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Thin Layer Chromatography for Forensic Science

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Honors Project

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Thin layer Chromatography is often used to find what compounds are in a substance or what the identity is when compared to a known compound. Chromatography is used to separate mixtures of substances into their components (Clark, 2007). It is often used for chemistry laboratory experiments

The purpose of the project was to develop a specific recipe for the solvent for the TLC that would be most effective for separating the ink of a Pilot Razor Point marker pen to use for Parkland College's Forensic Science lab experiment. The original recipe was good but not as effective as the class would want ideally.

I changed the amounts of the alcohol, acetone, water, and ammonium hydroxide (1 M) in the recipe until I found the solution that worked the best. The best solution separated the pen's ink into many distinct and colored dots, which showed the separation of the compounds into their components.

This project was a very interesting experience for me. I got to learn more about what it's like to work in a chemistry lab. I learned important things about lab safety and how to use chemicals. I had to make sure I took every precaution necessary and also had to keep track of all the chemical waste. It took a lot of attention to detail and careful consideration. There was some analytical thinking involved too, when trying to decide what changes to make to the recipe and how much to change it. I enjoyed working with my instructor, Christina Beatty, to find a good solution for the lab that needed some improvement. I am glad to say that the goal was accomplished- with the help of Kenna and Christina, I was able to

find several great new recipes for a solution that will likely be used in future forensic science class labs at Parkland.

The safety for the chemicals used during the project:

Ammonium Hydroxide: Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant), of ingestion.

Butylalcohol: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation

Acetone: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Procedure for the project

The procedure had two parts- preparing the **solution** and **TLC plates.**

For the ink plates I used the Thin Layer Chromatography paper plates. I drew a line lightly with a pencil one centimeter above the bottom. It was important to draw lightly because that would prevent the paper layer from breaking as it is pretty fragile. Then, less than a centimeter apart, I mark a tiny line in the middle of the line going across the bottom, to have indicators of where I should place the ink.

To get the ink, I soaked the Pilot Razor Point marker pen (the ink holder) in acetone in a vial. After the ink was kept in the acetone for about half an hour, I diluted it once, taking two pipette fulls of the ink solution and two pipette fulls of Acetone into another vial and mixed that. This dilution was done because I compared the diluted one with the non-diluted one, and it had better results.

The ink was put in small quick dots on the TLC plates on the marks, they were dotted 3 times each. There were four ink dots on each plate. The plates were also named in order to keep track of which was going into which solution.

For preparing the solution, I had a recipe that was given by the instructor. There was an alcohol part, acetone, water, and 1M Ammonium Hydroxide. These were all mixed together by using graduated cylinders for each of the substances and pouring them into a small plastic bottle of about 250 mL. Each bottle contained the components and safety hazard info in order to ensure safety of anyone who might have come across the bottles in the lab area.

For each trial, something in the recipe was changed- either the amount of alcohol/acetone/ammonium hydroxide/water or I had different types of alcohol replace the original.

During the first trials, I replaced the alcohol with the following alcohols:

Butylalcohol, Amylalcohol, Cyclohexane, Ethylalcohol. During these trials, I also tried putting different amount of dots of ink on the TLC plates to see which showed the clearest result and separation of the components of the ink. I found that 3 small dots worked the best.

After changing the types of alcohol, I started changing the amounts of the other ingredients by doubling or decreasing by half. The results of the trials are in the pictures, in chronological order, with the last ones being the best options. The best recipe will be highlighted in a table.

Finally, to set up the chamber for the experiment, I took a piece of filter paper and cut it in half and put it in a beaker that was approximately 250mL. I filled it with 25mL with the specific solution I was working with. Then I put a beaker that was several times smaller inside, upside down to serve as something to hold up the TLC plate that I would put in against the smaller beaker for it to stay upright. The large beaker was then closed with a lid to let the separation of chemicals take place on the TLC plates. The plates were kept in the chamber for 20 minutes and were taken out and dried. A line was drawn where the solution had reached the plate.

Original recipe:

Substance	Amount in mL
Alcohol	209 mL
Acetone	146 mL
1M Ammonium Hydroxide	42 mL
Water	125 mL

This was scaled down by 5 times because the amounts were massive and we didn't need that much of the solvent

Substance	Amount in mL
Alcohol	41.8
Acetone	29.2
1M Ammonium Hydroxide	8.4
Water	25

This scaled down recipe was used several times, but mostly it was scaled even more because we didn't need so much of it.

Substance	Amount in mL
Alcohol	20.9
Acetone	14.6
1M Ammonium Hydroxide	4.2
Water	12.5

After many trials that are depicted by the pictures, I figured out that the best results came from a doubled amount of alcohol (Butylalcohollooked best), doubled acetone, same Ammonium hydroxide, and no water. The reason it make sense to take out water is because the pen's ink isn't water soluble, and the trial showed that this gave a good separation.

