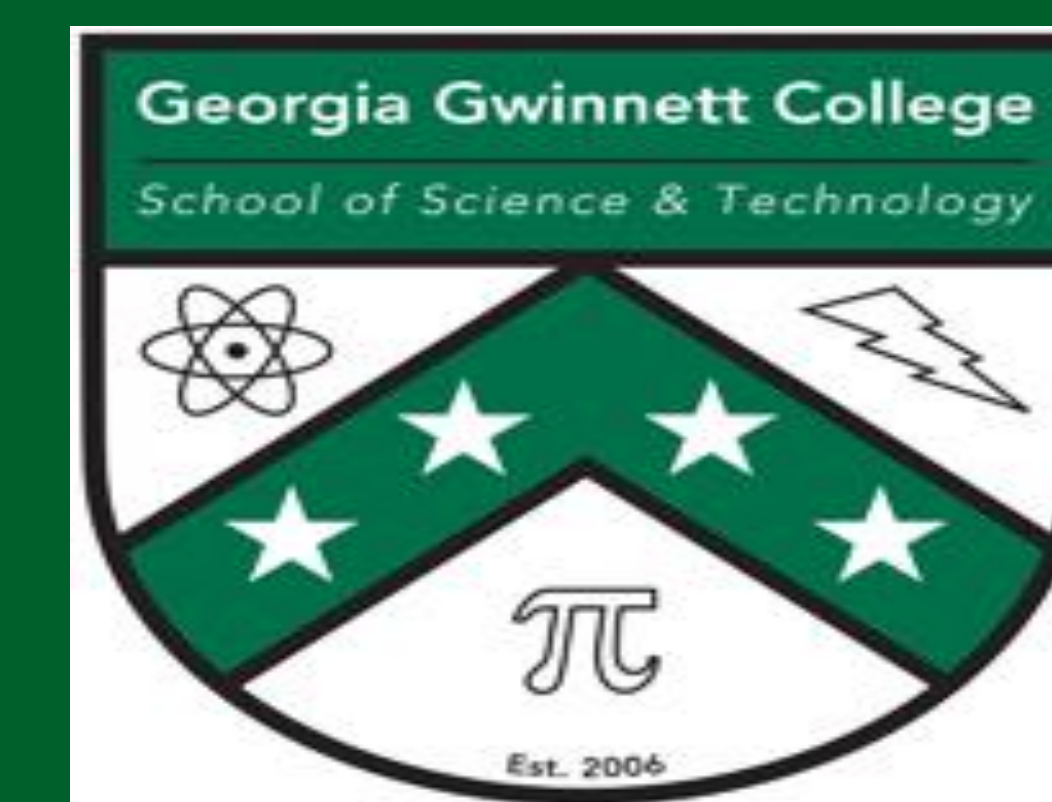




Fluorination of Aminoanthraquinone using Selectfluor

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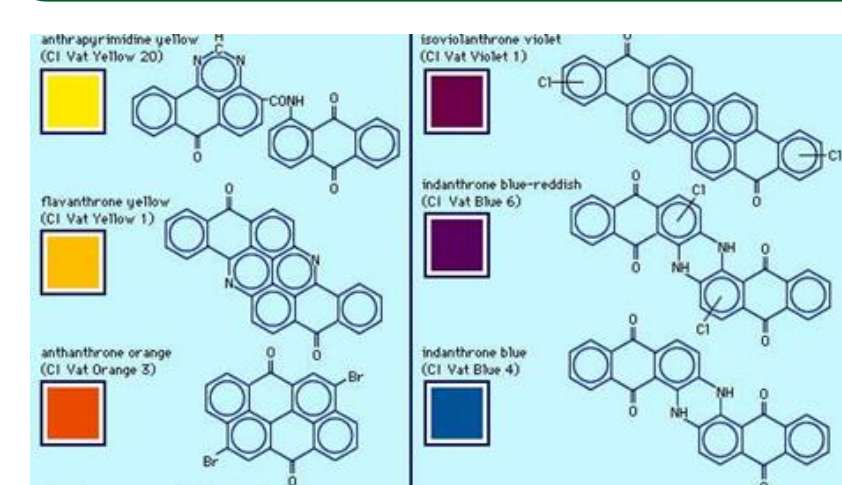
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Abstract

