and keeps skin healthy.

In this experiment, students will make natural soaps and body scrubs using different types and sizes of natural abrasives. They will test how each one feels on the skin, compare how well they exfoliate, and discuss which ones work best for different parts of the body.

AIM OF THE EXPERIMENT

To understand how different natural abrasives affect the texture, exfoliation properties, and suitability of handmade soaps (A) and scrubs (B) for various parts of the body.

LEARNING OBJECTIVES

By the end of this experiment, students will be able to:

General Learning Objectives

- Understand the importance of replacing microplastics in personal care products.
- Recognize the role of abrasives in personal care and cosmetic products.
- Appreciate the environmental benefits of natural ingredients in cosmetics.

Specific Learning Objectives

- Identify different types of natural abrasives and describe their characteristics.
- Follow step-by-step procedures to create natural soap and body scrub products.
- Compare the physical properties (texture, exfoliation level) of products with different abrasives.
- Evaluate which types of abrasives are most suitable for different parts of the body.
- Assess the ecological and health risks associated with microplastic use in cosmetics.
- Reflect on the role of consumer behaviour and industry responsibility in sustainable product development.

TIME

120 min

Additional time: ~1 h after 24 h; ~1 h after 6–8 weeks (if soap curing is included)

MATERIALS NEEDED

Equipment

- [ ] Table scale (up to 100 g)
- [ ] Hot plate
- [ ] Heat-resistant thermometer
- [ ] Mixing bowls = Heat-resistant glass beakers (100 mL – 500 mL)
- [ ] Weighting cup (up to 100 g)
- [ ] 100 mL evaporator
- [ ] Mixing jars, cups
- [ ] Glass stirring rod
- [ ] Cold water bath (optional)
- [ ] Stick blender
- [ ] Spoons or spatulas
- [ ] Silicone moulds for soap
- [ ] Jars or containers for scrubs
- [ ] Labels and markers
- [ ] Paper towels

Materials

- [ ] Sodium Hydroxide (NaOH) pellets
- [ ] Distilled Water
- [ ] Olive oil (Other oils like coconut or almond can be used, but keep in mind that the saponification ratio varies — you must adjust the amount of NaOH based on the type of oil.)
- [ ] Coconut oil
- [ ] Natural abrasives such as:
  - Sugar
  - Finely ground walnut shells
  - Volcanic ash
  - Bamboo powder
  - Gray-black clay
- [ ] Essential oils (optional)

SAFETY PRECAUTIONS

Before conducting this experiment, ensure you have read and understood the **General Safety Precautions** section of this handbook.

When handling Sodium Hydroxide (NaOH):

⚠️ Always add NaOH to water, never the other way around (to prevent splashing or violent reaction).

⚠️ Use gloves, goggles, and a lab coat.

⚠️ Work in a well-ventilated area or under a fume hood.

⚠️ Handle hot containers and mixtures with care.

⚠️ Do not ingest any materials.

⚠️ Clean spills immediately to prevent slipping.

GHS Safety Pictograms for Sodium Hydroxide (NaOH):

Corrosive – causes severe skin burns and eye damage

Irritant – may cause respiratory irritation (if inhaled as dust or fumes)

First Aid

Skin Contact: Rinse with water for 15 minutes; remove contaminated clothing.

Eye Contact: Rinse thoroughly for 15–20 minutes; seek medical help immediately.

Inhalation: Move to fresh air; seek medical help if symptoms occur.

Ingestion: Rinse mouth; do not induce vomiting; seek medical help immediately.

When using natural soap or scrub

It is recommended to use the soap/scrub immediately or as soon as possible, as it may harden or change texture over time without preservatives.

EXPERIMENT SETUP

Step 1 → Prepare the Work Area

Ensure your workspace is clean and free from distractions. Set out all necessary materials. Wear your safety gear.

Step 2 → Prepare the Experiment

Sodium Hydroxide (NaOH) Solution

This step should be supervised closely. For safety reasons, educators may prepare this solution in advance for younger or less experienced students.

⚠️ **IMPORTANT:** Follow Safety Precautions described above. Don't forget: always **add NaOH to water**, never water to NaOH, to avoid violent exothermic reactions (splashing, boiling, etc.).

- Work in the fume hood. If you do not have access to a fume hood, ensure good ventilation. Always wear appropriate personal protective equipment.
- Use a digital table scale and weight separately:
  - 10 g of distilled water into a heat-resistant beaker
  - 5 g of NaOH pellets into a weighing cup
- Use cold or room-temperature water to reduce the heat from the exothermic reaction.
- Optionally, place the beaker with water into a cold-water bath (e.g., a larger container filled with cold water or ice water) to help dissipate heat during mixing.
- Slowly and carefully add small portions of NaOH to the water (NOT the other way around) while stirring continuously with a glass stirring rod.
- Stir gently to avoid splashing and hold the beaker with your other hand or fix it in place to prevent it from tipping over.
- Wait for each portion to dissolve before adding more.
- The solution will heat up, this is normal.
- Once all NaOH has dissolved, allow the solution to cool to room temperature.

