Edible Water Pods

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Safety Suggestions

- Safety goggles required
- Protective clothing suggested
- Caution hot liquids
- If the pods made in this activity are to be eaten, all food safety rules must be followed;
    - Wash hands with soap and water before the activity
    - Clean/sanitize the work surface and where food will be consumed
    - Clean the inside and outside of all appliances (Blender)
    - Use only food grade materials
    - Separate food items from other reagents
- Adults should supervise the use of the blender.
- Thoroughly wash hands after this activity

Note: The purchased sodium alginate and calcium lactate must be fresh and food grade or better and can be found at natural food stores or online at Amazon. The materials must be stored away from laboratory chemicals.

Introduction

In this activity, you will make edible, biodegradable water pods! The sodium alginate in this experiment comes from brown algae, and is commonly used in food products as a thickener for salad dressings and other liquids. The calcium lactate comes from plant sugars and used as a source of calcium or preservative. Therefore, both are from nature and renewable. After creating solutions of these two chemicals you will "drop" a teaspoon sphere of the sodium alginate solution into the calcium lactate solution. The final pods (or capsules) have a coating that is like Jell-O and are squishy because of the liquid water inside. Once you have made the pods, you can pop them open, see how strong they are by pulling on them, or if approved, eat them. Adding food coloring to the sodium alginate mixture lets you watch the reaction better as it happens.

Materials

- Blender
- 2 bowls (1 quart and 2 or 3 quart)
- ¼ teaspoon sodium alginate
- 1 teaspoon calcium lactate
- 1 teaspoon measuring spoon
- Large spoon (for mixing)
- Paper towel
- Optional: Food coloring and clear, pulpless juice

Procedure

1. Measure 1 cup of cold water and place in a blender. Add food coloring if desired. Add ¼ tsp of sodium alginate to the blender and mix for ~20 seconds. Pour into the 1 quart bowl.
   Note: An additional ⅛ tsp. of alginate can be added if the reaction does not work well. Different brands and grades of sodium alginate may react differently.
2. In the 3 quart bowl, mix together 4 cups of cold water with 1 tsp of calcium lactate with a large spoon until the calcium lactate is dissolved.

3. Fill a 1 tsp measuring spoon with the alginate mixture and carefully lower it into the calcium lactate bowl so that the solution covers the spoon. See illustration below. Let the spoon of sodium alginate sit in the calcium lactate solution for ~5 seconds and then slowly invert the spoon so the capsule slides into the calcium lactate solution. Pull the spoon straight up out of the bowl. The alginate capsule/pod should now be floating in the calcium lactate bath. Repeat to make as many as up to eight pods at a time.
4. Let the pods sit for 15-20 minutes. Optionally, leave some pods in for longer to see how it affects the thickness of the outer coating.
   Note: The smaller the measuring spoon used, the quicker the pods will form.
5. Using the large spoon, carefully remove the pods from the calcium lactate liquid and set them on a paper towel. These pods can be squished open to observe the properties of the pods or can be eaten if approved by the adult supervisor.

How does it work? / Where's the chemistry?
Sodium alginate is a **polymer** which means it is made up of long chains of repeating molecules like a chain necklace. When the sodium alginate is placed in the calcium lactate a reaction occurs where the **calcium** and **sodium** switch places. The new **calcium alginate** is different because now the long linked chains begin attaching to each other to link the strands together like a chain link fence. This is called **cross-linking**. The connected strands of **calcium alginate** forms the jelly-like outside of the pod. The water is trapped inside the pod as the **cross-linked polymer** forms on the teaspoon and as it is carefully dropped in the solution.

What did you see?

Sense used to make observations	**Observations**
Sight *What do you see?*	
Touch *How do the pods feel?*	
Smell *What do the pods smell like?*	
Taste *What flavor do the pods have?*	

Think about: Why are these pods important? Would you use these instead of plastic water bottles? What needs to change before you would use them?

References
This experiment was based on edible pods marketed by https://www.notpla.com/ (accessed September 2019). The authors wish to acknowledge Beyond Benign as the inspiration and resource for this project.