

EFFECT OF TEMPERATURE ON THE MOVEMENT OF PIGMENT THROUGH CELL MEMBRANE

INTRODUCTION:

AIM:

The aim of experiment is to prove that temperature effects on a proteins in cell membranes so that pigment can pass through them

HYPOTHESIS:

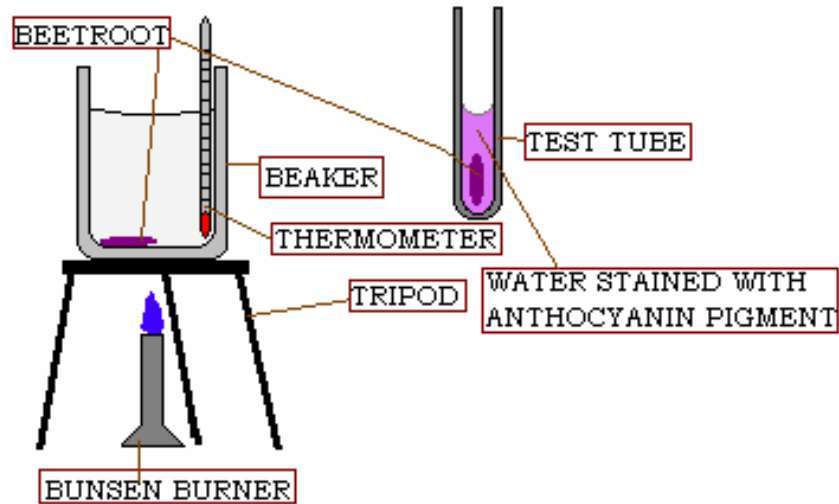
On higher temperatures proteins in membranes denature so there is no barrier to prevent the passage of large molecules

THEORETICAL BACKGROUND:

Certain chemicals and treatments, such as ethanol or high temperatures, can destroy the partial permeability of cell membrane. The membranes are still present but behave as if holes have been punched through them and they no longer provide barrier to the passage of large molecules such as sucrose. High temperatures and alcohols denature membrane proteins and increase fluidity of membrane lipids; alcohols at high concentrations can also dissolve lipids.

In beetroot cells the red anthocyanin pigment occurs in the vacuoles. Each vacuole is surrounded by a tonoplast membrane and outside of it, the cytoplasm is surrounded by the plasma membrane. On higher temperatures proteins loose their ability of control the transport through cell so any large molecule can pass trough.

APPARATUS AND MATERIALS:



- ◆ Test tube rack with 10 test tubes
- ◆ Graduated syringe
- ◆ Scalpel
- ◆ Cork borer
- ◆ Stop watch
- ◆ Forceps
- ◆ Colorimeter

- ◆ Tap root of beetroot
- ◆ Distilled water

SAFETY:

- ◆ Carefully use cork borer and scalpel to prevent injuries by cutting
- ◆ Use Bunsen burner with great precaution to prevent burns or lighting materials
- ◆ Water in beaker is very hot so watch out that you don't spill it on you to prevent burns
- ◆ Watch out that you don't break any glass apparatus to prevent cutting

METHOD:

- ◆ Using a cork borer and scalpel make 10 cylinders of beetroot of 5 cm length.
- ◆ Heat 200 cm³ of water up to 85 °C in 250 cm³ beaker (make sure that thermometer is in the water).
- ◆ While heating, with a syringe, put 10 ml of distilled water in 10 test tubes and label them: 85, 80, 75, 70, 65, 63, 60, 55, 50 and 45.
- ◆ When 85°C temperature is reached remove the Bunsen burner and put one beetroot cylinder in the water and leave it there for exactly one minute.
- ◆ After one minute use forceps to take it out and put it in a test tube marked 85.
- ◆ Put some cold water in the beaker until 80 °C is reached and then repeat the procedure.
- ◆ Repeat the procedure for all temperatures. Keep the volume of water about 200 cm³ in the beaker by removing some volume of water from it. If you accidentally lower the temperature too much, heat the baker a little bit.
- ◆ Leave the cylinders in the test tubes for exactly 30 min. When 30 min passes shake the test tubes and then remove the beetroot.
- ◆ When all beetroots are removed samples of coloured water should be put in the colorimeter machine and values should be recorded. The smaller the value is the darker is colour of solution, therefore larger amount of pigment left the cell.

RESULTS

TEMPERATURE	COLOUR INTENSITY OF WATER AFTER HEATING
85	13.8
80	14.8
75	17.8
70	18.5
65	35.5
63	39
60	40.6
55	42.6
50	45.4
45	63

GRAPH ANALYSIS

The graph shows a general slope downwards meaning that greater value of Y implicates smaller value of X. However there is some misleading in the graph because for 45 °C the value of colour is too big.

CONCLUSION:

My conclusion basing on the results is that with temperature rising, permeability of membrane is getting bigger so more pigment can pass through the cell.

EVALUATION:

According to the graph result shows that experiment hasn't been completely successful, because some results are out of place.

- ◆ First problem were lengths of beetroot. Radius of beetroot was the same but cylinders didn't have exactly same lengths so that suggests that in some cylinders was more available pigment. This problem can be solved with carefully measurement and cutting.
- ◆ Second problem was keeping the water at the exact temperature. This means that during one-minute time temperature was getting lower and sometimes needed some extra heating, which would result with higher temperature than needed. To solve this problem the best solution is to use a water bath with thermostat. Temperature would stay exactly the same, as we need it to be.
- ◆ Third problem was to take beetroot out of test tube after 30 min period of time. After heating beetroot would become softer and there were cases when during taking it out, it has broken so there was more pigment then expected. Solution is to pour the water into the clean test tubes and taking the beetroot out later.
- ◆ Forth problem was technical nature. Colorimeter was acting peculiarly strange because during the testing numbers on screen were constantly changing. In some moments changing would stop but that isn't reliable sign that that is the right colour density because after couple of moments changing would

start again. Solution is to use more sensitive equipment or to get colorimeter checked because it could be broken.

- ◆ Fifth problem is in humane nature. During the test we had a good time so occasionally we forgot to take the beetroot out for few seconds longer than it should be. We didn't pay all attention to professor so we forgot to shake test tubes before we took the beetroot out. Also, I didn't take a paper with me during the colour test so when I got result, occasionally I would forget what it was while I was going back to my seat. Also there was some noise in the classroom so I could misunderstand my partners in the experiment when they came with result.
- ◆ To be sure in experiment results the best thing is to repeat it at least once to increase the reliability of them. Now when I know the whole procedure of experiment, results in repetitive experiment should be more accurate. Also this is good background to compare how different concentrations of ethanol effect on the membrane permeability.