Anthraquinone derivatives are reported to have pharmaceutical properties. In this experiment, 1-aminoanthraquinone was reacted with the fluorinating reagent Selectfluor. The reaction was conducted under varying conditions using one equivalent of Selectfluor. Two reactions were conducted at room temperature that has been shown to form two products. Another reaction between 1-aminoanthraquinone with Selectfluor was conducted at 60 °C, which shows the formation of three products. The reaction products were purified using column chromatography and were characterized using spectroscopy.

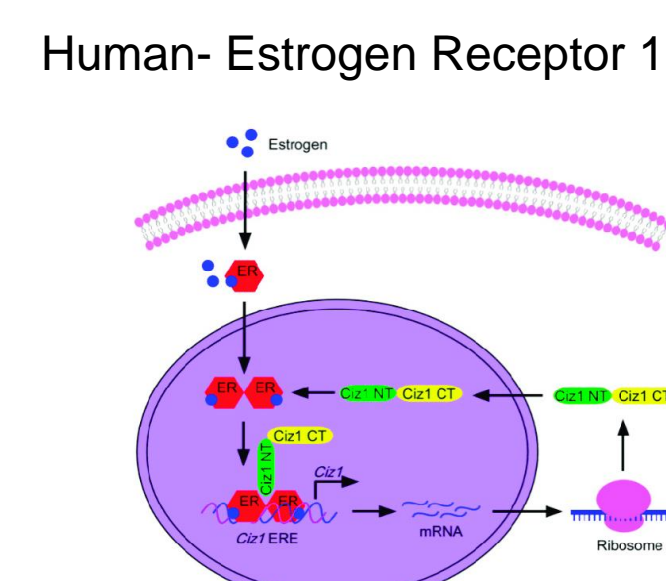
Introduction



Commercial uses

- Anthraquinones are typically used as colorants in drugs and personal care products such as tattoo ink and hair dye

1-Aminoanthraquinone



Pharmaceutical Applications

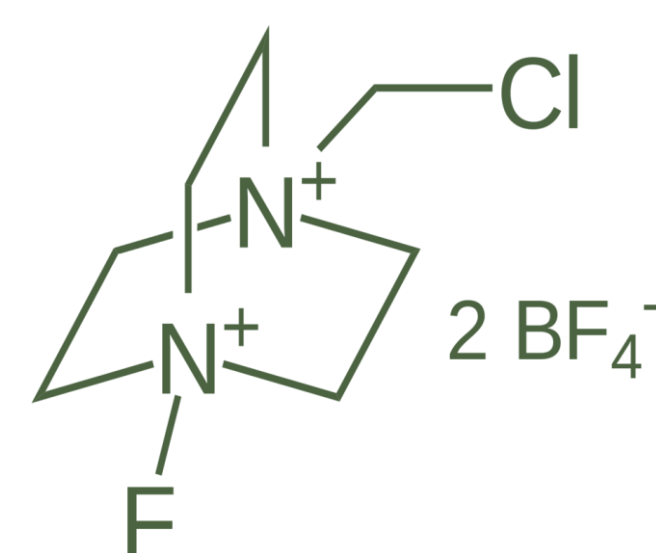
- Capable on increasing protein activity³
- An additional polar region should make the compound softer

