

Key Stage 3 – Materials

Happy Nappy film

This demonstration shows the properties of materials called superabsorbers, in particular sodium polyacrylate, the powder used in disposable nappies.

Year groups: 7-9 (ages 11-14)

Educational objective

To demonstrate the properties of superabsorbing materials.

Running time approx. 3 mins.

If you are having trouble playing this video, you may need to upgrade to the latest version of the [Flash media player](#).

Key student learning

- Disposable nappies are so effective because they contain a powder that can absorb 400-800 times its weight in water.
- Superabsorbing materials such as nappy powder are polymers. Poly' means many, and 'mer' means unit, so 'polymer' means 'many units', i.e. long chains of identical molecules joined together.
- In most polymers the chains of molecules cross-link, forming a three-dimensional mesh. Superabsorbing polymers trap the water in the mesh.
- The sodium ions in sodium chloride (salt) cause the chains of sodium polyacrylate to coil up and become less absorbent, squeezing the water out from the superabsorbing polymer.

Notes on using the films in the classroom:

When you are showing the films to the class, for example on an interactive whiteboard, consider pausing the film at various intervals. You can ask these questions to involve and extend your students:

- What do you think will happen next?
- Why has that happened?
- What chemical reaction has occurred? How would we write that?
- You may want to consider relating the demonstration to examples of work you have done in the class. If you prepare the materials in advance you could even get your students to conduct the demonstration alongside the film (see Safety information).
- Try this in the classroom

Materials needed

- 1 nappy
- Zip-seal plastic bag
- Bowl or beaker
- Jug of water
- tea bag (optional)

Method

- If you want to add a 'grossology' element to the demo, use warm water and add colour with the tea bag.
- Tear the lining of the nappy to reveal the padding. This is mainly cotton wool, but you will also find a gritty powder, sodium polyacrylate.
- Removing as much of the cotton wool as possible, tip the powder into the bag, seal it, then shake it to allow the powder to fall to the bottom.
- Pour the powder into the bowl, marking the level on the side.
- Pour in the jug of water until no more can be absorbed. Re-mark the level.
- Sodium polyacrylate is non-toxic and biodegradable. When you have finished with it you can add it to soil in pot plants and gardens or put it in the bin. Do not wash it down the sink or flush it down the toilet in case it continues to swell and blocks your pipes!

Safety information

Make sure that you wear goggles and appropriate protective clothing while conducting this experiment. For detailed safety information contact CLEAPSS .

Discussion

- Does the nappy contain more or less powder than you expected?
- If the powder is such a good absorber, what is the cotton wool for?
- Can you predict the amount of water that the powder can absorb?
- Did it absorb the amount you predicted?
- What else can superabsorbing powders be used for?
- What happens if you add salt to your hydrated gel? Why is this?

Extensions

- After the powder has absorbed the water, can it return to its original state? Once all the water has evaporated will it absorb the same amount of water as it did originally?
- Can the powder absorb any other liquids? Try adding salt or food colour to the water, fizzy liquids or more viscous ones such as juice, oil or tomato ketchup.

Links to everyday life

Water-storing crystals for pot plants

Superabsorbing crystals, or hydrogel, can be purchased from garden centres under trade names such as SwellGel. These are used in pot plants and hanging baskets to stop the plants drying out. When the soil is wet these crystals swell into transparent gel. In hot weather, the soil surrounding the gel crystals absorbs the water via osmosis and the plants get the water they need.

Fake snow

Superabsorbing gel looks very much like snow. It cannot be used for winter sports, but it is cool and wet and can be used as fake snow for photography purposes.

Drug delivery

Superabsorbing gel can be used to deliver drugs without having to break the skin. The gel is known as a carrier when it is loaded with a drug and used for skin-based (topical) applications. As it swells, the polymer chains in the cross-linked mesh move further apart so the drug can diffuse more quickly through the gel to the skin.

Although superabsorbing gel was not used at the time, this technology could potentially be used to deliver anti-ageing drugs in face creams.

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Curriculum links

Key Stage 3

This activity encourages practical enquiry skills in the area of 'Chemical and material behaviour', specifically:

- Varying solubility
- Link behaviour and nature of materials to particle structure
- Changes of state - solid, liquid, gas
- Explanation of the different physical properties of each state

For this activity and many more, visit sciencemuseum.org.uk/educators

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Plant pot made from recycled plastic, 1990.



Schoolboys rolling a giant snowball, c 1930.



Woman applying skin cream, 1945-55