

# SPIN CHROMATOGRAPHY

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Chromatography is a method used to separate the components of a mixture. Although there are various types of chromatography, paper chromatography, thin layer chromatography, gas chromatography, high pressure liquid chromatography, and ion chromatography, the simplest and most economical method is paper chromatography.

In a paper chromatography experiment, a mixture containing two or more components is deposited on a piece of filter paper, a solid adsorbing substance. The components are adsorbed (i.e., held on the surface of the solid substance) to varying degrees which depend on the nature of the component, the nature of the adsorbant, and the temperature. Then the wash solvent (liquid) is added to the adsorbant and allowed to flow through it under applied or gravitational pressure, or by capillary effect. As the solvent passes the deposited mixture, the components tend to be dissolved to varying extents and are swept along the solid adsorbant. The rate at which a component will move along the solid depends on its relative tendency to be dissolved in the solvent and its tendency to be adsorbed on the solid. The net effect is that, as the solvent passes slowly through the solid adsorbant, the components of the mixture separate from each other and move along with the solvent forming rather diffuse zones or spots. With the proper choice of solvent and adsorbant, it is possible to resolve many complex mixtures into their components.

Normally, a paper chromatography experiment requires 15 to 60 minutes, depending on conditions, to separate a mixture. By the use of a spinning paper, and addition of solvent over a short time interval, a separation of the components of a mixture can be accomplished within 1 to 2 minutes. It should be noted that the separation is not as good as that resulting from a slower moving solvent in traditional paper chromatography, but depending on the care used, reasonable results can be obtained. This method can also be used simply as a form of laboratory amusement.

## MATERIALS NEEDED

### A. Felt-tip pen chromatography

Filter paper or chromatography paper. Circles up to 20 cm diameter (7.8 in) or rectangles 12.7 x 17.8 cm (5 x 7 in). Flat coffee filters can be used. (Note: 11 cm or 12.5 cm filter paper has been most commonly used)

Felt-tip markers, water color or permanent

Water

Alcohol: methanol (wood alcohol) - available at hardware or paint stores

ethanol (available as ethyl rubbing alcohol, 70% by volume, at drug stores)

2-propanol (available as isopropyl rubbing alcohol, 70% by volume, at drug stores)

25% alcohol solution. Prepared by diluting 35 mL of 70% ethyl rubbing alcohol to 100 mL with water.

droppers

pencil

Masking tape

Spin art machine, battery powered. (This investigation used an Ohio Art Company Twirl O Paint model 509 and a Natural Science Industries Paint-n-Swirl™ no. 7811)

### B. Food Color chromatography

Food colors (use food colors as available in grocery stores, or obtain powdered food colors from chemical supply companies or manufacturers) Food color solution concentrations are 0.1% by mass.

Cotton swabs (Q-tips or equivalent)  
1% sodium chloride solution

## **SAFETY PRECAUTIONS**

Wear safety goggles or glasses at all times in the laboratory.

When working with youngsters, it is highly recommended that only water soluble markers be used with water as the solvent.

Alcohol is flammable. Avoid sparks or flames.

Work in a well ventilated area to minimize alcohol fumes.

Do not attempt to stop the spin art turntable with your hand. Always allow it to stop by itself.

## **DISPOSAL**

Alcohol solutions can be stored in air-tight bottles. If necessary, dispose of any alcohol or alcohol solutions in the drain with running water.

Excess food color solutions can be disposed of in the drain with running water.

## **PROCEDURE**

Tape a piece of filter or chromatography paper to the turntable of the spin art machine. (Note: Roll four pieces of masking tape into cylinders, sticky side out, and place on the turntable of the spin art machine. The filter papers will stick to the tape. The tape will last for many experiments.)

Using a pencil, mark the approximate center of the paper.

Start the machine. While it is spinning, gently place the pencil on the paper approximately 0.5 to 1.0 cm from the paper center. This will result in a pencil circle on the paper that can be used as the origin for a semi-quantitative chromatographic separation.

### **A. Felt-tip pen chromatography**

The spinning paper can be marked with felt-tip pens. Several methods may be used:

1. Touch a felt-tip pen to the pencil circle on the paper.
2. Touch several different felt-tip pens to the pencil circle on the paper.
3. Stop the turntable and draw several short lines on the pencil circle using different colored felt-tip pens.
4. Touch felt-tip pens to the paper at several locations producing a series of concentric circles. If the felt-tip pen is moved toward the outer edge of the paper, spiral lines can be made. (This method is best for making designs rather than just separating colored inks into their components.)
5. Draw a design or picture on the paper before placing it on the spin art machine.

With the turntable spinning, using a dropper, slowly drop liquid onto the center of the filter or chromatography paper. A total of 1 to 2 mL of liquid will be needed. Try water only (this works best with water soluble markers). If the markers are not water soluble use a 25% alcohol-water solution, methanol, or 70% rubbing alcohol (either ethyl or isopropyl). Depending on the type of markers used, each liquid may produce different results.

The liquid should not wet the entire paper. After the liquid has been added to the paper, allow it to spin for about 30 seconds, then stop the machine. The final pattern, on the paper, will tend to be elliptical or amoeba-like in shape rather than circular.

Remove the paper, note the color separation that has occurred. Label the paper on a dry area with a pencil and allow it to dry.

NOTE: If this procedure is being used for entertainment purposes, drops of liquid can be placed anywhere on the spinning paper to produce designs.

## **B. Food Color chromatography**

The spinning paper can be marked with food colors. Several methods may be used:

1. Dip a cotton swab into some food color solution (pure colors or mixtures). Touch the cotton swab to the pencil circle on the paper.
2. Stop the turntable and use cotton swabs to draw several short lines on the pencil circle using different food color solutions.
3. Touch the cotton swabs to the paper at several locations producing as series of concentric circles. (This method is best for making designs rather than just separating food color mixtures into their components.)

With the turntable spinning, using a dropper, slowly drop 1% sodium chloride solution onto the center of the filter or chromatography paper. A total of 1 to 2 mL of liquid will be needed. The liquid should not wet the entire paper.

After the liquid has been added to the paper, allow it to spin for about 30 seconds, then stop the machine. Remove the paper, note the color separation that has occurred. Label the paper on a dry area with a pencil and allow it to dry.