

Chromatography

Introduction

Not all black markers are made the same! Marker companies each use different combinations of chemicals, called pigments, to produce the colors that they want. This means that each company's marker has a distinct combination of pigments that can act as a sort of fingerprint for that marker brand when they are separated. When scientists want to separate things they use a technique called chromatography. Chromatography uses the different properties of chemicals to separate them from mixtures.

Materials (per group)

3-4 coffee filters

5 different brands of black marker plus other colors

Scissors

Bamboo skewers

7 Small cups with water (six for experiments, one for extra water)

Pencils

Unknown, filter paper strip pre-spotted with mystery marker

Aluminum Foil

M&M's

Skittles

Activity 1 (Marker Fingerprints)

1. Cut the filter paper into strips
2. Spot each strip ~1/2 inch above the bottom of the filter with a marker. The spot should be of decent size, at little bigger than this small letter "o".
3. Label each strip with the brand of marker you are testing using a pencil (you don't want the label to smear)
4. Fill a cup with < 1 inch of water
5. Carefully lower one of the filter paper strips into the cup so that it touches the water but the marker spot is above the water level
6. Use a skewer to pierce the filter strip and hold it in place above the water
7. The water will rise up the filter paper carrying the marker ink with it. After 5-10 minutes the ink should have separated into its components and can be carefully removed from the water to dry
8. Repeat for each brand of marker and mystery sample
9. Compare the mystery sample to the brand references you have collected

Adapted from:

Museum of Science and Industry lesson "Ink Chromatography"

http://www.msichicago.org/fileadmin/Education/Learninglabs/lab_downloads/EvidenceLab_ink_act.pdf

Education.com "Candy Chromatography" lab

http://www.education.com/science-fair/article/chemistry_paper-chromatography/

Discussion

Though all of the markers look black when we write with them, they are in fact all made from different combinations of pigments. Because some of those pigments dissolve better than others, the water moving up the strip is better able to move the more soluble pigments. This separation is the basis of chromatography. Because each marker brand uses their own unique blend of pigments to make black, those pigments form a sort of “fingerprint” of the marker brand. By using chromatography you can visually check the mystery marker’s fingerprint against the series of reference markers to determine which one it is.

Introduction for activity 2

Markers aren’t the only things that use pigments for their color. Candy also contain pigments to make them bright and colorful. Much like the marker companies, the candy maker want specific colors and have to find the perfect combination of pigments. By extracting the colored pigments, we can determine what colors of candy are mixed pigments and if different candy companies use the same pigment combos for the same colors

Activity 2 (Candy Pigments)

1. Choose three different colored M&M’s and three different colored Skittles
2. Make 6 small depressions in the aluminum foil sheet and put a large drop of water in each one
3. Place a piece of candy in each of the water drops and let sit for 10 minutes to release pigments into the water drop
4. Prepare more filter paper strips while candy pigments are being collected
5. Using the tip of a skewer spot each strip ~1/2 inch above the bottom of the filter with the now colored water. Try and make the spot as small as you can to make the color separation more clear
6. You will have to repeat each spot 3-4 times to make sure there is enough pigment
7. Label each strip with the kind/color of candy that you are testing using a pencil
8. Fill a cup with < 1 inch of water
9. Carefully lower one of the filter paper strips into the cup so that it touches the water but the marker spot is above the water level
10. Use a skewer to pierce the filter strip and hold it in place above the water
11. The water will rise up the filter paper carrying the candy pigment with it. After 5-10 minutes you will be able to see what pigments are used in candy coloring.

Discussion

Just like the markers from activity 1, the color you see in candy is not necessarily the color of the pigments used. You could use this information to distinguish between same colored candies much like you can distinguish between marker brands.

Adapted from:

Museum of Science and Industry lesson “Ink Chromatography”

http://www.msichicago.org/fileadmin/Education/Learninglabs/lab_downloads/EvidenceLab_ink_act.pdf

Education.com “Candy Chromatography” lab

http://www.education.com/science-fair/article/chemistry_paper-chromatography/