

Biodegradable water bottles from brown seaweed - Years 6/7

What is green chemistry?

Green Chemistry aims to change the mindset and practices associated with everyday chemistry, to be safe, sustainable, environmentally friendly, re-used and non-toxic.

Seaweed for the future

Seaweed is a great source of material that chemists, biologists, engineers, and medical industries are trying to use to improve our future. Brown seaweed (Figure 1) contains a substance called alginate that turns into a gel when mixed with water. Solutions with calcium can be added to create a functional material which can then be turned into biodegradable water bottles (Figures 2 and 3).

Did you know?

Alginate can be eaten, its not harmful to our body, but some do have allergies to seaweed, so please DO NOT EAT OR HANDLE if you have a known seafood allergy.



Figure 1. Brown seaweed from South Australia

Encapsulation is the word we use to describe when a liquid is enclosed (held together) like water in a bottle.



Figure 2. Alginate gels holding different liquids together.



Figure 3. Blue water encapsulated with alginate

In this experiment, you will mix alginate with a calcium solution to encapsulate a liquid. See if you can change the shape of the alginate, or even try different liquids to encapsulate, like orange juice or milk. Think about how you can use this for different applications and what could be changed to improve the process.

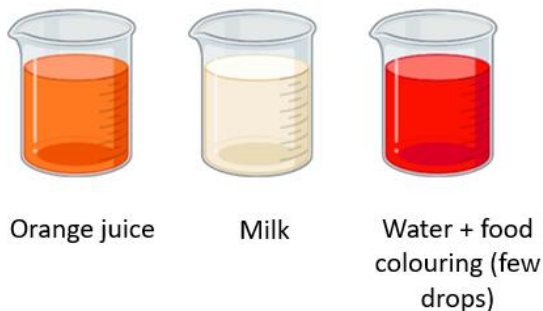
Materials

- 4 clear cups with a different liquid in each. One containing orange juice, one containing dilute food colour, one containing milk and one containing CaCl_2 . Approximately 10 mL of each liquid is required.
- 1 plastic pipette
- 3 wooden stirrers
- 3 x 10mL of alginate solution
- 1 spoon – to scoop out the biodegradable water bottles from the calcium chloride solution.

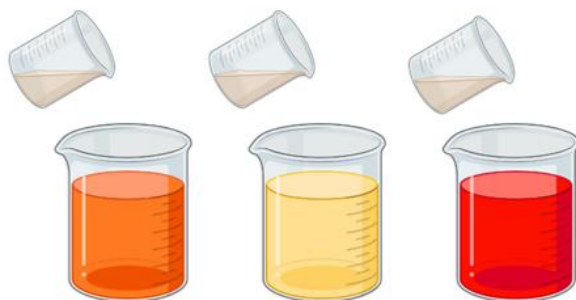
The pH of each liquid will be tested as a class. The pH indicator chart is on our website <https://tcgcm.com.au/outreach>.

Method

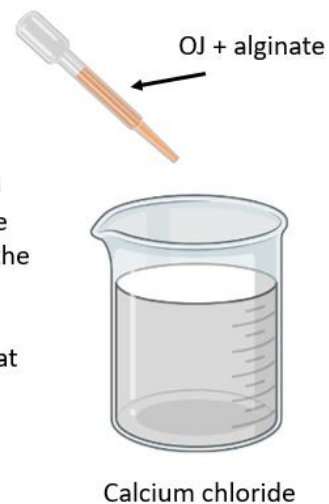
STEP 1:
Collect your liquids.



STEP 2:
Mix 10ml of alginate with 10ml of your liquid. Stir to combine. Test the pH of your solutions.



STEP 3:
Pipette drop your alginate liquids into the calcium chloride. Observe what happens 😊



Observe what happens and have a look at the questions on your table 😊

Results

Group members: _____

Solution name	Write observations	Stick photo or draw diagram here

Discussion questions

- a. Observe the reaction. What happened? Can this be used for a water bottle? Why/why not?

- b. What liquid was better at being encapsulated? Write in order of the best to the worst.

- c. Explain why using seaweed is a sustainable source of material?

- d. How could you improve this experiment? What was its limitations?

Extension questions

- e. What was the solvent? What was the solute?

- f. Was this a chemical reaction? Why/why not?

- g. How else could you use the properties of alginate to help the environment?