ChemBam

Chromatography of painkiller drugs

AIM

- For students to understand how TLC can be used to identify the drugs within mixed painkiller tablets

- For students to understand that the drugs **absorb** UV light, and appear as dark spots on the fluorescent TLC plates due to quenching the plate fluorescence

- For students to understand that UV is only one way of visualising TLC plates; chemical stains, such as permanganate can be used to show up certain chemicals

QUESTIONS – answer guide for teachers

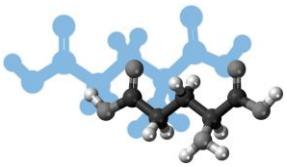
1. The R_f values calculated from the experiments recorded in the photographs on the website were: aspirin (0.55), paracetamol (0.38), caffeine (0.15), and ibuprofen (0.64). Variation can be found with different silica plates, but students should see the same trend in the order of elution up the plate, and can determine their unknowns easily by comparisons on the same plate. The plates used on the website were purchased from VWR, catalogue number: 1.05554.0001, unmodified silica gel 60, aluminium backed, with fluorescent indicators, supplied by Merck Millipore as 200x200 mm plates, 25 pack. Reagent grade ethyl acetate, from Fisher Scientific, was used.

2. All the structures contain alternating double-single C-C bonds, which tend to make the molecule absorb UV light by causing electronic transitions of the pi-electrons.

3. The stationary phase is the silica on the TLC plate, and the mobile phase in this system is the ethyl acetate eluent.

4. Most ink will dissolve in ethyl acetate and run up the plate, all over your TLC spots.

5. Paracetamol stains easily with permanganate, giving a yellow/brown spot, without heating- this helps to identify the paracetamol, which runs quite close to aspirin. The paracetamol easily oxidises, and stains quickly with the permanganate solution. (Students may recall that MnO_4^- contains Mn(VII), which is a strong oxidising agent, and reacts with chemicals that can oxidise, forming MnO2 (yellow-brown) or Mn2+ (white). i.e. alcohols, ethers, esters, alkenes, ketones, carboxylic acids, amines, amides. Ibuprofen appears as a faint white spot, and aspirin develops into a yellow/brown spot after some time, or with heating – heating the plate is not easy though, as it is easy to heat it too much and the whole plate will turn brown)



6. This depends upon what was supplied as X and Y:

   In this example X = Beechams powder (aspirin and caffeine), and Y = home-brand supermarket paracetamol and caffeine tablet:

Painkiller	**R_f**	**Did it immediately stain with permanganate?**
Aspirin	0.55	Yellow after standing some time
Paracetamol	0.38	Immediately yellow
Ibuprofen	0.74	White after standing
Caffeine	0.15	no
Unknown X	0.55 0.15	Yellow after standing some time no
Unknown Y	0.38 0.15	Immediately yellow no

7. Rf is affected by the adsorbent used (whether silica or alumina is used), the size of the silica particles on the plate, and the eluent used; changing the solvent system would affect the Rf.