Thin Layer Chromatography (TLC): tools for teaching organic chemistry lab

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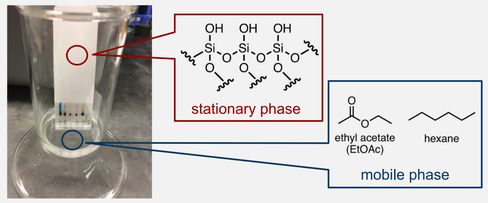
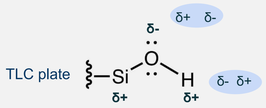
TLC: the method



Chemical concept
attractive force between (oppositely charged) **dipoles**



polar molecules "stick" to silica more than non-polar molecules due to these favorable electrostatic interactions

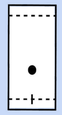
physical method of separating a mixture by passing it through a **stationary phase** (i.e., SiO_2 on TLC plate) using a **mobile phase** (i.e., solvent) where the components move at different rates

Usefulness of TLC

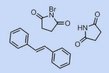
- Monitor reaction progress and rates
- Assess purity of a compound
- Identifying compounds
- Determining effectiveness of extractions

TLC module overview

week 1
skill-building
learn how chemical structures impact retention on the TLC plate



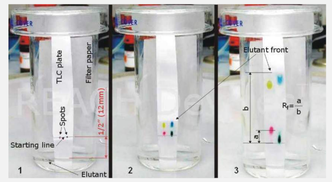
week 2
practicing
identify TLC conditions to separate compounds in a reaction

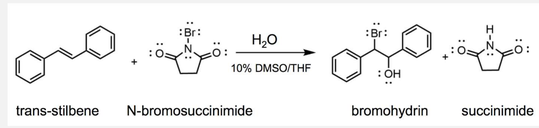


week 3
apply
Ask & answer your own research question about concentration and reaction rates

Carry out organic reaction and monitor it by TLC

Hands-on-minds-on
Deliberate ***step-wise approach*** to building skills and understanding

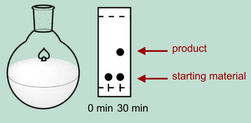




Course Objectives

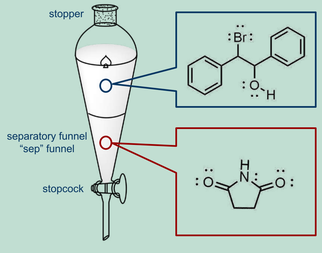
- Give students the hands-on experience to learn organic chemistry
- Highlight the importance of organic chemistry in real-world contexts
- Develop students' scientific mindset
- Develop teamwork skills (i.e. working cooperatively, collaboratively, and collectively)

Module A
Thin layer chromatography



Goal: Design procedure to separate product from a reaction mixture

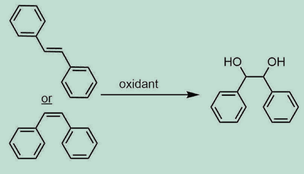
Module B
Liquid-liquid extraction



Goal: Design procedure to extract contaminant from water

Module C
Green Chemistry

Atom economy
Prevention of waste
Safer solvents

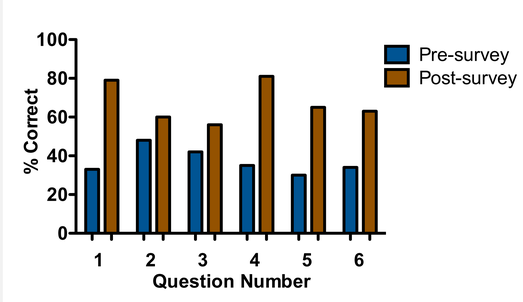


Goal: Design a ***greener*** route to form the targeted diol

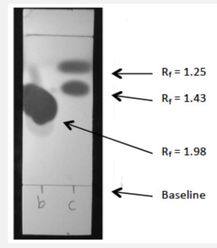
- *Students gain a deeper understanding of course material when they grapple with questions as opposed to when they passively listen to answers*
- *Active learning -- students retain knowledge and information much longer and they are better able to apply their knowledge broadly*
- *Meaningful learning – building off skills from previous labs*

Assessment of Student learning

(1) Content survey



(2) Writing assignment: Blog Post
Alternative to a lab report



Students must:

- Identify which spot corresponds to each compound
- Correct data analysis errors and advise on what to do differently on future TLC work
- Provide a scientific principle-based rationale for suggested TLC conditions

Highlights of TLC module:

- Research-driven, active-learning adventure
- Experimental focus is on renewable resources and sustainability (Green)
- Students work in groups
- Exposure to traditional techniques of organic chemistry (chromatography, distilling, extraction, etc.)
- Less is more. Students spend more time on fewer techniques. Students perform each lab at least twice.

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