Present work and designing strategy

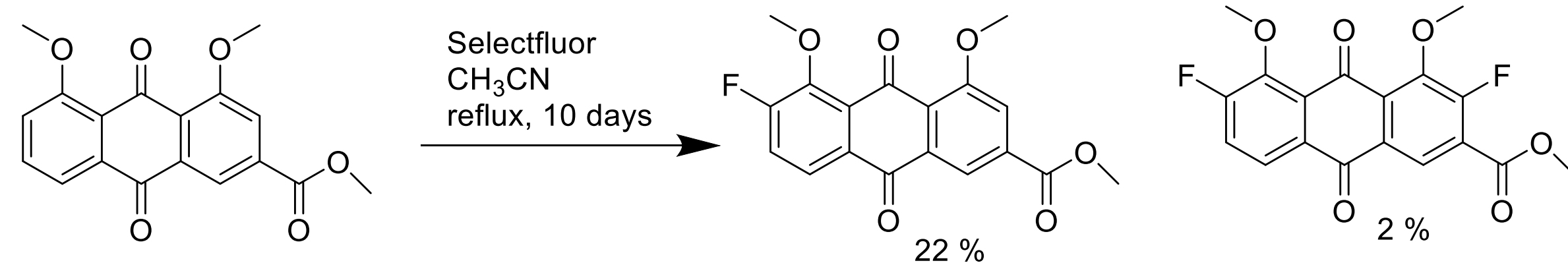
- The objective of the present study is to isolate and characterize the products collected during the last semester in order to determine the structural composition of products formed.

Selectfluor

- Electrophilic fluorination reagent
- Site selective, decreased chance of multiple fluorination
- Green fluorine source, less volatile and environmentally hazardous⁵



Previous Selectfluor studies and reactions with anthraquinone derivatives



Regio-selective fluorination has shown promising results for non-steroid anti-inflammatory drugs for the treatment of osteoarthritis⁴



Used an anthraquinone derivative dissolved in acetonitrile to detect fluoride ions. Color change occurred when in the presence of fluoride ions⁶

Methods

- A 0.2M solution of aminoanthraquinone was prepared in acetonitrile by dissolving 104 mg of aminoanthraquinone in 25ml of acetonitrile.
- After allowing the acetonitrile to dissolve as much as possible while stirring an equivalent of Selectfluor was slowly added. The solution was left stirring for days with occasional TLC checks using 50:50 hexane, ethyl acetate solution.
- Reaction solutions were then filtered and separated into organic and solutions. Filtered precipitates were checked using IR spectroscopy. The organic solution, containing the product was dried in a Buchi Rotavapor then further separated through column chromatography.