The Final recipe:

Substance	Amount in mL	Percentage
Butylalcohol	41.8	56%
Acetone	29.2	39%
Ammonium hydroxide (1M)	4.2	6%
Water	0	0%
Total	75.2	100%

Pent type: Pilot Razor Point Marker

The best solutions:

#1. (WITH OTHER INK, good but ink doesn't have as many colors)

Substance	Amount in mL
Butylalcohol	41.8
Acetone	29.2
Ammonium hydroxide (1M)	4.2
Water	12.5

#2

Substance	Amount in mL
Butylalcohol	41.8
Acetone	29.2
Ammonium hydroxide (1M)	8.4
Water	25

#3

Substance	Amount in mL
Butylalcohol	41.8
Acetone	29.2
Ammonium hydroxide (1M)	8.4
Water	25

#4

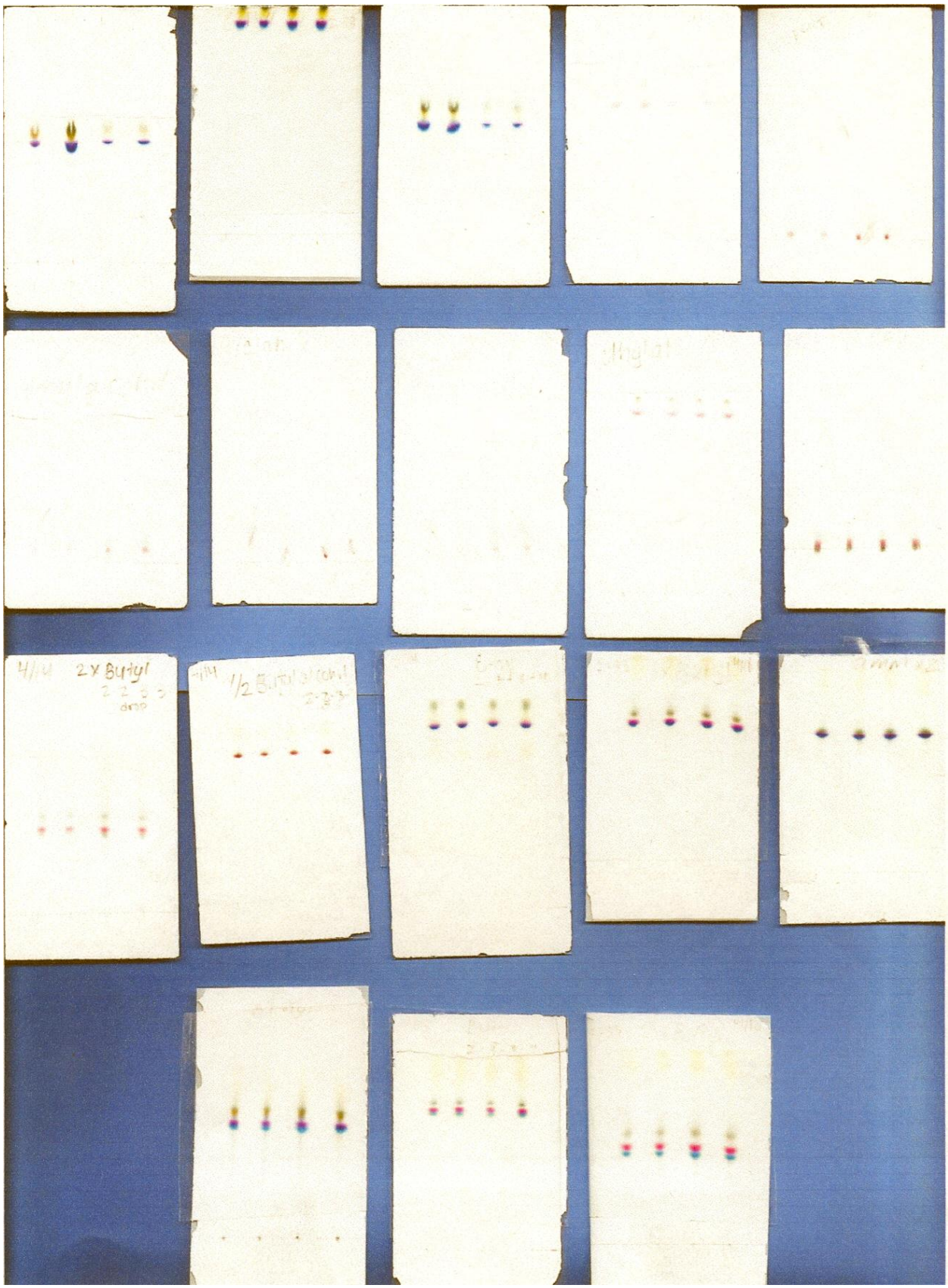
Substance	Amount in mL
Butylalcohol	41.8
Acetone	29.2
Ammonium hydroxide (1M)	4.2
Water	12.5

