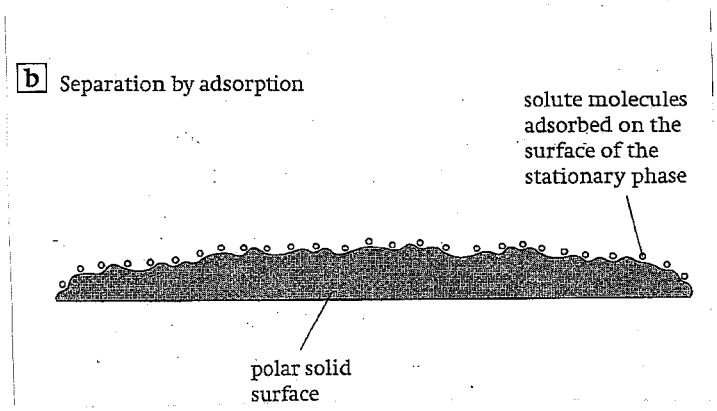
Thin-layer chromatography (TLC)

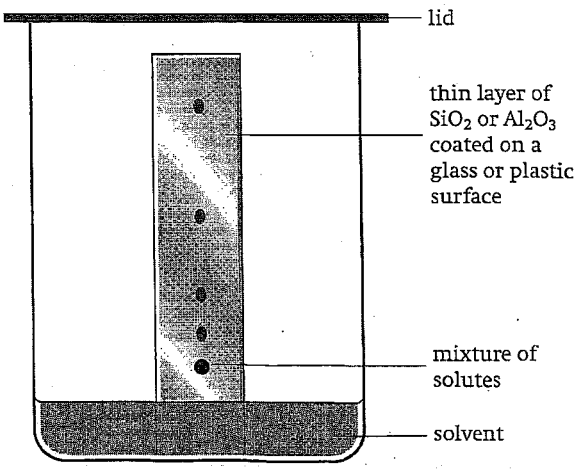
In TLC, the stationary phase is a solid which adsorbs solute molecules onto its surface.



Adsorption chromatography.

The solid stationary phase is usually alumina (Al_2O_3) or silica (SiO_2), which is made into a slurry with water and spread onto a microscope slide. This is then put into an oven where it dries out into a solid white coating on the glass.

The chromatogram is then developed with a solvent in a tank.



Polar molecules has a greater attraction for a polar solid used as the stationary phase and they are adsorbed more strongly onto its surface. Therefore they travel more slowly up the thin layer of alumina or silica and seperation occurs.

Solutes are located on the chromatogram and identified by comparing with standard known substances or by calculating R_f values.

Although TLC is normally described as adsorption chromatography, some partitioning does occur if water is present. Both dried alumina and silica can become re-hydrated. When this happens, water also act as a partitioning stationary phase together with the adsorbing stationary solid phase.

TLC is quicker than paper chromatography and it can be used on smaller samples.

The thin layer can be made from different solids, a wide range of mixtures can be seperated and the components of the mixtures identified by

careful choice of both the stationary and mobile phases.

For example, a thin layer of silica will separate chlorinated insecticides, steroids or alkaloids such as morphine and opium.

Thin-layer chromatography can also be used to select the conditions for larger-scale seperations. Different combinations of stationary phases and mobile phases can be tested quickly to find the most effective method for particular seperation.

TLC is mainly used for the seperation of organic compounds and has applications in clinical diagnosis, forensic testing and quality control.

Exercise 1

State two advantages of thin-layer chromatography over paper chromatography.

Workings

Advantages of TLC over paper chromatography.

1) TLC is faster than paper chromatography.

2) The thin layer may be made from different solids. So a wide variety of mixture can be seperated by careful choice of the mobile and stationary phases.

3) TLC can be used for quickly selecting the best conditions for large-scale seperations.

Exercise 2

The results of a thin-layer chromatography seperation on silica gel are shown below.

Compound	Distance travelled (cm)
compound 1	1.5
compound 2	9.1
solvent	12.5

Calculate the Rf values of the compounds and comment on their values.
(Hint: consider the nature of the thin layer)

Workings

Compound 1, $R_f = \frac{1.5}{12.5} = 0.12$

Compound 2, $R_f = \frac{9.1}{12.5} = 0.73$

Compound 1 has a greater affinity for the thin layer than compound 2. As the thin layer is silica gel which is polar, compound 1 is more polar than compound 2.