

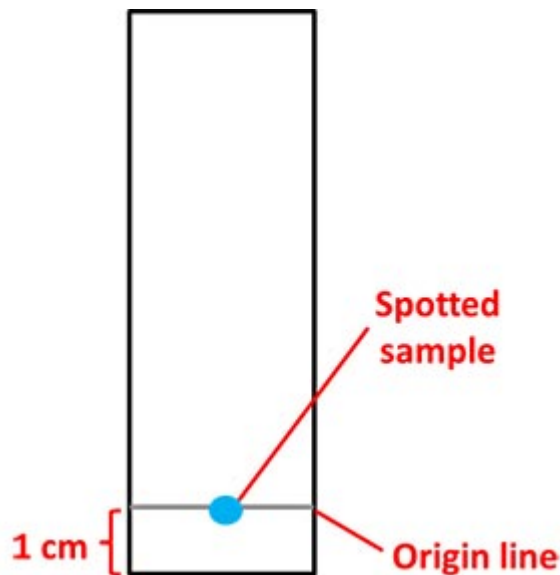
## Candy Chromatography: What Makes Those Colors?

[https://www.sciencebuddies.org/science-fair-projects/project-ideas/FoodSci\\_p006/cooking-food-science/candy-chromatography](https://www.sciencebuddies.org/science-fair-projects/project-ideas/FoodSci_p006/cooking-food-science/candy-chromatography) ([http://www.sciencebuddies.org/science-fair-projects/project-ideas/FoodSci\\_p006/cooking-food-science/candy-chromatography](http://www.sciencebuddies.org/science-fair-projects/project-ideas/FoodSci_p006/cooking-food-science/candy-chromatography))

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### Experimental Procedure

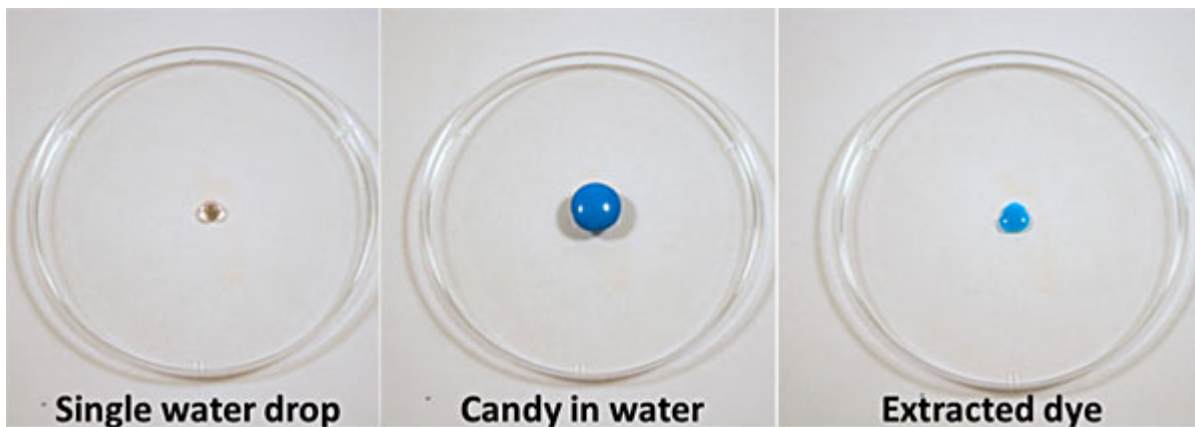
1. Do your background research so that you are knowledgeable about the terms, concepts, and questions listed in the Background tab.
2. Choose three colors of candies you want to test.
  - a. For example, you could test red M&Ms®, brown M&Ms®, and blue Skittles®.
3. Cut each chromatography paper in half (length-wise) to make approximately 2 centimeters (cm) wide by 7.5 cm long strips. You will need at least 30 chromatography strips.
4. Use a pencil to lightly label which candy color or food coloring will be spotted on each paper strip. Label 5 chromatography strips for each candy color and 5 strips for each food coloring (red, green, and blue). *Tip: do not use a pen for writing on the strips: the ink will run when the solvent passes through the strips.*
5. Draw a pencil line 1 cm from the edge of each strip of paper, as shown in Figure 3 below.
  - a. This will be the origin line.
  - b. You will spot the candy color for each strip right on this line, as shown in Figure 3.