- Transfer the cooled solution to a suitable, labeled storage container.
- Label the container clearly (include concentration, date, and hazard info).

Note: The quantities listed above are suitable for making approximately 40 g of soap. If you wish to prepare a larger batch, you can scale the solution accordingly.

Step 3 → Conduct the Experiment

A Making NATURAL SOAP (40 g)

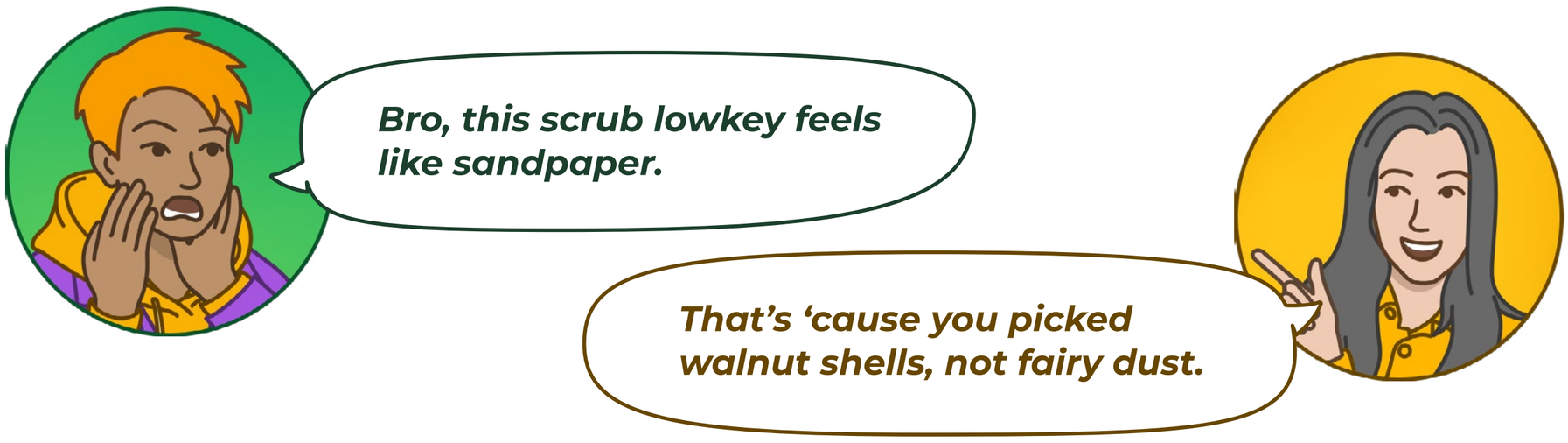
1. Weigh separately 25 g of olive oil and 7 g of coconut oil.
2. Combine both oils in a heat-resistant container (e.g., evaporating dish or glass jar).
3. Melt the oils using a hot water bath.
4. Stir thoroughly using a glass rod until oils are dissolved and mixed.
5. Allow the oil mixture to cool to approximately 40 °C.
6. Transfer the cooled oils in a beaker or container suitable for blending.
7. Slowly add the cooled NaOH solution into the melted oils while stirring with a glass rod.
8. The mixture will turn darker, opaque, and thicker, this is normal.
9. Blend the mixture with a stick blender until it reaches a “pudding-like” (approx. 5 minutes).
10. Be careful not to splash—keep the blender fully submerged and mix gently at first to avoid the soap mixture spraying out.
11. Divide the soap mixture into three small bowls.
12. Add approx. ½ teaspoon of a different abrasive into each bowl (e.g., volcanic ash, clay, walnut shells).
13. You can adjust the amount of abrasive depending on the desired exfoliating strength.
14. Mix each thoroughly.
15. Pour into soap moulds and allow to cool and harden.

After 24 h hours

16. Remove soaps from the moulds carefully.
17. Wear gloves during unmoulding to protect your hands from any uncured soap.
18. Place them in a well-ventilated area to continue curing.
19. The longer the soap is left to cure in a cool, dry place, the better it becomes—it hardens more, lasts longer, and is gentler on the skin.

