

Bugs to Dye For

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Introduction

Have you ever eaten bugs? It is quite likely that you have! Some yogurts, juices, and ice creams that include the words “cochineal extract” or “carmine” use dried bugs to enhance pink or reddish colors in foods. Cochineal bugs are used today to color many things including food, beverages, and cosmetics. Native and Indigenous people, including Incas and Aztecs in Central and South America, used cochineal bugs to color fabrics and other materials. They even found a way to get other colors, besides pink or red, from these same bugs. Try this activity to discover how they did it!

Materials

- dried cochineal bugs (available for purchase online or at craft stores)
- snack-size zip-closing plastic bag
- storage-grade quart-size (about 1 liter) zip-closing plastic bag
- rolling pin (or sealed metal food can)
- several small plastic cups or bowls
- piece of white, 100% cotton fabric (about 6” x 6”, or 15 cm x 15 cm) – like part of an old T-shirt, pillowcase, or cotton squares
- 2 measuring spoons (1 tablespoon, or about 15 mL, and ½ teaspoon, or about 7.5 mL)
- measuring cup (1 cup, or 250 mL)
- plastic pipet or eye dropper
- baking soda
- vinegar
- warm tap water
- marker for labelling
- coffee filters (optional)



Procedure

Extract the cochineal dye

1. Place 1 tsp. of dried cochineal bugs in the snack-size zip-closing plastic bag. Remove as much air as possible and securely seal the bag.
2. Using a rolling pin or thermos, roll over the bugs in the bag to crush them into a powder.
3. Place smashed cochineal bug powder into the quart-size zip-closing bag. Add 1 cup of warm tap water to the bag.
4. Shake vigorously for several minutes, then allow to settle.
5. Open the zip-closing bag and carefully pour the liquid into an empty cup, leaving the crushed bug body parts in the bag. Chemists call this type of process **decanting**.
6. The red-colored liquid in the receiving cup is the cochineal dye that will be used to make additional solutions. Label this “Cochineal Dye Solution” and set aside.

Optional: Set aside the towel/filter with the big bug parts; you can allow them to dry, smash some more and make more dye as above.

Change the color of the dye solutions by adding acids and bases

1. Make a **basic** solution with baking soda by dissolving ½ tsp. baking soda in 1 cup of water (label “Baking Soda”).
2. Set up three small cups or bowls as “dye pots.” Mark cups as “Cochineal Dye,” “Vinegar and Cochineal Dye,” and “Baking Soda and Cochineal Dye.” Add 1 tbsp. of cochineal dye solution to each
3. Add ½ tsp. vinegar (an acid) to cup “Vinegar and Cochineal Dye.” What color results?
4. Add ½ tsp. baking soda solution (made in step #1) to cup “Baking Soda and Cochineal Dye.” What color results?

Safety Suggestions

- ✓ Safety glasses required
- ✓ Protective clothing and gloves suggested
- ✓ Caution: hot liquids
- ✓ Do not eat or drink any of the materials used in this activity
- ✓ Thoroughly wash hands after this activity

Disposal: Neutralize all solutions (*See the How Does It Work? section on page 9*) before pouring down the drain. Wash reusable items with soap and water. Disposable items, such as zip-closing plastic bags, may be disposed of safely with the household trash or recycling.

Note: Cover your workspace and protect your clothing to avoid unwanted stains from the insect dye.

Dye your cotton

1. Dip a small cotton sample into the cup labeled “Cochineal Dye.”
2. Dip another small cotton sample into the cup labeled “Vinegar and Cochineal Dye.”
3. Dip another small cotton sample into the cup labeled “Baking Soda and Cochineal Dye.”
4. Experiment with using droppers or spoons to apply the liquid in each of the cups to cotton cloth in new patterns. Label the droppers or spoons used in each of the liquids.
5. Set aside and allow to dry.
6. Enjoy and appreciate your dyed sample!

What did you observe?

What did you notice when the vinegar mixed with the cochineal dye solution? What do you think other acids (like lemon juice or carbonated soft drink) might do if added to a fresh solution of cochineal dye? What happened when you added the baking soda to cochineal dye solution?

How does it work?

The extracted dye from the female cochineal bugs is used to color foods, makeup, and clothing. Cochineal dye is great because it can be used to get various colors when mixed with different solutions. Vinegar is an acid, and adding it changes the cochineal dye to an orange color. The baking soda is a base, and turns the cochineal dye purple. The cochineal dye is an example of an indicator. Chemists use the color changes of **indicators** to categorize substances as acids or bases.

How do you know if cochineal dye is in your foods, make-up, or clothing? Check the ingredient label for the different names cochineal dye goes by: cochineal, carmine, carminic acid, Natural Red 4, or E120.

What else can you do?

Use your colorful cochineal dye for other projects, like tie-dye or the activity on page 9 in this edition of *Celebrating Chemistry*.

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