Chromatography of Foods

Chromatography is a separation technique for mixtures based upon their relative affinities for stationary and mobile phases. This technique will be practiced by separating a mixture of FD&C dyes.

Materials
- Large coffee filters (15 cm)
- Toothpicks
- Jar lid (4 cm)
- Petri dishes
- Food coloring sets – 4 vials
- Grape & Orange Kool-Aid
- 1 lb. bag of M&M’s
- Transparency pens
- Pencil with graphite-based led

Procedure
1. On a piece of filter paper, use a pencil to trace a circle with the lid.

2. Use a pencil to number the spots on the filter paper for each of the substances to be tested. Your teacher will tell you how many positions you will need. Spread out the numbers so they are equal distances apart.

3. Record the substances to be tested by their appropriate number in the Data section.

4. For each of the substances to be tested place a small dot on the penciled line by dipping a toothpick into the colored liquid to be tested and touching the paper. Allow the spot to dry and then re-spot in the same position. (For the solids to be tested use the directions found in the Teacher’s Notes to prepare the samples.)
5. Use the pencil to punch a hole in the center of the coffee filter. Insert a folded piece of coffee filter into the hole as a wick.

6. Add water to the Petri dish so that it is approximately one-third full. Set the wick into the water with the filter paper resting on top of the disk. Allow the chromatogram to develop. The filter paper itself must NOT touch the water in the Petri dish.

7. For best separation of components, remove the chromatogram BEFORE the water reaches the edge of the filter paper (chromatograph). Record the colors in the data table. What trends do you note? (Are there primary colors in more than one sample?)

Data and Observations

<table>
<thead>
<tr>
<th>Substance</th>
<th>Center</th>
<th>Middle</th>
<th>Edge</th>
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</tbody>
</table>

*Tape your chromatogram on the back of this sheet.*

Questions

1. What kind of change took place? Was it chemical or physical? How can you tell if the change was chemical or physical? What could you do to test this hypothesis?
2. Why do we use chromatography?
3. How might a chemist use a similar process to analyze a sample?
4. What do the words heterogeneous and homogeneous mean? How do they apply to the substances in this lab?
5. What are two other mixtures that can be separated by ordinary physical means?
Teacher's Notes

Directions for preparation of test substances:

1. CHARTREUSE- 12 drops yellow food coloring & 1 drop green food coloring. Mix and apply to the paper strip with a toothpick.

2. TURQUOISE- 5 drops blue food coloring & 1 drop green food coloring.

3. M&M's- Place one drop of water on one M&M and use the toothpick to apply the coloring from that drop of water. Use a brown or tan M&M then repeat process for a green M&M.

4. PURPLE SAURUS REX- Mix an entire packet of unsweetened Kool-Aid with a few drops of water to make a thick paste. Apply to the paper strips with a toothpick.

5. ORANGE KOOL-AID- Mix an entire pack of unsweetened Orange Kool-Aid with a few drops of water to make a paste. Apply to the chromatogram with a toothpick.

Recommended pens to use for this lab are: Vis-à-Vis™ transparency pens (black, blue, red, green) or Flair™ black pens.

Results of Chromatographs:

<table>
<thead>
<tr>
<th>Coloring</th>
<th>Center</th>
<th>Middle</th>
<th>Edge</th>
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</thead>
<tbody>
<tr>
<td>Chartreuse</td>
<td>Blue</td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Turquoise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown M&amp;M</td>
<td>Yellow</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>Green M&amp;M</td>
<td>Blue</td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Purple Kool-Aid</td>
<td>Blue</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>Orange Kool-Aid</td>
<td>Yellow</td>
<td>Red</td>
<td></td>
</tr>
</tbody>
</table>

Answers to questions:

1. Chromatography is a physical change. Any of the separated colors could simply be remixed in water. Physical changes are reversible.
2. Chromatography is a method of separation for pigments or dyes by using different rates of evaporation for the component substances.

3. Chemists can use more complex forms of this method to analyze a sample to determine its contents.

4. Homogeneous matter is the same throughout and exists in only one phase of matter. Heterogeneous matter is composed of a mixture of substances that can usually be seen with the naked eye. Heterogeneous matter can be separated by physical changes.

5. Sand and salt can be separated by dissolving the salt in water and filtering the sand from the solution. Evaporation of the water would recover the salt. COLORED M&M'S can be separated by moving the differently colored pieces into separate piles.

Student Answers Will Vary

Safety Precautions
You should monitor the eating of the M&M's to be sure that the students are not consuming the ones used for the experiment or ones that have been handled in any way. You might divide the candies by pouring some into a small bathroom paper cup and pass them out to the students.

Disposal
All liquid materials may be poured down the sink. All solid materials should be placed in a trash can.