

# Dyes in Candy and Their Effects

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TECM 1700

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Parents let children eat candy daily, but can the dyes in the candy harm children? It is well known that the dyes can have a harmful effect on a child's health, but just how many dyes are in each piece of candy? The harmful effects caused by these dyes are not minor as they can be responsible for cancer and other major diseases. Due to the severity of the side effects of these dyes, it is important to limit a child's intake of food that has multiple dyes in the food. Some people think that each candy only uses one color dye in the candy. We are going to take the dye off each of the different colors of M&Ms and Skittles. We will then use chromatography to determine the amount of dyes used in the creation of each of the colors of candy. We believe that brown M&M's and purple Skittles use more than one dye to create the shown color.

## Candy Chromatography

Ever wondered why candies are different colors? Many candies contain colored dyes. Bags of M&Ms or Skittles contain candies of various colors. The labels tell us the names of the dyes used in the candies. But which dyes are used in which candies? We can answer this by dissolving the dyes out of the candies and separating them using a method called chromatography.

### Materials

For this experiment you will need:

- One bag of M&M candies
- One bag of Skittles candies
- Two coffee filter papers
- Two bowls
- Water
- Table salt
- Two pencils
- Scissors
- A ruler
- Eleven toothpicks
- Aluminum foil
- Measuring cup
- $\frac{1}{8}$  teaspoon
- One empty and clean 1-liter bottle with cap

After you gather all of the materials, you are ready to prepare for the experiment.

### Preparing the Materials

Before you begin the experiment, you will need to prepare the materials by following these steps:

1. Cut both of the coffee filter papers into 3 inch by 3 inch (8 cm by 8 cm) squares.

2. Draw a line across both of the coffee filter papers with the pencil about  $\frac{1}{2}$  inch (1 cm) from the bottom edges.
3. Make six small dots with a pencil equally spaced along the line on one of the coffee filter papers.
4. Make five small dots with a pencil equally spaced along the line on the other coffee filter paper.
5. Leave  $\frac{1}{4}$  inch (0.5 cm) between the first and last dots and the edge of the papers.
6. Use the pencil to label each dot on one of the coffee filter papers, below the line, with the following letters: Y for yellow, G for green, BU for blue, BR for brown, O for orange, R for red.
7. Use the pencil to label each dot on the other coffee filter paper, below the line, with the following letters: Y for yellow, O for orange, R for red, G for green, P for purple.
8. Take two 8 inch by 4 inch (20 cm by 10 cm) pieces of aluminum foil.
9. Lay both pieces of aluminum foil flat on a table beside each other.

Once you have finished preparing the materials, you can proceed to removing the dye from the candies.

## Removing the Dye from the Candies

To remove the dye from the candies, follow the steps below:

1. Pick up one bowl.
2. Fill the bowl halfway with water.
3. Use your finger to place six drops of water, spaced evenly, on the first piece of foil.
4. Place each color of the M&M candies on each drop (as shown in Figure 1).
5. Use your finger to place five drops of water, spaced evenly, on the second piece of foil.
6. Place each color of the Skittles candies on each drop (as shown in Figure 2).
7. Wait three minutes for the colored dye to come off the one side of each piece of candy.
8. Turn each piece of candy over to get more of the colored dye to dissolve in the water.
9. Wait three minutes for the colored dye to come off the other side of each piece of candy.
10. Remove each piece of candy from the water drops.
11. Dispose of each piece of candy.
12. Pour the water out of the bowl.



Figure 1: M&M Soaking in Water Droplets



Figure 2: Skittles Soaking in Water Droplets

After completing the steps above, you are ready to place the candy dyes on the coffee filter paper.

## Placing the Candy Dyes on the Coffee Filter Paper

To successfully place the candy dyes on the coffee filter paper, follow the steps below:

1. Dampen the tip of one of the toothpicks in one of the colored solutions from the first piece of aluminum foil with the M&M candies.
2. Touch the toothpick lightly to the corresponding labeled dot on the coffee filter paper that has six dots.
3. Place the appropriate color solution on each of the other five labeled dots using a different toothpick for each color (as shown in Figure 3).
4. Wait for the color spots on the filter paper to dry.
5. Repeat steps 1-4 three times.
6. Dampen the tip of one of the toothpicks in one of the colored solutions from the first piece of aluminum foil with the Skittles candies.
7. Touch the toothpick lightly to the corresponding labeled dot on the coffee filter paper that has five dots.
8. Place the appropriate color solution on each of the other four labeled dots using a different toothpick for each color (as shown in Figure 4).
9. Wait for the color spots on the filter paper to dry.
10. Repeat steps 1-4 three times.

