Investigation into the effect of solute concentration on osmosis in potato chips

Introduction

In this investigation, you will investigate osmosis in potato cells. You will prepare a range of dilutions of blackcurrant squash and allow osmosis to occur. The concentration of the blackcurrant squash will affect osmosis.

Apparatus

100 cm^3 beaker containing approximately 95 cm^3 of blackcurrant squash
50 cm^3 measuring cylinders
6 × boiling tubes
white tile
scalpel
ruler
cork borers
distilled water
marker pen for labelling of boiling tubes

Access to:
blackcurrant squash
electronic balance ± 0.1 g

Method

1. Label boiling tubes with the concentrations of blackcurrant squash (0, 20, 40, 60, 80 and 100 %).
2. Using a measuring cylinder, transfer the relevant quantities of water and blackcurrant squash into the boiling tubes to produce the solutions shown. Use the table below to help you.

Concentration of blackcurrant squash (%)	Volume of blackcurrant squash needed to make 30 cm^3 solution (cm^3)	Volume of water needed to make 30 cm^3 solution (cm^3)
0	0	30
20	6	24
40	12	18
60	18	12
80	24	6
100	30	0

3. Place the boiling tubes in a test tube rack.
4. Cut six chips from a potato using a cork borer and cut into 5 cm lengths. Cut off any potato skin.
5. Dry the chips on a paper towel.
6. Record the mass of each chip and place one chip in each of the boiling tubes. The solutions should completely cover the chips.
8. Leave for 25 minutes.
9. Remove the chip from the 0 % solution boiling tube.
10. Dry the chip on a paper towel.
11. Record the final mass of the chip.
12. Repeat steps 9 -11 for the other solutions.

Analysis

1. Calculate the percentage change in mass for each chip.
2. Plot a graph of concentration against percentage change in mass.
3. Determine the concentration when there was no change in mass.

Risk Assessment

Hazard	Risk	Control measure
Sharp scalpel blade can cut	Cuts to the skin while cutting potato	Always cut downwards and away from the body

Teacher/ Technician notes

Blackcurrant squash (not sugar free) - 1 litre is enough for 9 working groups.
Large baking potatoes,1 per working group.

A potato chipper will quickly cut chips of uniform size. It saves time if the chips are cut (using a chipper) just before or at the beginning of the lesson by a technician. Students will still need to trim the chips to fit into the beaker/ boiling tube. If using a cork borer, each group should use the same size borer for each of their potato cores.

No repeats are planned, but groups can compare results to discuss reproducibility.

The results should show that the chips gain mass in dilute concentrations of squash, but lose mass in strong concentrations. The graph should be drawn with the x-axis across the centre of the page, to show the increase and decrease in mass. Where the plotted line crosses the x-axis shows the concentration where there is no gain or loss in mass. Students should understand that this is the isotonic point and the concentration inside the potato cells is equal to that in the external concentration.

Students should design their own table, but a suggested table format is shown below.

Concentration (%)	Mass at start (g)	Mass at end (g)	Change in mass (g)	Percentage change in mass (%)

Practical techniques covered

B1 Use of appropriate apparatus to make and record a range of measurements accurately, including length, area, mass, time, temperature, volume of liquids and gases, and pH.

B3 Use of appropriate apparatus and techniques for the observation and measurement of biological changes and or processes.

B4 Safe and ethical use of living organisms (plants or animals) to measure physiological functions and responses to the environment.

B5 Measurement of rates of reaction by a variety of methods including production of gas, uptake of water and colour change of indicator