Figure. Reaction set up, flask was placed in a sand bath during the heated trial

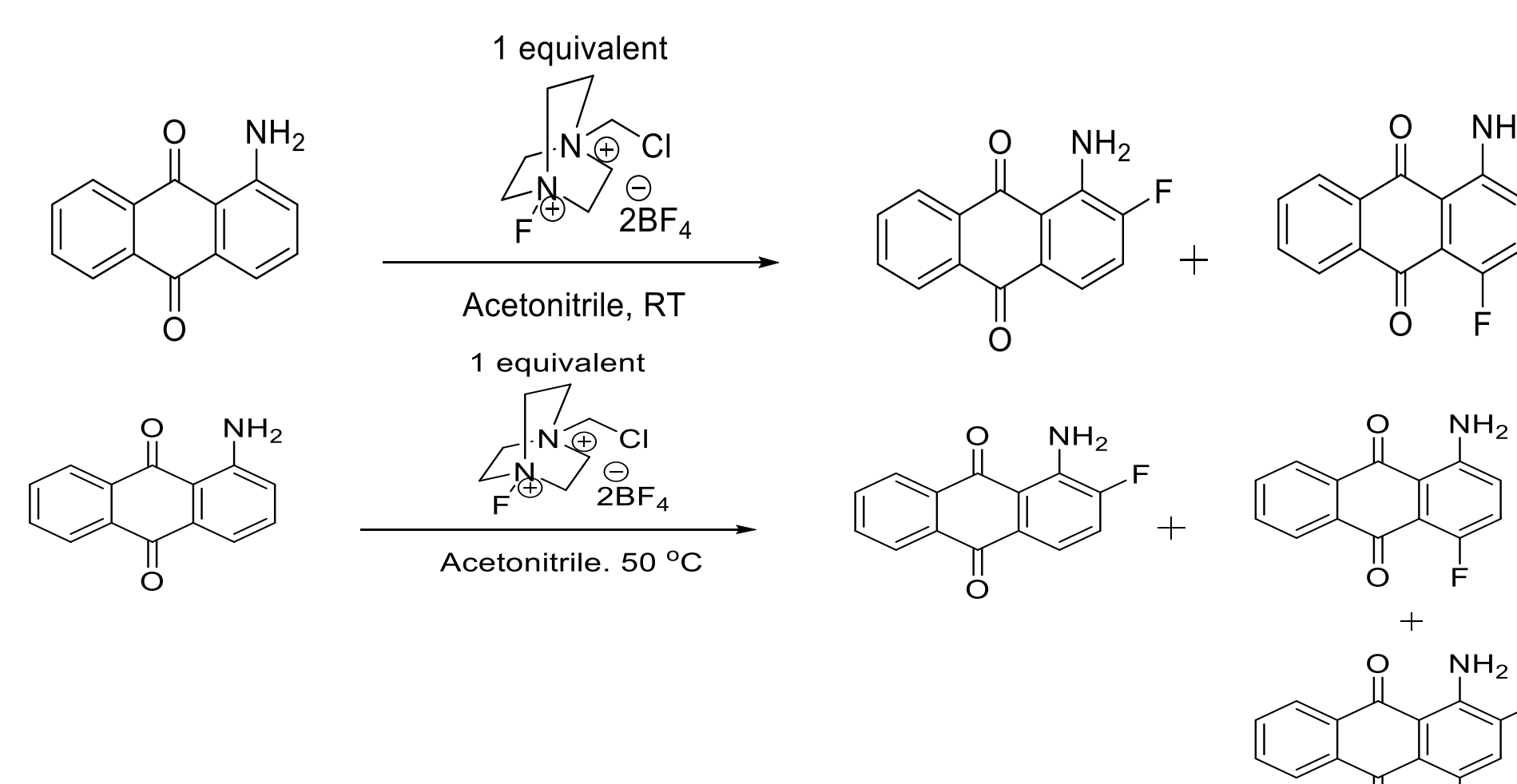
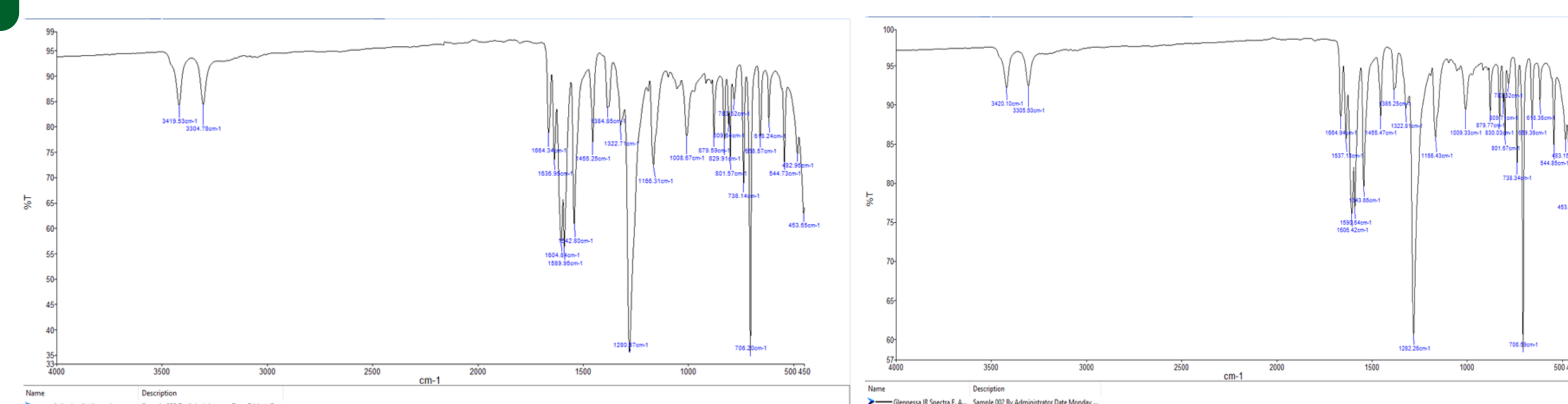


