

Plastic Fantastic film

This demonstration shows the synthesis of a polymer, nylon, by reacting two chemicals.

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

Educational objective

To demonstrate the production of nylon.

Running time approx. 3 mins.

Key student learning

- Nylon is a special type of material known as a polymer. 'Poly' means many, and 'mer' means unit, so 'polymer' means 'many units', i.e. long chains of identical molecules joined together.
- There are many different types of polymers all around us, including man-made polymers, such as plastics.

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 to involve and extend your students, e.g.

- 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

- 10 ml of sebacyl chloride
- 10 ml of hexamethylene diamine
- Transparent cup or beaker
- Syringe
- Tweezers
- Roller winder (optional):
- Paint roller
- Clingfilm
- Wooden skewer

Method

- Prepare your roller by wrapping it in clingfilm with the wooden skewer poking out of the open end. This will act as your winding handle when you make your strand of nylon.
- Use the syringe to add the first chemical, sebacoyl chloride, to the beaker.
- Refill the syringe with the second chemical, hexamethylene diamine, and add to the beaker. The two chemicals will not mix; one forms a layer on top of the other.
- Use the tweezers to pick up a strand of the nylon, which is formed at the layer where the two chemicals meet and react.
- Wrap the strand around the roller and wind the wooden handle.
- The nylon will continue to be produced in one continuous strand until one or both chemicals are used up.

Safety information

Make sure that you wear goggles and appropriate protective clothing while conducting this experiment. For detailed safety information and advice on how to dispose of any remaining chemicals or products of the reaction, contact CLEAPSS (www.cleapss.org.uk).

Discussion

- Do the two chemicals mix in the way you expected?
- How is the nylon being made?
- Why is it produced in one long strand?
- What is the longest strand you can make?
- What do we use nylon for?

Extensions

- How could you ensure that the strand remains the same thickness throughout?
- Is it possible to colour the nylon you make? Through trial and error students will find that food colouring can only be added to the hexamethylene diamine, which is an aqueous solution; it will not mix with the sebacoyl chloride as it is not water based.

Links to everyday life

Parachute silk

Nylon was very important during the Second World War, as a substitute for silk, to make parachutes and tyres.



Spitfires in flight c. 1940s.



Artificial joints, ligaments and replacement blood vessels

Medical uses

Nylon can be used in a variety of medical applications, from sutures (stitches) to artificial limbs. When mixed with carbon fibre and epoxy resin to give it strength it is used to make plates that help to mend bone fractures.

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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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