OBJECTIVES
1. Investigate properties of a polymer
2. Demonstrate crosslinking of a polymer
3. Demonstrate de-crosslinking of a polymer

BACKGROUND INFORMATION
Sodium alginate and polypropylene glycol alginate are commonly used as thickeners in foods such as ice cream and fruit-filled snacks. Sodium alginate, crosslinked with calcium ions, is used in the production of pimento strips for stuffing green olives. Alginate is also used for dental impression materials, drug encapsulation, wound dressings, and as a component of the antacid Gaviscon.

In this experiment students make nontoxic strands of crosslinked calcium alginate, and then they break the crosslinks by putting the strands into brine.

WHAT YOU WILL NEED
- 25ml Gaviscon
- 100ml 1% w/v CaCl₂ solution
- 75mL Saturated sodium chloride solution
- 2x sealable glass jars (approx. 150mL each)
- Labels for jars
- Plastic syringe (without needle) approx 10mL

Teacher Notes:
- To make 100mL 1% CaCl₂ solution add 1g Calcium chloride (a level teaspoon=5g) to 100mL of water in a screw top jar and shake.
- You can substitute CaCl₂ solution for “Damp-rid” available at the supermarket.

WHAT TO DO
Forming Calcium Alginate
1. Pour the 100mL of the CaCl₂ solution into one of the sealable jars and label Ca²⁺.
2. Pour the Gaviscon in a thin stream into the CaCl₂ solution by using the syringe to give a uniform flow.
3. Flexible, translucent “worms” will form instantly as the sodium ions are exchanged with calcium ions and the polymer becomes crosslinked. The longer the calcium alginate is in contact with the calcium chloride solution, the more rigid the worms will become. You can lift the worms out of the solution to feel their texture. You may be surprised that alginate is a food additive when you consider its origin (see questions).
Decrosslinking the Calcium Alginate Polymer

4. Remove a few worms from the Ca\(^{2+}\) jar immediately after they form.
5. Place them in a clear jar that is half full of saturated sodium chloride solution (labeled Na\(^{+}\))
6. Shake both jars, after a few shakes the crosslinked polymer in the jar of brine will dissolve and form a cloudy solution, while the alginate worms in the calcium chloride solution will remain intact.

QUESTIONS

1. How are alginates obtained and what is their chemical structure?
2. Name two other polymers of natural origin and briefly describe their properties and uses.

CURRICULUM
Strand: Natural & Processed Materials

Core learning outcomes:
3.1, 3.2, 3.3, 4.1

RESOURCES
