

WHY DOES THE COLOUR LEAK OUT OF COOKED BEETROOT?

Purpose

- To investigate the effect of temperature or alcohol concentration on membrane structure.
- To develop practical skills.

SAFETY

Wear eye protection and lab coats.

Take care using a cork borer, a knife and water baths at 60 and 70 °C.

Alcohol is highly flammable. Keep away from naked flames and ignition sources.



You need

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| <ul style="list-style-type: none"> • Raw beetroot • Size 4 cork borer • White tile • Knife • Ruler • Water baths at 0, 10, 20, 30, 40, 50, 60, 70 °C, or alcohol • Plastic beaker, about 250 cm³ • 8 boiling tubes | <ul style="list-style-type: none"> • 2 boiling tube racks • Crushed ice • Thermometers (one per water bath) • Colorimeter • Cuvettes • Stopclock • Distilled water • Pipettes for measuring 2 cm³ and 5 cm³ • Small measuring cylinders |
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If alcohol concentration is investigated several water baths and ice will not be required. Pipettes and alcohol will be needed instead.

Beetroot pigments

If you read a recipe for cooked beetroot it will usually recommend that you do not remove the outer skin of the beetroot and do not cut off all the stalk and root if you want to avoid getting lots of red dye in the cooking water. Beetroot contains red pigments called betalains, located within the cell vacuole. What happens to the membranes and pigments when beetroot is cooked or put in alcohol?

The aim of this practical is to use beetroot to examine the effect of temperature or alcohol concentration on cell membranes and relate the effects observed to membrane structure. To function correctly a cell needs to be able to control transport across the partially permeable cell membrane.

1 Scientific questions and information research

Before you start the experiment you should:

Research relevant information and state what you are going to investigate – decide what you think will be the effect of temperature or alcohol on beetroot cell surface membranes and how this will affect their permeability. Write down your idea as a hypothesis that you can test and support your idea with biological knowledge. To help you decide on what you are going to investigate and how you will carry out the practical work, you might need to research the background science and methods people have used to investigate similar problems.

2 Planning and experimental design

- a** Go through the procedure provided for the factor you are investigating and decide if:
- all the variables have been identified and, where possible, controlled or allowed for
 - the apparatus is suitable and will provide appropriate measurements that will allow you to test your hypothesis validly
 - the measurement will be precise and repeatable
 - there are likely to be any systematic or random errors
 - there are likely to be any safety issues and how you would minimise any risks
- b** Write up your decisions on each of the points above and describe any alterations to the procedure that may be needed and any detail that might need to be added.
- c** Write a risk assessment for the procedure including the safety precautions you will take.
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