Diffusion through a Selectively Permeable Membrane

Summary: My group and I tested the permeability of dialysis tubing by using two different solutions. The dialysis tubing contained a mixture of glucose and starch solutions and was submerged in a mixture of mostly H_2O with small amounts of iodine potassium iodide (I_2KI). The diffusion of molecules was then measured by using Benedict's Test Reagent in both the H_2O with I_2KI mixture and glucose with starch mixture to determine whether sugar molecules could pass between the selectively permeable membrane. Our results showed that the dialysis tubing does allow the diffusion of glucose molecules. This would seem possible given that the average pore size for dialysis tubing is 2.7nm (*Highsmith, 1982*). This is much larger than the diameter of a typical atom, which is about 200pm (*McMurry, 2011*). The glucose molecule $C_6H_{12}O_6$ forms a six membered ring in solution, which would likely compact it enough to pass through one of these pores (*Raven et al., 2008*).

Methods & Results: My group and I obtained a 25cm piece of dialysis tubing. One end was folded over and clamped to make a bag so that it would contain a liquid. We then filled the bag ¼ full with 30% glucose solution and another ¼ full with starch solution. Both solutions were mixed thoroughly, which produced a gold-brown colored liquid.

The outside of the tubing was then rinsed with water to prepare it for submersion. We then filled a beaker with water and added approximately 30 drops of iodine potassium iodide (I_2KI), which turned the liquid from clear to a faint gold color. The dialysis tubing containing glucose with starch mixture was then carefully submerged in the water and draped over the side of the beaker. During this process we were very careful to ensure that one liquid did not contaminate the other and produce erroneous results. At this point, the diffusion process was left alone to occur for 30 minutes.

At the end of this designated time, we removed the dialysis tubing with mixture and placed it in a dry beaker. The colors of both separate solutions still appeared to be the same: gold-brown and faint gold colors for the dialysis tubing mixture and the beaker with H_2O with I_2KI mixture, respectively. Finally, we added Benedict's Test Reagent to both liquids and mixed. This turned the dialysis tubing mixture to a darker orange-brown color and the beaker liquid to a clear but darker brown-yellow color, indicating the presence of glucose in both liquids. This showed to us that the diffusion of glucose occurs through the dialysis tubing's selectively permeable membrane.

References:

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