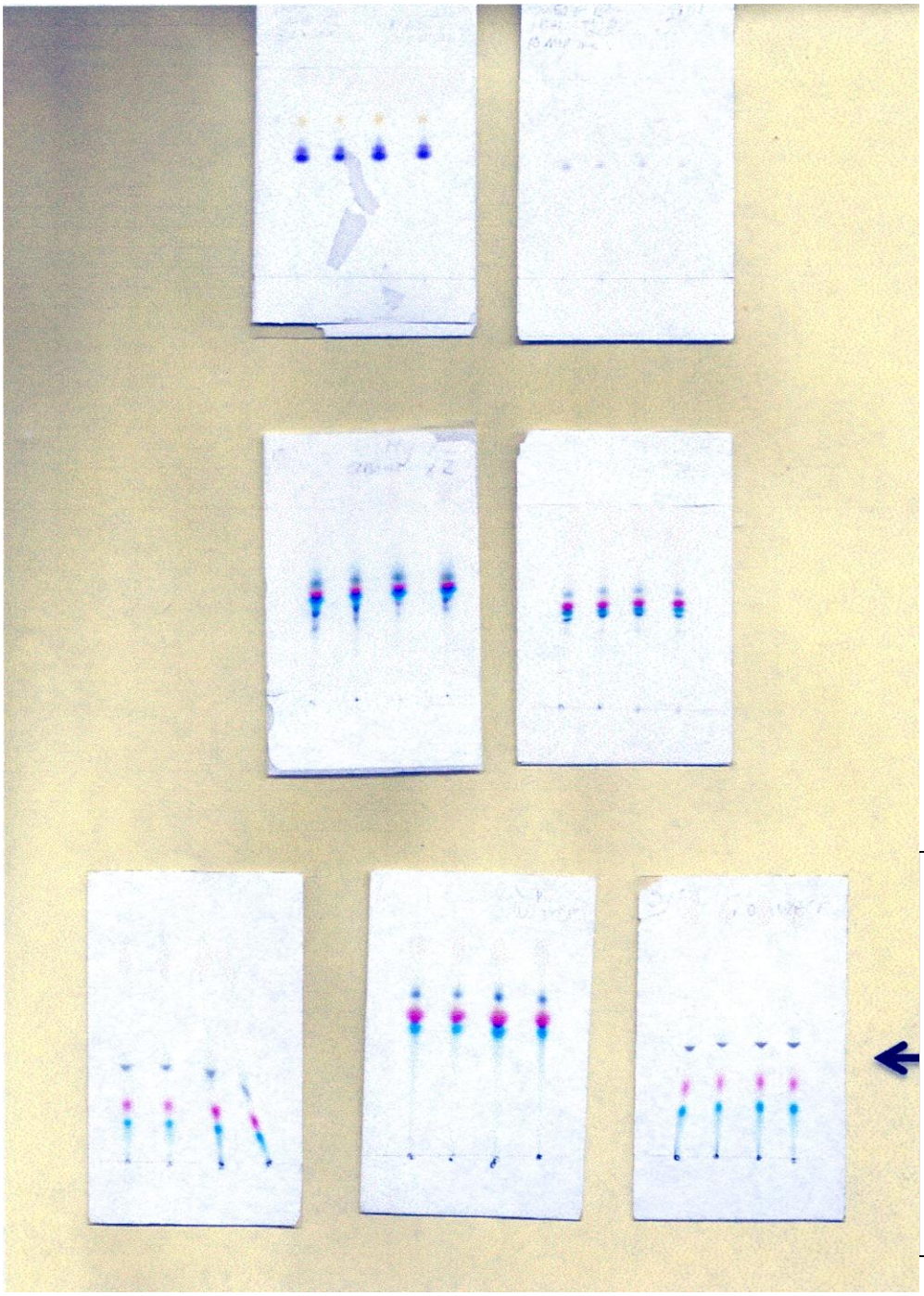
#5

Substance	Amount in mL
Butylalcohol	41.8
Acetone	14.6
Ammonium hydroxide (1M)	4.2
Water	0

#6

Substance	Amount in mL
Butylalcohol	41.8
Acetone	29.2
Ammonium hydroxide (1M)	4.2
Water	0


2x Butyl
1/2 Butyl alcohol



Best Ones

On the left: recipe but with water, and the one on the right too.

One in the middle had no water.

Butylalcohol	41.8
Acetone	29.2
Ammonium hydroxide (1M)	4.2
Water	0

Works Cited

Clark, Jim. “Thin Layer Chromatography.” Thin Layer Chromatography. N.p., 2007. Web. 14 May 2014. http://www.chemguide.co.uk/analysis/chromatography/thinlayer.html.