Figure. Schematic representation: Reaction 1 & 2 and potential products



Figure. Rotavapor R-3

Results and discussion



Aminoanthraquinone

Peaks:
3419- *N-H stretching*
3304- *N-H stretching, secondary Amine*
1589- *C=C*
1280- *Strong C-N aromatic amines*

Experimental Data

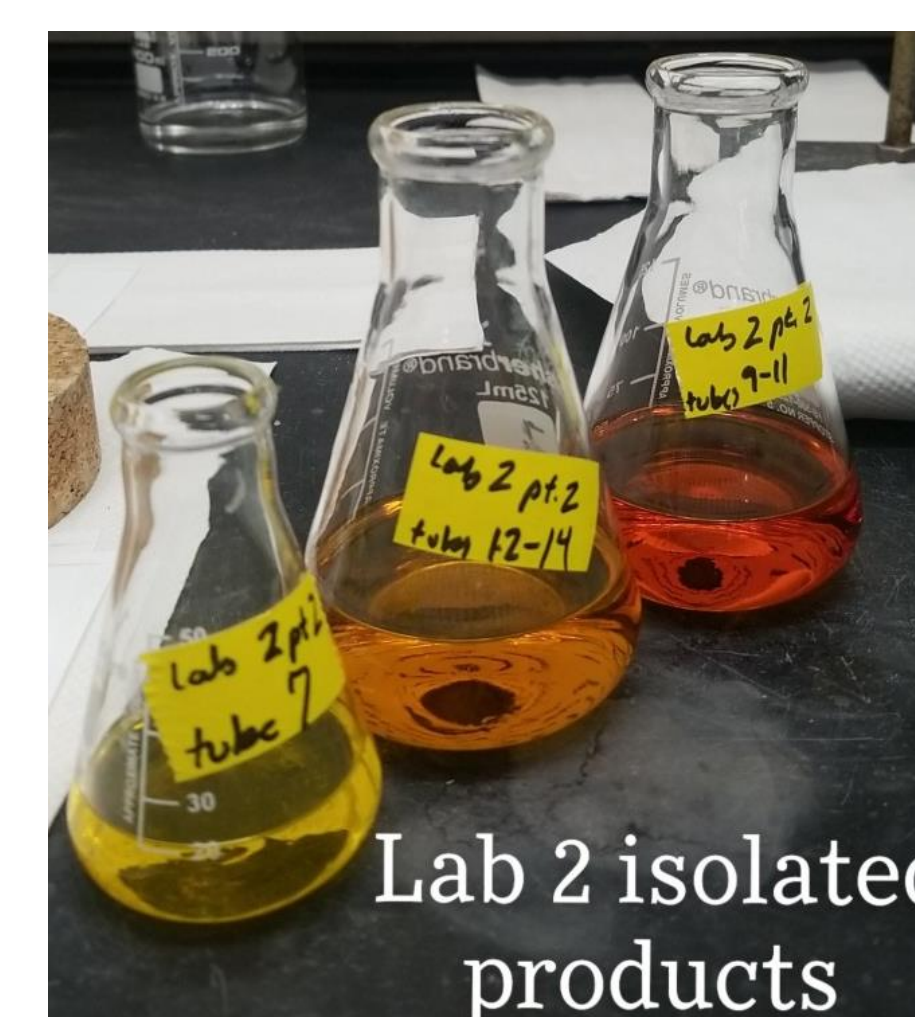
Peaks:
What is not there
1400-1000 Strong, to suggest a Fluorine, product is in solution

- Precipitates collected were tested with Meltemp and IR (*above*) then compared to the literature data for aminoanthraquinone.
 - Determined that precipitates were unreacted starting material
- Products were isolated through column chromatography. Pure solutions were collected for further characterization. (*right middle top*)
- TLC's were used to compare isolated products from separate experiments(*right bottom*)
 - First and second products remain the same through each trial

Figure. Running a column to isolate products from trial 2.



