Flower Pigments

Developers:

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Topic Area: Life Science

Grade Level: Grades 6 through 8

Goals:

1) To teach students how scientists use Thin Layer Chromatography (TLC) separations to identify substances.
2) To use TLC to separate the pigments found in flower petals.

Objectives:

Students will use TLC to separate the pigments found in various flower petals.

Vocabulary:

CHROMATOGRAM - a developed TLC plate.

CHROMATOGRAPHY - the process of separating a substance into its components.

FLAVINOIDS - pigments that give flowers color.

SOLVENT - a liquid that causes a substance to dissolve producing a solution.

SOLVENT FRONT- line seen as solvent moves up TLC plate.

TLC - chromatography using a thin layer of silica gel coated onto a plastic or glass plate.

Background:

FLAVINOIDS

Most plants at the height of the summer are green. This is because they contain chlorophyll. Yet various brilliant colors exist in the plant kingdom. Flowers and fruit appear colored because of the flavinoids contained in their cell walls. Flavinoids are pigments found in plants; most are seen in visible light; yet some are only visible under ultraviolet light. Some colors of flowers are made up of a number of flavinoids. For example, an orange carnation contains both a red and a yellow flavinoid.

Materials:

- sand
- mortar and pestle
- melting point capillaries
- silica plates (TLC plates)
  - Aldrich #112, 277-7
- 25- and 250-ml graduated cylinders
- pipets
- marking pens
- glass stirring rods
- vials/jars
- single-edged razor blade in a holder
- goggles

Flowers:

carnations (red, orange)

roses

geraniums

zinnias (any flower with many petals and vibrant color)

Chemicals:

isopropyl alcohol (99% rubbing alcohol) - Drug store.

butanol (Fisher Scientific Co. #A399-500)

acetic acid (Fisher Scientific Co. #A38-500)

water

Teacher Procedure:

1) To extract flavenoids from flowers, place petals into mortar and sprinkle with sand. Grind the petals into pulp with pestle. Add isopropyl alcohol in small amounts until a colored solution is formed. (CAUTION: a concentrated solution works best)

2) Pipet solution into a small vial, cap and label. Since solutions are sensitive to light and air, fresh solutions give best results (no more than 1 day old).

3) Cut silica plates into approx. 1cm x 8cm strips by using a single edged razor blade in a holder. Cut on the back side of the plate (plastic side). Only touch the edges of the silica plates as fingerprints will affect the separations.

4) Prepare solvent solution:

a) pour 100 ml of butanol into a jar

b) add 25 ml of acetic acid to the jar (acid is corrosive, handle with gloves)

c) add 33 ml of water

5) Pipet small amount of solution into 4-oz jars and cap.

6) Distribute silica plates and 4-oz jars of solvent solution to students.

Student Procedure:

1) Use melting point capillary tubes to spot the TLC plate. Dip one end of the capillary tube into the plant extract solution (the tube will automatically draw a small amount up into the tube). Quickly touch the end of the tube to the plate to dispense a drop onto the plate. Let dry and repeat a few times to get a concentrated spot. Spot the plate about 2 cm above the bottom of the plate (the spot must be above the level of the solvent in the 4-oz jar).

2) Place the spotted silica plate into the solvent solution and quickly replace the cap.

3) Observe the pigment spot as it moves up the plate with the solvent front.

4) Remove plate from jar when solvent front is approximately 1 cm from the top of the TLC plate.

5) Record observations on chart provided. Using crayons or colored markers to reproduce the chromatogram on the chart is suggested.

6) Discuss observations.

Discussion Questions:

1) What effect did the solvent solution have on the spot?

2) How do the pigments observed on the plate differ from the actual color of the flower?

Extensions:

1) Provide students with two TLC plates with the same spot. They can then place the plates in the two different solvent systems and determine if the spot contains chlorophyll or flavinoids. A good comparison would be between a red pepper extract and an orange carnation . The spots are similar in color but the red pepper spot will only move in the chlorophyll solvent. (See next lesson on Chlorophyll.)

2) Provide students with mystery flavinoid spot. The students can then determine which extract they have by comparing the chromatogram to the chart they have made.

3) Flowers also have flaviniods which are visible only under U.V. light. This can be an added lesson if a light source is available.

Data

	Flower Type	**Spot Color**	**Chromatogram**
1			
2			
3			
4			
5			