

Encapsulation

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Acknowledgements

This resource was originally developed by the University of Reading to support outreach work delivered as part of the Chemistry for All project.

To find out more about the project, and get more resources to help widen participation, visit our Outreach resources hub: rsc.li/3CJX7M3.

Learning objectives

By the end of this session, you will be able to:

- Describe the role of probiotics in the gut.
- Describe the need for encapsulation of probiotics.

Encapsulation

- Hydrochloric acid in your stomach dissolves most probiotics which means they do not get through to your small intestines where they are needed.
- The process of encapsulation gives probiotics a slimy coat that protects them from the hydrochloric acid for the one to two hours while food is in the stomach. This helps the probiotics to pass through to the small intestine without being destroyed.
- Examples of chemical compounds used in encapsulation include:
 - **Sodium alginate** extracted from seaweed forms a gel in the presence of calcium ions. It is commonly used as a thickener, emulsifier and texture improver.
 - **Calcium lactate** reacts with the sodium alginate to form a gel.
- Bubble tea contains fruit juice beads. These are made by the same encapsulation process used to protect the probiotics.

Career link

Watch the video on **Slide 8**, also available from rsc.li/3X1uBOq, to learn about careers that are Making the Difference. You can also find out about the different study options available to you on the A Future in Chemistry website: rsc.li/3RE1IMA.

Activity 1: encapsulation of fruit juices

Equipment

- Concentrated blackcurrant fruit juice
- Concentrated orange fruit juice
- Concentrated lemon fruit juice
- Sparkling water
- 6 × 50 ml beakers
- 3 × 100 ml beakers
- 5 × 5 ml syringes
- 3 × 1 ml syringes
- 3 × stirring rods
- Sieve
- Whiteboard pen

Chemicals

- 2% sodium alginate solution
- 1.5% calcium lactate solution

Safety and hazards

Sodium alginate and calcium lactate are not classified as hazardous. Alginate beads and solution can block sinks so only dispose of them as instructed.

Although the beads you will make are like those used in some foods and drinks, you should not consume anything you make in the lab with science equipment.

To do

1. Label one 50 ml beaker as beaker A and one 50 ml beaker as beaker B.
2. Place approximately 15 ml calcium lactate solution into beaker A using a 5 ml syringe.
3. Add 10 ml sodium alginate solution to beaker B using a clean 5 ml syringe.
4. Add 5 ml of your chosen fruit juice to beaker B using a clean 5 ml syringe.
5. Use a stirring rod to carefully stir beaker B.

Note: try not to mix too much air into the mixture as this causes difficulties when creating your fruit beads and means you can't shape them properly.

1. Draw up 1 ml of your beaker B solution into a clean 1 ml syringe.
2. Hold the syringe above the calcium lactate solution (beaker A) and add the beaker B solution dropwise into the calcium lactate solution.
3. Leave the beaker for five minutes to allow the jelly beads to form and set.
4. After they have set, sieve the beads out from the solution and run cold water over them to rinse off the remaining calcium lactate solution. What do your beads look like? Record your observations for question (a).
5. Place these beads into another beaker and add 25 ml sparkling water. What happens? Record your observations for question (b).
6. Repeat steps 1–5 using a different fruit juice. Experiment with making different beads. What size can you make them? Can you make different shapes? How have you done this? Record your observations for question (c).

Questions

(a) Describe the appearance of your jelly beads collected in step 4.

Encapsulation: student workbook

Available from rsc.li/3aT2RsW

(b) Describe what happens when you add sparkling water to your jelly beads in step 5.

(c) Which fruit juice made the best jelly beads and why?
