Osmosis and potato tuber assignment

Estimating Osmolarity by Change in Weight Abstract Optimum water content for normal physiological processes in plants is crucial. In order for normal activities to take place, the amount of water relative to osmotically active substance (OAS) in cells must be maintained within a reasonable range. The one way to estimate optimum water content is to find osmolarity of plants cells. Osmolarity can be indirectly measure by comparing change in weight and volume when plant cells are incubated in OAS solution of known molarity.

Estimated osmolarity of plant cells is the molarity of solution at which weight or volume of the plant cells does not change, means there is no net loss or gain of water. Introduction This study shares the results of an effort to understand diffusion and osmosis in general. It focused more into osmosis in plants cell, and how to indirectly measure osmolarity in potato tuber tissue. Osmosis is the diffusion specifically of water across a membrane. Diffusion occurs when certain substance, such as an ion, is more concentrated on one side of membrane.

If the membrane allows this ion through, the ions will move from the more concentrated side to the less concentrated side until reaching equilibrium. A cell’s tonicity indicates in which direction is the net flow of water and is based on the ionic content of the cell. A cell which is isotonic has an ionic concentration identical inside the membrane and out. Since the cell is at equilibrium, there is no concentration gradient and the flow of water in is equal to the flow of water out.

A cell which is hypertonic has a higher concentration inside the cell than out. This causes a concentration gradient across the membrane which results in a net flow of water into the cell. A cell which is hypotonic has a lower concentration and therefore water will flow out of the cell. The tendency of water movement from hypotonic solution through the membrane into a hypertonic solution can be prevented by applying force or pressure on the hypertonic side. The force that must be applied to prevent osmotic movement of water is referred to as osmotic pressure.

When potato tuber cells are placed in the sucrose solution of different concentration, there is an expected weight loss in solution of higher concentration (hypertonic solution) or weight gain in solution of less concentration (hypotonic solution) and no change in isotonic solution. The objective is to find the sucrose molarity (isotonic solution) at which weight of the potato tuber tissue did not change, which is, in turn, an estimated osmolarity of potato tuber. Materials and Method 7 cylindrical pieces of about 5 cm uniform length were obtained from potato tuber. To increase the surface area pieces were cut into two long halves.

Samples were blotted before measuring the weight to ensure accuracy. All samples were immediately transferred to seven different beaker of sucrose solution with known molarity of 0. 0M to 0. 6M. 0. 0M (Deionized water) served as control for our experiment. After kept in for approximately 1. 5 hours to incubate, sample were taken out of solution, blotted and weighted. Percentage changes in weight were calculated for each sample and data were recorded. Results As we had expected there were weight loss in hypertonic solution ranging from 0% to 31. 25% and weight gain in

hypotonic solution ranging from 0% to 18. 75%. At about 0. 3M solution of sucrose there is no net gain or loss of water, which we concluded an osmolarity of potato tuber tissue. In 0. 33M solution of sucrose, the concentration of sucrose in solution and concentration of sucrose inside the potato tuber cell is equal and thus the concentration of water at both side of a membrane. As a result, there is no net flow of water across the membrane. That makes the 0. 33M solution of sucrose an isotonic solution for potato tuber tissue. Hence we estimated the osmolarity of potato tuber tissue to be 0. 33. Discussion The results show that the approximate osmolarity of potato tuber cells is 0. 3. In the beginning our prediction was that there will a net loss or gain in the weigh of the potato tuber cells in all solution except in the isotonic solution. Our results show that there is net gain or loss of weight in the cells that goes according to our prediction and hypothesis. There the prediction and the hypothesis are proved valid for our experiment. Beyond the scope of our experiment we can try to understand the rate of net flow of water in or out of a cell. If we know the rate of net flow we can control the process of maintaining optimum water content in plants.

We could design the assay which could estimate the rate of net flow of water in or out. If we do the same experiment in graduated beaker we can measure the raise or fall in volume of water at certain interval and come up with rate of water in or out of cell. Also we can calculate the volume by which either plasma membrane will shrink or expand. Net flow of water could be different in different membrane that could due to structure of plasma membrane, the protein channel and by understanding net flow we could explain certain structure of plasma membrane from different angle.

There are few open ended question which yet to study in detail. Why the membrane of potato tuber cell does not allow sucrose to go through and it allows water to pass through? In general, what makes plasma membrane a ‘ Selectively Permeable’? In order to answer this question, detail structural study of plasma membrane needed which composed of a phospholipids bilayer studded with proteins. For the reader of this report, I would also like to point out that we had systematic error during the experiment in measuring Initial Weight of samples. After the experiment was finished our results did not match with rediction and hypothesis that we had for Weight Change. After careful review of our data and comparing them with other group we realized that there was an error of 2. 2 g in all our measurement of Initial Weight which we corrected in our final data. Systematic error was due to different scale that we used to measure Initial Weight and Final Weight. Errors like this could easily be avoided by using same instrument during entire span of experiment. References Symbiosis ” Customized edition for Biology Department at Middlesex County College, NJ Biological Science ” 3rd Edition by Scott Freeman