Cambridge Assessment International Education

# Determining the rate of incipient plasmolysis Transcript

Because they have a cell wall, plant cells are relatively tolerant of changes in the water potential of their environment.

When placed into a solution of low water potential, plant cells usually become plasmolysed. In this state, the cytoplasm and vacuole shrink as a net volume of water is lost from the cell. This causes the cell surface membrane to pull away from the cell wall. It may even become completely detached.

These effects are due to osmosis.

In this investigation, you will study the effects of osmosis on individual cells within a tissue.

Osmosis is the net movement of water molecules from a region of higher water potential (dilute solution) to a region of lower water potential (concentrated solution), through a partially permeable membrane until an equilibrium in water potential is reached.

When plant cells are placed into a solution with a lower water potential than the cells, water leaves their cytoplasm and vacuole, and the cell becomes plasmolysed.

In this investigation, the effect of changing the concentration of a solution of sodium chloride will be explored by determining the time at which 50 % of cells in a tissue are experiencing incipient plasmolysis.

Incipient plasmolysis is defined as the point at which the cell surface membrane begins to detach from the cell wall.

This investigation will use onion epidermis cells. From the data obtained, an estimate of the water potential of onion cells can be made.

It is important to produce a range of solutions of different sodium chloride solutions that represent a sufficient range.

This can be achieved by preparing a range of dilutions from the stock solution of sodium chloride (1.00 mol $dm^{-3}$) using the proportional or serial dilution method.

To prepare the first dilution, 5 $cm^3$ distilled water is put into a test tube using a syringe.

Next, 15 $cm^3$ of the sodium chloride stock solution labelled sodium chloride solution (1.00 mol $dm^{-3}$) is transferred from the stock beaker into the same test tube using the other syringe.

This solution, which is now three quarters as concentrated as the stock solution, is inverted to mix.

To prepare the second dilution, 10 $cm^3$ distilled water is put into a test tube using a syringe.

Next, 10 cm3 of the sodium chloride stock solution labelled sodium chloride solution (1.00 mol $dm^{-3}$) is transferred from the stock beaker into the same test tube using the other syringe.

This solution, which is now half as concentrated as the stock solution, is inverted to mix.

This process, called proportional or simple dilution, is repeated to form another solution of sodium chloride, of the lowest concentration for this investigation.

The next part of this investigation will involve exposing samples of onion epidermis tissue to the five solutions of sodium chloride.

No narrative required.

It will be important later to immediately transfer the prepared slides to the microscope. At this point in the investigation, it is helpful to prepare the microscope.

The objective lens is set to x 10.

This achieves a combined magnification of x 100.

It is now appropriate to prepare the slides of onion epidermis.

Firstly, five microscope slides should be labelled with the concentrations of the four solutions and distilled water.

Using a dropping pipette, a few drops of the most concentrated solution are added to the middle of the first microscope slide.

A small piece of onion epidermis is removed using the blunt forceps.

This epidermis is carefully cut to prepare a piece of onion epidermis approximately in the shape of a small square.

The epidermis square is then carefully placed using the mounted needle into the middle of the microscope slide.

A couple of extra drops of the appropriate solution is then added to the epidermis and the mounted needle is used to gently lower the cover slip on top.

A paper towel can be used to remove any excel solution that is outside the cover slip.

It is important to immediately transfer to the microscope stage.

The timer is started, and a video is recorded for ten minutes.

During this time, the cells in the onion epidermis will lose a net volume of water to the surrounding solution, resulting in their plasmolysis.

This is repeated in the same way for the other solutions.

Replaying the video can help identify the time point at which 50 % of the cells begin to show plasmolysis. This is called incipient plasmolysis.

It is possible to present this data in the form of a line graph.

Learning more about how some plants withstand plasmolysis better than others can provide an insight into the adaptations of some plants called halophytes. These grow in seawater and other

solutions with low water potential. Some halophytes, like the mangrove, are important members of ecosystems that are under threat from human activities.