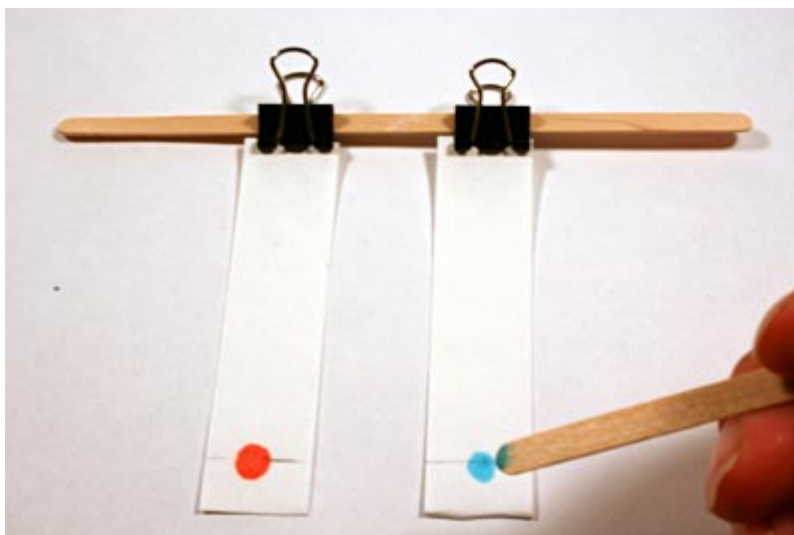
**Figure 3.** Each chromatography strip will have an origin line. The dye to be tested will be spotted in the middle of the origin line.

6. Next you need to extract some dye from each candy you wish to test.
  - a. Fill the 100 mL beaker with some water.
  - b. Use the pipette to put a *single* drop of water in the clean plate or plastic lid as shown in Figure 4 below. Set one candy in the drop of water.
    - i. *Tip:* If you use too much water, the dye will not be concentrated enough to see on the chromatography strip.
    - ii. *How to use the pipette:* Squeeze the pipette at its widest point. While continuing to squeeze, insert the narrow end into the beaker of water. Release the wide end and the pipette will fill with water. Put the narrow end of the pipette directly over the plate or plastic lid. Gently squeeze the wide end of the pipette to release one drop of water.
  - c. Leave the candy in the drop of water for three minutes to allow the dye to dissolve.
  - d. Remove the candy, then dip a pipette tip, or clean wooden splint tip, into the now-colored drop of water.
  - e. Spot the candy dye solution onto the chromatography strip by touching the pipette tip, or a wooden splint, to the strip, right in the center of the origin line as shown in Figure 5 below.
  - f. Allow the spot on the strip to dry completely (this should take approximately 1 minute).

- g. Repeat steps 6e to 6f three more times. You want to make sure to have enough dye on the chromatography strip so that you can see the dye components when they separate out on the paper.
- h. Repeat steps 6b to 6g with four more strips and four new candies that are the same type and color (e.g., all red M&Ms®).



**Figure 4.** To extract the candy dye, leave a piece of candy in a single drop of water for three minutes. When you remove the candy, a puddle of dye will be left behind.



**Figure 5.** Spot the extracted candy dye onto the paper chromatography strips using the tip of a wooden splint or a pipette.

