Lab 6: Paper Chromatography

Pages145-154

Pre-lab page 151

No Post lab – Chromatogram must be turned in attached to lab report

Chromatography

- Chromatography is an analytical technique used to separate the components of a mixture.

- All forms of chromatography work on the same principle.

Chromatography

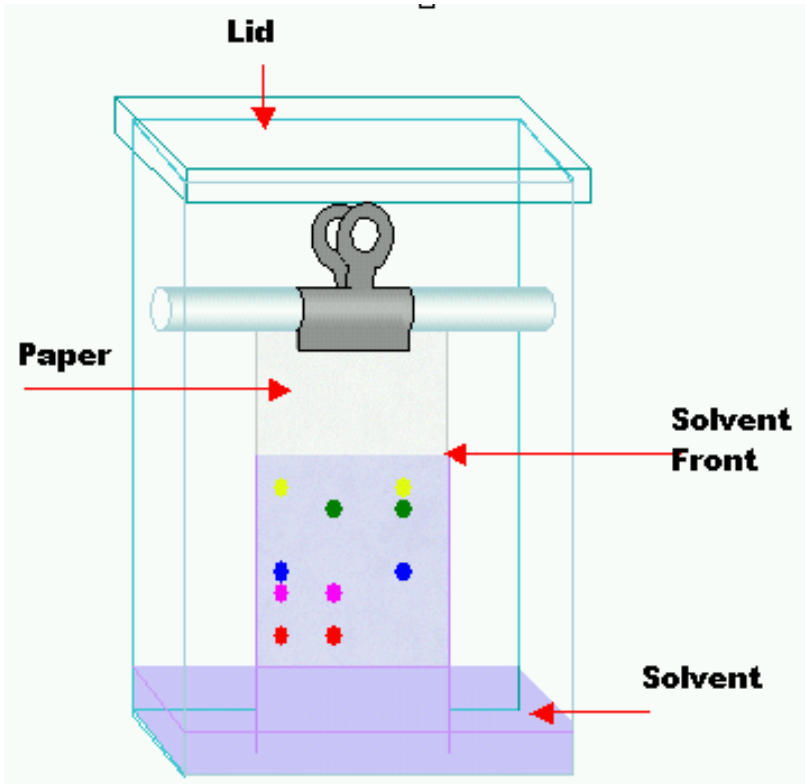
- They all have a ***stationary phase*** (a solid, or a liquid supported on a solid) and a ***mobile phase*** (a liquid or a gas).
- The mobile phase flows through the stationary phase and carries the components of the mixture with it.
- Different components travel at different rates

Paper Chromatography

- In paper chromatography, the stationary phase is a very uniform absorbent paper.

- The mobile phase is a suitable liquid solvent or mixture of solvents.

Technique



- The ascending strip technique.

Horizontal circular technique

- With filter paper it is necessary to use a "wick" (a small piece of rolled filter paper) to pull the solvent onto the filter paper.
- The wick is inserted through a small hole in the center of the filter paper. The paper is spotted just off the center of the paper.
- The filter paper is placed over the top of an evaporating dish or petri dish with the wick resting in the solvent.
- A second petri dish can be inverted over the top to slow evaporation of some solvents. Four or five samples can be tested at one time using this setup.

Experimental Method

- Samples to be identified are spotted on to a pencil line drawn on a sheet of chromatography paper.
- An unknown sample is also spotted onto the same line
- The paper is suspended in a container with a shallow layer of a suitable solvent or mixture of solvents in it.
- It is important that the solvent level is below the line with the spots on it.

- Using a pencil, draw a line across the plate at ~ 0.5 cm.
- This is the origin: the line on which you will "spot" the plate

- Under the line, mark lightly the name of the samples you will spot on the plate, or mark numbers for time points.
- Leave enough space between the samples so that they do not run together,

How does chromatography work?

- The basis of chromatography is that molecules are adsorbed onto the stationary phase at different rates, based on solubility.

- This causes separation of the mixture.

What separates the compounds as a chromatogram develops?

- As the solvent begins to soak up the plate, it first dissolves the compounds in the spot that you have put on the base line.
- The compounds present will then tend to get carried up the chromatography plate as the solvent continues to move upwards.

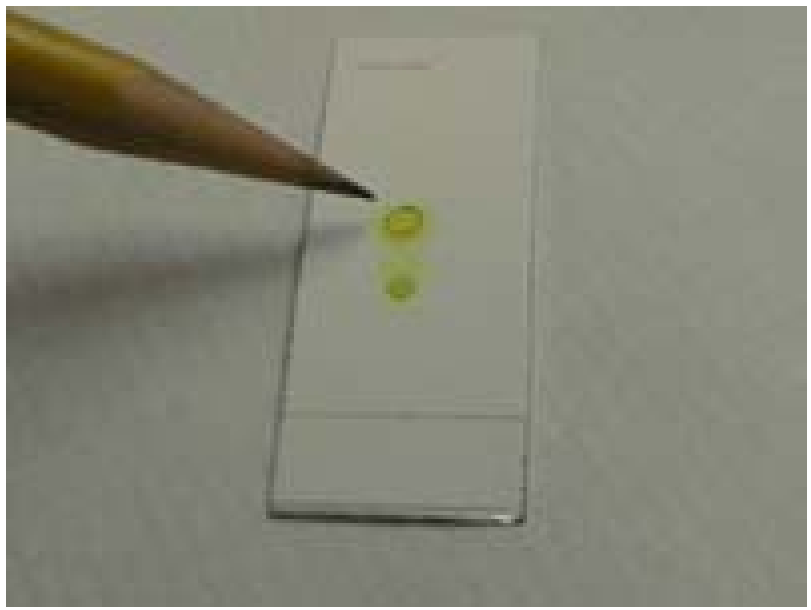
- How fast the compounds get carried up the plate depends on two things:
- How soluble the compound is in the solvent. This will depend on how much attraction there is between the molecules of the compound and those of the solvent.
- How much the compound sticks to the stationary phase.
- This will depend on how much attraction there is between the molecules of the compound and the stationary phase.

- Once the samples have been ‘spotted’, place in a covered beaker.
- The container is covered to make sure that the atmosphere in the beaker is saturated with solvent vapour.
- Saturating the atmosphere in the beaker with vapour stops the solvent from evaporating as it rises up the paper.

Tips

- Make sure that the solvent level in the beaker is not too deep.

- Remove the chromatogram when the solvent level is ~ 0.5 cm away from the top of the paper.



- Draw a pencil line at the end of the solvent front.
- Circle the spots.

Rf values

- Some compounds in a mixture travel almost as far as the solvent does; some stay much closer to the base line.
- The distance traveled relative to the solvent is a constant for a particular compound as long as you keep everything else constant - the type of paper and the exact composition of the solvent, for example.

R_f values

- The distance traveled relative to the solvent is called the R_f value.
- For each compound it can be worked out using the formula:

$$Rf = \frac{\text{Distance traveled by compound}}{\text{Distance traveled by solvent}}$$

Example

- If one component of a mixture traveled 9.6 cm from the base line while the solvent had traveled 12.0 cm, then the R_f value for that component is:

$$Rf = 9.6 / 12.0 = 0.8$$