Diving Deeper into InkWorldName of Module

AIChE Community Affiliation (i.e. Northeastern University AIChE Student Chapter)
Name(s) of Presenter(s)

I. Objective	To introduce chromatography to students in a fun method.
II. Materials	a) Paper Towel b) 3 black markers from different brands. c) 1 Tall transparent glass cup d) 50 mL Water e) 1 pencil f) Tape
III. Procedure	1) Fill the cup with water. 2) Cut the paper towel so that the width fits onto the glass without touching the side of the glass. Also, make sure the length is not longer than the height of the glass. Prepare 2 of these. 3) Make a mark with each brand of markers on the prepared paper towel at about 2 cm above the bottom edge with every type of black marker. 4) Secure the top side of the paper towel with tape and stick it to the body of a pencil. 5) Dip the paper towel slowly into the cup and make sure not to immerse the markings into the water. 6) Let the paper towel hang and observe the water slowly absorbed by the paper towel. 7) Compare the color produced from each marker.

	8) Ask participants: “What makes the marking travel up the paper towel?”, “What makes the water rise even though only the tip touches the water?”, “How is chromatography applied in Chemical Engineering?”
IV. Theory	To demonstrate the concept behind how chromatography works. The results of the chromatography changes depending on the size of the molecules in the pigment of the different markers. In addition, the solubility of the marker’s pigment can also be determined by performing chromatography. If the substance is soluble, then it will travel the farthest to the top of the paper. Whereas, if the substance is not soluble, then it will not move far up the paper. Chromatography is not only limited to the field of Chemistry. It also plays a vital role in separations which is an essential process in a chemical engineering plant. The concept of solubility and size of molecules are key properties that are always discussed in chemistry courses. As a result, this experiment will serve an excellent introduction to these concepts in an exciting way that will keep the students engaged.

Diving Deeper into InkWorld

Iowa State University AIChE Student Chapter

Teresa Wijaya, Divya Christy

Introduction

Demonstrating the concept behind how chromatography works. The results of the chromatography changes depending on the size of the molecules in the pigment of the different markers. In addition, the solubility of the marker's pigment can also be determined by performing chromatography. If the substance is soluble, then it will travel the farthest to the top of the paper. Whereas, if the substance is not soluble, then it will not move far up the paper.

Chromatography is not only limited to the field of Chemistry. It also plays a vital role in separations which is an essential process in a chemical engineering plant.

The concept of solubility and size of molecules are key properties that are always discussed in chemistry courses. As a result, this experiment will serve an excellent introduction to these concepts in an exciting way that will keep the students engaged.

Procedure

1) Fill the cup with water.

2) Cut the paper towel so that the width fits into the glass without touching the side of the glass. Also, make sure the length is not longer than the height of the glass.

3) Make a mark with each brand of markers on the prepared paper towel at about 2 cm above the edge of the paper towel.

4) Secure the top side of the paper towel with tape and stick it to the body of a pencil.

5) Dip the paper towel slowly into the glass and make sure not to immerse the mark into the water.

6) Let the paper towel hang, and observe the water slowly absorbed by the paper towel.

7) Compare the color produced from each marker.

8) Ask participants: "What makes the marking travel up the paper towel?", "What makes the water rise even though only the tip touches the water?", "How is chromatography applied in Chemical Engineering?"

Result

Discussion

What makes the marking travel up the paper towel?

<u>Left Mark</u>

- This marking is made by an erasable white board marker.
- This marker is insoluble since it does not travel far up the paper towel.
- In a chromatography test, the substance which is a heavier molecule and insoluble will not travel up the chromatography paper.

<u>Middle Mark</u>

- This marking is made by a washable marker.
- This marker is soluble since it moves pretty further up the paper towel.

- In a chromatography test, the substance which is a lighter molecule and soluble will travel far up the chromatography paper.

Right Mark

- This marking is made by a permanent marker.
- This marker is insoluble since it does not travel far up the paper towel.
- In a chromatography test, the substance which is a heavier molecule and insoluble will not travel up the chromatography paper.

What makes the water rise even though only the tip touches the water?

- The water molecules are absorbed by the pores of the paper towel against the direction of gravity force by a process called capillary action.

How is chromatography applied in Chemical Engineering?

- It is used in separations of chemical molecules in a plant.

Safety Assessment Form

Basic Information:

AIChE Community Affiliation: *Student Chapter Name, Local Section Name, Other AIChE Community Name (Technical Entities, Divisions, Forums, Committees, Operating Councils, etc)., Undergraduate Student Member(s), Graduate Student Member(s), Professional Member(s)*	Iowa State University AIChE Student Chapter
Primary Contact Name:	Teresa Wijaya
Primary Contact Email Address:	teresa@iastate.edu
Name of Module:	Finding the pigments that build a color
Brief Description of Module:	Using the chromatography method, students will analyze the pigments that build a color.
Does your module have a demonstration or experiment component? *Indicate Yes or No*	Yes
Briefly describe any interactive portions of your module:	Students can choose which color to observe and do most of the chromatography process.

Materials Used/Waste Generated:

If you need additional space, please insert additional rows and continue numbering sequence.

	Item *Include concentration where applicable*	**Chemical State** *Where applicable, specify solid, liquid, or gas. Otherwise write "N/A"*	**Estimated quantity used** *include units where applicable*	**Estimated amount of waste generated** *Include units where applicable*	**Waste Classification** *Where applicable, specify Acid, Base, Organic, Metal, Oxidizer, Other (include explanation if other), or Regular trash*
1	Tap water	Liquid	50 mL	50 mL	Regular trash
2	Paper towel	N/A	1 sheet	1 sheet	Regular trash
3	Markers	N/A	3 different brands black markers	N/A	Regular trash
4	Clear plastic cup	Solid	1 piece	1 pieces	Recyclable
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Access to 120V power outlet:

Access required? *Respond Yes/No in the space provided*	**No**
If yes, specify reasoning/any equipment it will be used for: *Please note that outlets requested to plug in laptops/monitors will not be granted*	**N/A**

Hazard Identification & Mitigation:

Please ask yourself the following questions prior to completing the below table. ***1) What can go wrong?*** *(Identification of Hazards);* ***2) How bad can it be?*** *(Severity of Hazards);* ***3) How easily or often can it happen?*** *(Frequency or Likelihood);* ***4) How is the risk managed?*** *(Both preventive & mitigation safety measures)*

Hazards: *Describe any hazards associated with the above list of materials used and waste generated and any other hazards associated with the execution of the module*	- **Water spill that can cause slips/ trips** - **Food poisoning (e.g. markers swallowing)**
Safety Measures: *Describe any safety measures that will be taken to mitigate hazards identified above*	- **Wipe up all spills immediately** - **Use all equipment and supplies carefully and responsibly**
Required PPE: *Specify required PPE, who is required to use it, and within what proximity*	-

Certification:

I certify that this module is safe for presentation <u>to</u> K-12 community members (including students, parents, and educators) and to AIChE volunteers and community members. I additionally certify that this module is safe for presentation <u>by</u> K-12 community members (such as parents & educators) and by AIChE volunteers and community members.

Teresa Wijaya		Mon, Aug 30, 2021
Primary Contact Name	**Primary Contact Signature**	**Date**