7. Repeat step 6 for the other two colors of candy you want to test. In the end you should have 15 spotted chromatography strips—5 for each colored candy type.
8. You also need to prepare chromatography strips with food coloring dyes.
  - a. These will be your known compounds, with which you will compare the "unknown" candy dyes.
  - b. For each food coloring color put a drop of coloring on a fresh plate or plastic lid.
  - c. Dip a clean wooden splint tip or a pipette into the drop of food coloring.
  - d. Spot the food coloring onto a chromatography strip by touching the wooden splint, or pipette, to the strip, right in the center of the origin line.
  - e. Repeat steps 8c to 8d until you have 15 chromatography strips spotted with food dye— 5 red, 5 blue, and 5 green. Also repeat step 8b if needed.
9. Prepare a 0.1% salt solution for the chromatography solvent.
  - a. Add 1/8 teaspoon of salt to 4 cups of water (approximately 1 gram [g] of salt to 1 liter [L] of water).
    - i. If you only have a 1/4 teaspoon measuring spoon fill that spoon half full of salt— that will be close enough for this project.
  - b. Shake or stir until the salt is completely dissolved.
10. Pour a small amount of the salt solution into the 500 mL beaker.
  - a. Clip two of the prepared chromatography strips to a wooden splint. Make sure the two strips do not touch each other or the beaker and that their bottoms are aligned. Rest the splint on top of the beaker so that the strips hang straight into the beaker.
  - b. If necessary, add more of the salt solution. The goal is to have the end of the chromatography strips just touching the surface of the solvent solution (salt solution), as shown in Figure 6 below.



**Figure 6.** Your chromatography setup should look similar to this example. The edge of the chromatography strips should just barely touch the solvent.

11. Let the solvent rise up the strip (by capillary action) until it is about 0.5 cm from the top then remove the strip from the solvent. Keep a close eye on your chromatography strip and the solvent front— if you let it run too long the dye may run off the paper and become distorted.
12. Use a pencil to mark how far the solvent rose.
13. Allow the chromatography strip to dry, then measure (in centimeters) and calculate the  $R_f$  value for each candy color (or food coloring) dye component. Record your results in your lab notebook.
  - a. *Tip:* Use Equation 1, which is given in the [Introduction](#) (#distance-equation1), for calculating the  $R_f$  value.
14. Repeat steps 10–13 until you have run all of the chromatography strips.
  - a. Each time you run the experiment make sure there is enough solvent in the beaker. The chromatography strips should be just touching the surface of the solvent. Add more solvent (salt solution) as needed.
15. Using the five repeated strips for each candy color (or food coloring), calculate the average  $R_f$  for each dye component.

## Analyzing Your Results

1. Create a data table like Table 1 for each candy type and color or food coloring that you tested in your lab notebook.

Candy Type/Color or Food Color:	
Component Color	Component R <sub>f</sub> value
<b>Total number of components:</b>	

**Table 1.** Data table in which to record each of the separated components from one type and color of candy or food color.

2. Record all your results for one candy type and color or food color in a different data table.
3. Make a pie chart for each candy type and color as well as food color. The pie chart should show the number of components (one wedge per color), the color of each component (label and color each wedge appropriately), and the R<sub>f</sub> value for each component (part of the wedge's label).
4. Compare the R<sub>f</sub> values for the candy colors and the food coloring dyes. Can you identify which food coloring dyes match which candy colors? How many dye components does each candy color have? Do your results make sense to you?
  - a. *Hint:* You can look at the ingredients on the packaging to see which food coloring dyes may have been used to help you answer these questions.
  - b. *Note:* It is possible that other components in the candies may affect how well the food coloring dyes travel through the paper. Why do you think this might be? (*Hint:* Think about *solubility* or *polarity*, and re-read this part of the Introduction.) If you have unexpected results, do you think this might help explain them?

## Frequently Asked Questions (FAQ)

FAQ for this Project Idea available online at [https://www.sciencebuddies.org/science-fair-projects/project-ideas/FoodSci\\_p006/cooking-food-science/candy-chromatography#help](https://www.sciencebuddies.org/science-fair-projects/project-ideas/FoodSci_p006/cooking-food-science/candy-chromatography#help) ([http://www.sciencebuddies.org/science-fair-projects/project-ideas/FoodSci\\_p006/cooking-food-science/candy-chromatography#help](http://www.sciencebuddies.org/science-fair-projects/project-ideas/FoodSci_p006/cooking-food-science/candy-chromatography#help)).