After 4–8 weeks

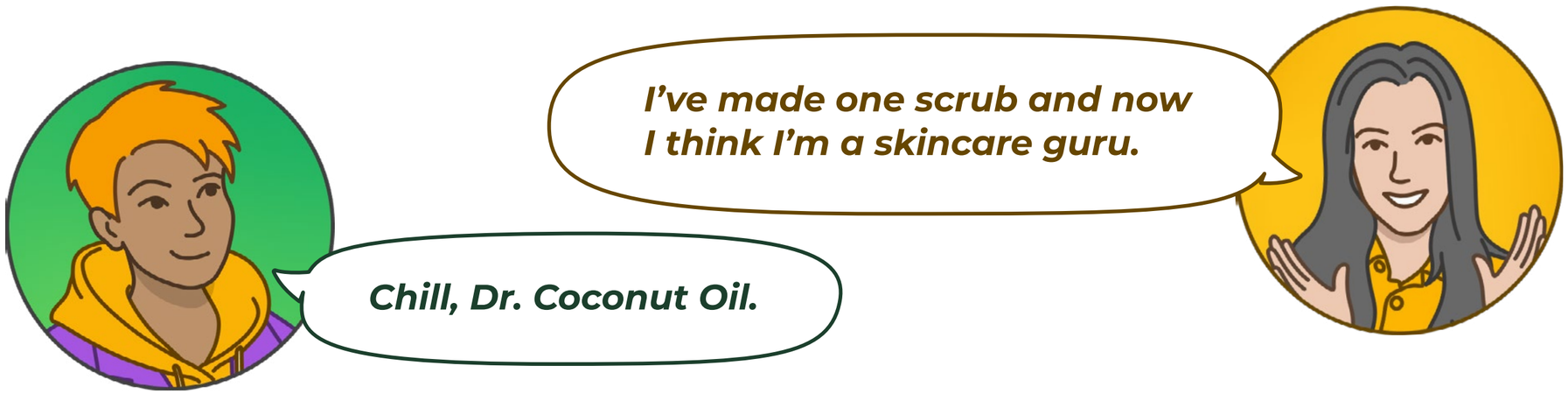
20. The soap is fully cured and ready to use.
21. Label your samples and record observations (texture, colour, smell, exfoliation feel).



B Making NATURAL BODY SCRUB (10 g)

1. In three separate containers, mix:
   - 2 teaspoons of coconut oil (10 g)
   - 1 teaspoon of a single natural abrasive (sugar, bamboo powder or ground walnut shells)

   You can adjust the amount of abrasive depending on the desired exfoliating strength.
2. Add a few drops of essential oil (optional).
3. Mix well and label each container.



Step 4 → Monitor and Record Data

- Observe and describe the texture of each abrasive before and after mixing.
- Compare the feel and consistency of each soap and scrub.
- Gently test each product on a small area of the forearm.
- Record how each feels on the skin and note any differences in exfoliation power.

Create a table to record abrasive type, product type (soap or scrub), texture, exfoliation strength (gentle/moderate/strong), and suggested body area for use (face, hands, feet, etc.).

RESULTS

Use a table or chart to compare the properties of each product. Compare your product with those of your classmates or other groups that used a different abrasive.

	Abrasive	*Texture*	*Exfoliation Level*	*Suitable Body Area*	*Special Notes*
Soap 1					
Soap 2					
Soap 3					
Scrub 1					
Scrub 2					
Scrub 3					

MY NOTES

Natural exfoliants don’t pollute water,
but microplastics can stay there for centuries!

ANSWER KEY QUESTIONS

Answer the questions either orally or in writing. Emphasize collaboration and critical thinking throughout the process!

1. Which abrasive was most effective and why?
2. Which product was the most skin-friendly or pleasant to use?
3. How would the choice of oil influence the final texture or effectiveness?
4. Can you identify real-world products that use similar natural abrasives?

Let's think critically:

5. How does this experiment connect to real-world applications or further research?
6. What further research or testing could be done to improve these DIY formulations?
7. Could these types of natural products be marketed sustainably?

FOR EDUCATORS

Additional Activities / Extensions (Optional):

- Challenge students to redesign the experiment with a new variable (e.g., oil type, abrasive ratio).
- Organize a presentation or poster session where groups compare their formulations.
- Research and try a new natural exfoliant found in the literature such as poppy or strawberry seeds.

Adapting the Experiment for Secondary School Students:

- Use only one type of soap and one scrub to simplify.
- Pre-measure all ingredients.
- Focus on basic sensory testing (feel, smell).

Adapting the Experiment for Primary School Students:

- Focus on sensory exploration: texture, smell, and safe play; present as a “science of touch” activity.
- Use pre-measured ingredients and clear visual instructions.
- Work only with scrubs (no lye or soap base).

General safety precautions

The following general safety precautions apply to all experiments in this handbook.

Please review them carefully before conducting any lab work. Some experiments may also have additional specific precautions listed within their respective tutorials.

⚠️ **Follow Instructions:** Always listen to your teacher/educator/assistant and follow the lab instructions carefully. If you're unsure about any step, ask for clarification before proceeding.

⚠️ **Know Safety Equipment:** Familiarize yourself with the location and proper use of safety equipment like eyewash stations and fire extinguishers.

⚠️ **Be Careful with Glassware:** Exercise caution when handling and washing glassware to avoid breakage and injury.

⚠️ **Safety Gear:** Always wear a lab coat, safety goggles, and gloves. Ensure you have closed-toe shoes and tie back long hair.

⚠️ **Handle Chemicals Safely:** Handle chemicals and equipment with care. Never taste or sniff chemicals. Always label containers or tubes.

⚠️ **Check Pictograms:** Before using any chemical, review the safety pictograms on the label to understand the hazards associated with it.

⚠️ **Handle Solvents Carefully:** Use solvents in a fume hood to avoid inhaling fumes and ensure proper ventilation.

⚠️ **Dispose of Waste Properly:** Follow proper procedures for disposing of chemical and biological waste. Do not pour chemicals down the drain unless instructed.

⚠️ **Report Accidents:** Immediately inform your teacher/educator/assistant of any accidents, spills, or injuries, no matter how minor they seem.