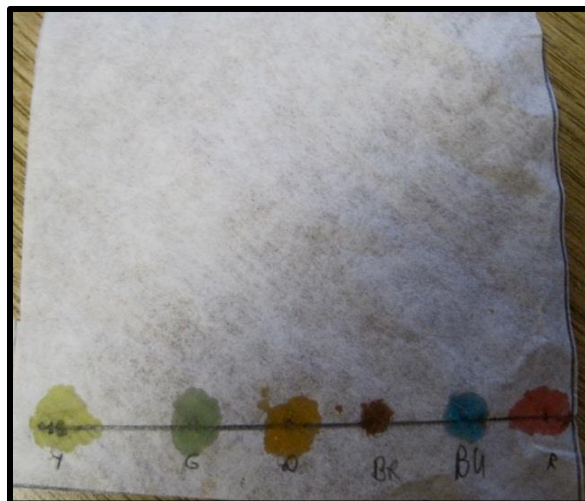


Figure 3: M&M Dyes on Coffee Filter Paper



Figure 4: Skittles Dyes on Coffee Filter Paper

After you have completed placing the dyes on the coffee filter paper, you must prepare the salt solution.

## Preparing the Salt Solution

To create the salt solution, follow the steps below:

1. Rinse the 1-liter bottle.
2. Measure one cup of water into the measuring cup.
3. Pour one cup of water into the 1-liter bottle.
4. Measure  $\frac{1}{8}$  teaspoon of salt.
5. Add the salt to the 1-liter bottle.
6. Screw the cap of the 1-liter bottle on tightly.
7. Shake the contents of the bottle until all of the salt is dissolved in the water.

Now that you have prepared the salt solution, you are ready to perform the experiment.

## Performing the Experiment

To successfully perform the experiment, follow the steps below:

1. Pour part of the salt solution into each bowl so that the solution barely covers the bottom of each bowl.
2. Check that the level of the solution remains low enough that when you put the filter paper in the dots will be above the water level.
3. Tape the top of one of the coffee filter papers around a pencil.
4. Place the pencil across the top of one of the bowls so that the filter paper barely touches the top of the salt solution (as shown in Figure 5).
5. Repeat steps 3-4 for the other coffee filter paper.
6. Wait 20-30 minutes.
7. Remove each coffee filter paper from the solution when the salt solution is about ½ inch (1 cm) from the top edge of each piece of paper.
8. Lay each paper on a clean, flat surface to dry.



Figure 5: M&M and Skittles Experiment Setup

Now that you have completed the experiment, you are ready to interpret your results.

## Results

Our recorded results from the M&M and Skittles chromatography experiment are shown below in Table 1 and 2. Table 1 shows the different color bands of the M&M candies and Table 2 shows the different color bands of the Skittles candies.

M&M Candies	Blue	Brown	Green	Orange	Red	Yellow	Total Color Bands
Brown M&M				X	X	X	3
Green M&M	X		X			X	3
Orange M&M				X		X	2
Red M&M				X	X		2

<b>Yellow M&amp;M</b>						X	1
<b>Blue M&amp;M</b>	X						1

Table 1: M&M Candies Chromatography Results

<b>Skittle Candies</b>	<b>Blue</b>	<b>Green</b>	<b>Orange</b>	<b>Red</b>	<b>Yellow</b>	<b>Total Color Bands</b>
<b>Red Skittle</b>				X		1
<b>Yellow Skittle</b>					X	1
<b>Purple Skittle</b>	X			X		2
<b>Orange Skittle</b>			X		X	2
<b>Green Skittle</b>	X				X	2

Table 2: Skittles Candies Chromatography Results

Now that the results have been recorded in the tables above from the candy chromatography experiment, we must analyze the results.

## Discussion

With this experiment we aimed to prove that brown M&Ms and purple Skittles would have the most dyes out of all of the colored candies. The results of this experiment both proved and disproved our hypothesis that brown and purple had the most colors. The purple Skittle did indeed have the most color bands but orange and green shared the same amount of color bands. For the brown M&M it also did have the most color band but it shared that title with the green M&M. Some sources of errors that may account for the hypothesis being wrong is that we used coffee filter paper instead of chromatography paper, which is made specifically for what we did in this experiment, so in future experiments we would be using chromatography paper. One other thing that may have affected the results may have been how close together the dots were but the dye didn't seem to bend into each other. The results showed which colors candies had the most dye and some of these dyes can cause cancer and other diseases. One dye that can harm your child is blue 1 or known as brilliant blue. Blue 1 may not harm your DNA when you eat it but it can cause chromosomal aberrations (Kobylewski & Jacobson, 2010). Blue 1 is also thought to have additive properties in children that have hyperactive disorders. Blue 1 need to be research more so that we can understand what true problems blue dye 1 can cause in children. So with all of these it will be possible to look towards the future to hopefully create a safer environment for our children.

## Reference

Kobylewski, S., & Jacobson, M. (2010, July 27). *Food dyes a rainbow of risks*. Retrieved from <http://cspinet.org/new/pdf/food-dyes-rainbow-of-risks.pdf>

Date: November 12, 2012

To: Heather Huggett TECM 1700 Teacher

From: Jamie Carson, Adam Miller, Anthony Munoz, and Theodore Schuerman

Subject: Group Evaluation

Jamie wrote the step-by-step process of how to remove the dye from the candy and created the tables, pictures, and came up with the color scheme. Adam wrote the discussion and did research on blue dye 40. Anthony assisted with the title page and the introduction. Teddy wrote the introduction and made the title page.

Anthony has missed a total of three meetings and 20 points will need to be taken away from his final score. We scheduled a non-mandatory meeting on November 7<sup>th</sup> for more outside work time.