



Kitchen Chemistry: Gummy Worms (Alginate Worms)

Preparer's Version

Introduction

Sodium alginate, derived from brown seaweed, is a versatile polysaccharide widely used in the food industry for its gelling, thickening, and stabilizing properties. Chemically, it is composed of repeating units of mannuronic and guluronic acid, forming long chains of sugars that readily dissolve in water to create a viscous solution. In the context of the "Alginate Worms" demonstration, a 2% sodium alginate solution is flavored and then squirted into a 2% calcium chloride solution, leading to the formation of edible gummy worms. This process showcases the unique chemical properties of sodium alginate, particularly its ability to undergo ionic cross-linking in the presence of divalent cations like calcium.

Safety Hazards

- Personal Protective Equipment:
 - Safety glasses/goggles
 - Nitrile gloves
 - Chemical & flame retardant lab coat
- Physical Hazards
 - Calcium chloride may form combustible dust concentrations in air.
 - Sodium alginate may form combustible dust concentrations in air.
- Chemical Hazards
 - Calcium chloride causes serious eye irritation.
 - Sodium alginate may form combustible dust concentrations in air.
 - Sodium alginate should not be heated; heating the sodium alginate can reduce viscosity and polymerization.

Materials

- 30 g Calcium chloride (food-grade)
- 30 g Sodium alginate solution (food-grade)
- Flavoring extracts
- Deionized water
- 2L beaker (2x)
- Magnetic stir bar
- Stir plate
- Glass stir rod
- 500 mL glass jar or bottle (one for each flavored solution)
- Syringes (unused)
- 400 mL bowls (two per flavor; glass preferred)

Safety Data Sheet(s)

- [Calcium chloride](#)
- [Sodium alginate](#)

Procedure

1. Weigh 30. g of food-grade calcium chloride and add it to 1,500 mL of deionized water. Mix well using a glass stirring rod or magnetic stir plate.
2. In another beaker, weigh 30. g of food-grade sodium alginate and add it to 1,500 mL of deionized water. Mix well using a glass stirring rod. This solution should be viscous.
3. Separate the 2% sodium alginate solution into 300 mL aliquots. Add the recommended volume of flavoring extracts for the volume of solution and mix well. Make sure to avoid cross-contaminating flavors.
4. Test the solutions by drawing back the plunger to sample a small volume of the flavored sodium alginate solution. Steadily squirt it into some of the 2% calcium chloride solution, rinse off the resulting worm, and taste test it. If needed, add more flavoring extracts.
5. Label the flavored sodium alginate solutions with their flavors and the date they were made. Keep them in tightly-sealed containers and refrigerate in a food-safe fridge. Discard after 3 months.

Tips & Tricks

- Make sure to test and taste each flavor – make any necessary changes to maximize the flavor of the gummy worms.
- Use food coloring if necessary to keep the gummy worms vibrant and colorful.
- Be sure to prepare extra deionized water to rinse excess calcium chloride from the gummy worms.

Clean-Up Procedures

1. Keep any unused calcium chloride solution for later use and store the remaining sodium alginate solutions in a food-safe fridge for up to 3 months.
2. Rinse the labware thoroughly with deionized water at least three times in the sink.
 - a. For the glassware used for sodium alginate, wipe the interior of the beaker down with 70% isopropyl alcohol before rinsing with deionized water. Alginate gel is biodegradable but shouldn't be poured down the drain because it's viscous. It can be swept up and shoveled into a container for disposal. Avoid creating dust.
3. Clean thoroughly with laboratory detergent.