Products



Results and discussion

H¹ NMR Spectroscopy

A Eft-90 Nuclear Magnetic Resonance Spectrometer was used to measure H¹ nuclear resonance in four samples. Since all three trials were confirmed through TLC to produce the same first and second products. Products one and two form the second trial as well as the eluted starting material were dissolved in CDCl₃ before running them in the NMR. To combat the low concentration of samples a higher number of scans were done on each sample.

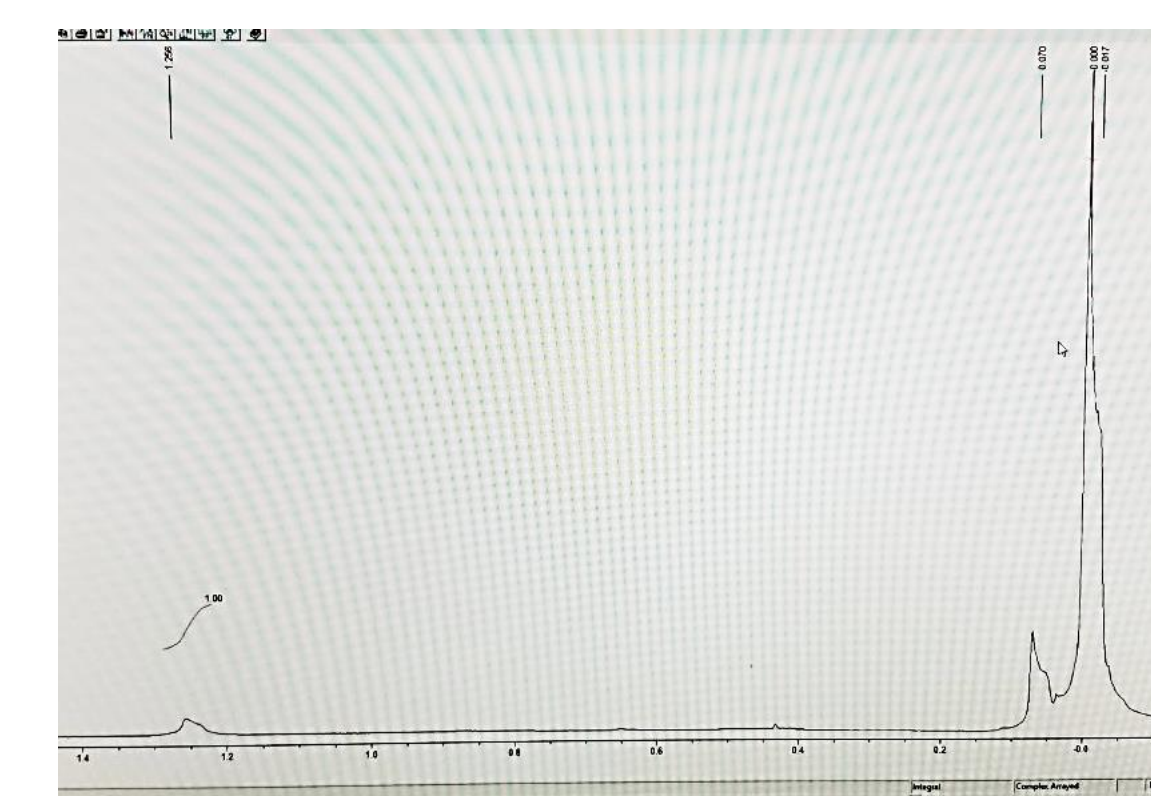


Figure. Trial 2 Part two, Product 1: Only one peak is observed. This is may be due to the low presence of product. The peak seen is likely the H attached to Amino-group due to its high polarization.

The number of unique hydrogen peaks present as well as their placement downfield should suggest the placement of the fluorine on the compound. For example, if a single fluorine was added to the ortho position of the amino ring then there should be 4 unique peaks.

