Calcium Alginate Hydrogels

University of California, Los Angeles Student Chapter of Society for Biomaterials SFB Education Challenge 2013

Student Worksheet

Name:

_____ Period: ____ Date:___

Materials for each student group

- 1. One (1) heart burn tablet
- 2. One (1) plastic, sealable bag (sandwich-sized)
- 3. Three (3) clear cups
- 4. Eyedropper or straw

Materials at the Front of the Room/Teacher's Bench

- 1. Deionized/Distilled Water
- 2. Spoons/Measuring cup
- 3. Bottle of Calcium Booster
- 4. Food coloring and/or glitter

Background

Polymers are a class of materials with a wide range of properties and uses as you learned in the lesson. Alginate is a <u>natural</u> biomaterial because it is found in nature—from seaweed! One application of this natural biomaterial is to make hydrogels (a solid material filled with water). In this hands-on experiment, you will be making hydrogels by polymerizing alginate with calcium chloride. Alginate is a main ingredient in heart burn pills and calcium chloride is the main ingredient in the fish tank solution. You will also add food coloring to simulate encapsulating a drug or glitter to simulate encapsulating cells. Get ready for some fun!

Hypothesis

Alginate dropped into a solution with calcium will form hydrogels while a solution without calcium will not allow for polymerization and formation of solids.



Cups A, B, and C contain three different solutions. Cup A is the alginate solution, Cup B is the calcium chloride solution, and Cup C is water. We will try to make hydrogels by adding alginate (Cup A) to calcium chloride (Cup B) and water (Cup C).

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Methods

Prepare Alginate Solution

- 1. Take your 3 cups and label A, B, and C
- 2. Take <u>Cup A</u>, add 5 mL of water
- 3. Put a single heartburn tablet in a plastic, sealable bag, remove excess air, and seal it.
- 4. Use a textbook to break the tablet into smaller pieces or a powder inside the bag
- 5. Open the bag, pour the broken tablet into <u>**Cup A**</u> and swirl contents for 1 minute until powder dissolves
- 6. Add glitter and/or one (1) drop of food coloring

Prepare Calcium Chloride Solution

- 1. Take <u>Cup B</u> and add 20 mL of water
- 2. Add to Cup B 2 mL of Calcium Booster
- 3. Swirl cup to mix contents

Prepare Control (Water)

1. Take <u>Cup C</u> and add 20 mL of water

Making hydrogels

- 1. Place Cups A, B, and C in front of you
- 2. Take the eyedropper and drop the alginate (Cup A) slowly into the calcium chloride solution (Cup B), let it sit for 10 seconds
- 3. Take the eyedropper and drop the alginate (Cup A) slowly into the control (water solution) Cup C, let it sit for 10 seconds
- 4. Play around with the way you add alginate (Cup A) to Cups B and C to see if you can make different shaped hydrogels.

Observations and Discussion Questions

- 1. What color is the solution in Cup B?
- 2. Draw the shapes you were able to make in Cups B and C

Cup B	

Cup C

3. Did Cups B and C make hydrogels? Was your hypothesis correct?

4. Cup C is a control since it had no calcium in it. Why is having a control important when conducting experiments?

5. Are the hydrogels hard or soft?

6. Do you see glitter? Are the hydrogels the color of the food coloring? If glitter represented cells, can you image how the hydrogel would encapsulate the cells?

7. What color is the solution in Cup B now? Compared to Question 1, why do you think there is or is not a change?