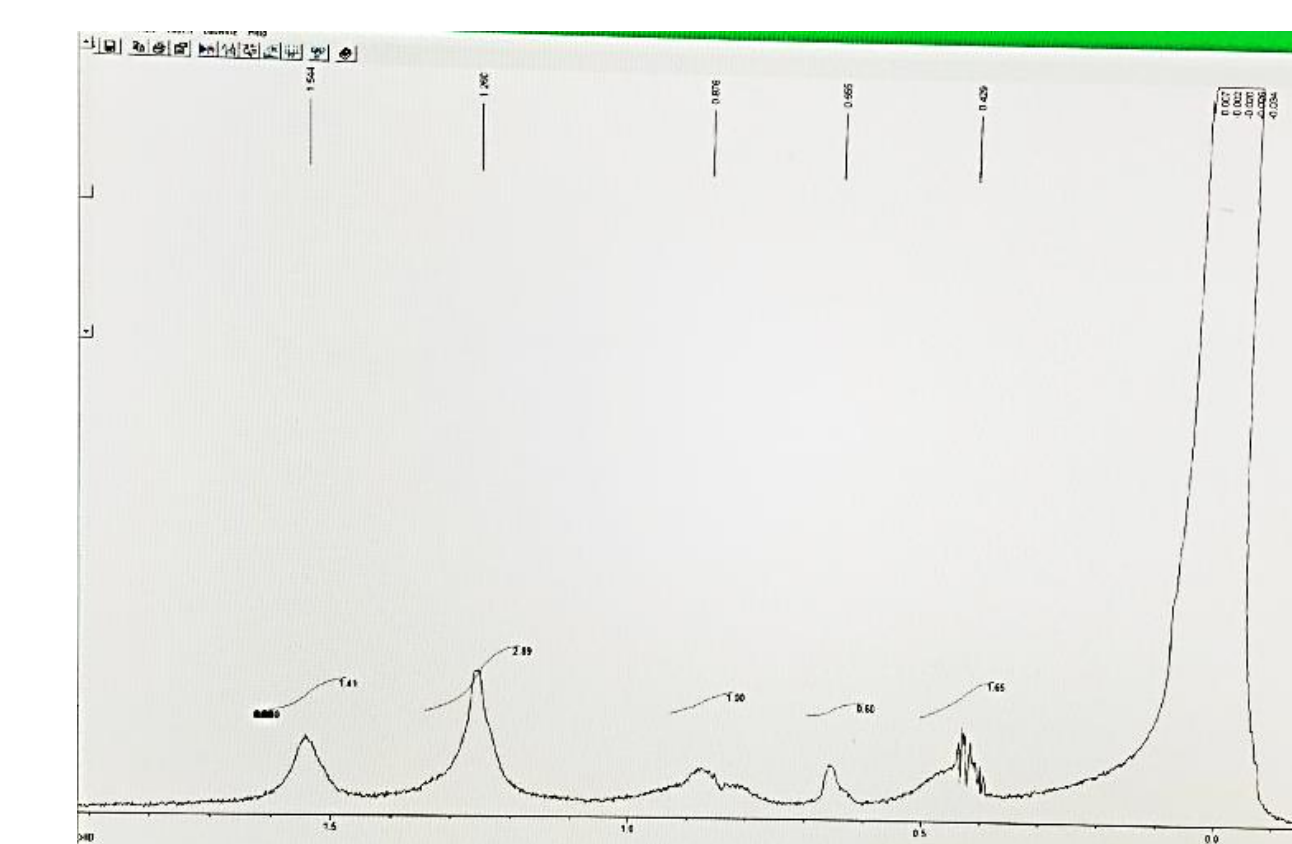


Figure. Trial 2 Part two, Product 2: Approximately 5 unique peaks observed. This number of peaks aligns with a para-addition of fluorine. The most downfield peak is likely the Hydrogen group on nitrogen, the next peak should be hydrogen on the beta carbon. The third peak from the left is likely the hydrogen on the adjacent carbon to fluorine. The fourth peak may be the hydrogen group adjacent to the ketones on the leftmost ring. The final rightmost peak represents the hydrogens furthest from electrophilic groups

Conclusions

The fluorination of aminoanthraquinone produced two products at room temperature and three when heated suggesting it has different thermodynamically favored products. Further studies should be done at higher concentrations to provide a greater yield and determine the kinetics of the reaction.

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Acknowledgments

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