



# **Robotic Platforms for Qualitative and Quantitative Real-time Analysis**

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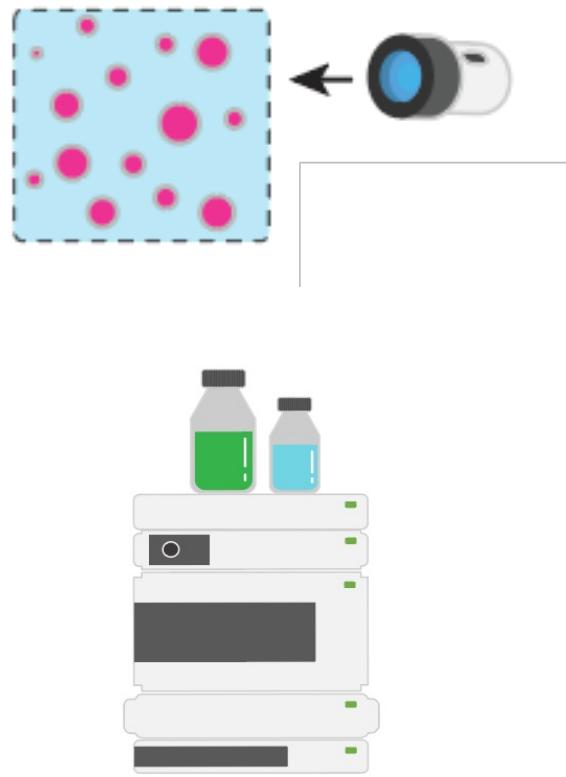
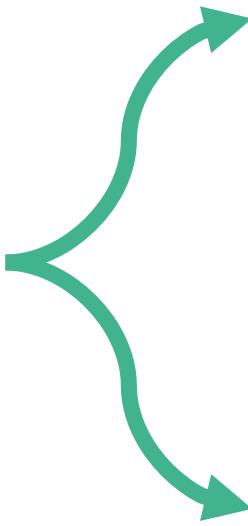
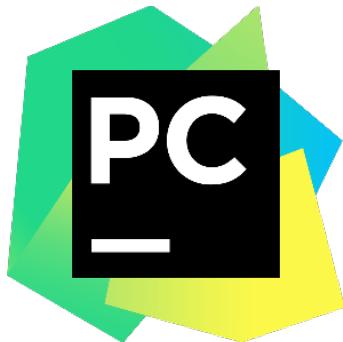
Fan (Luke) Yang

Supervisor: Dr. Jason Hein

April 30<sup>th</sup>, 2021

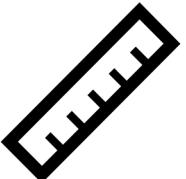


# Outline



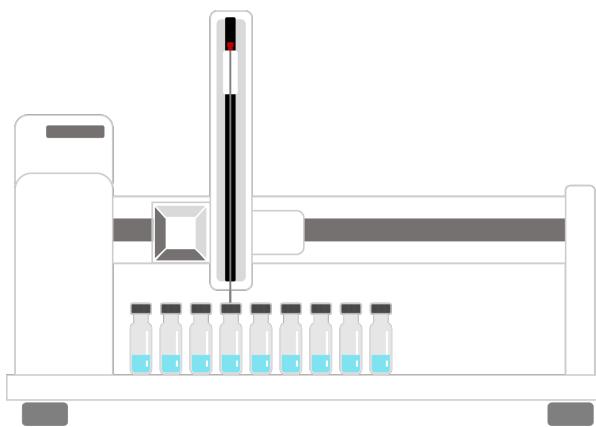
PC: PyCharm, a development software for Python programming

# Laboratory Automation Increases Productivity

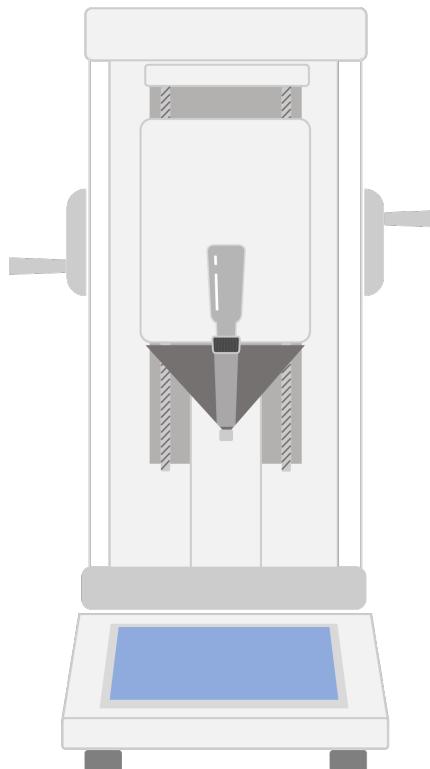


- Using robots...
  - Saves research time
  - Reduces human error

# What Our System Can Do



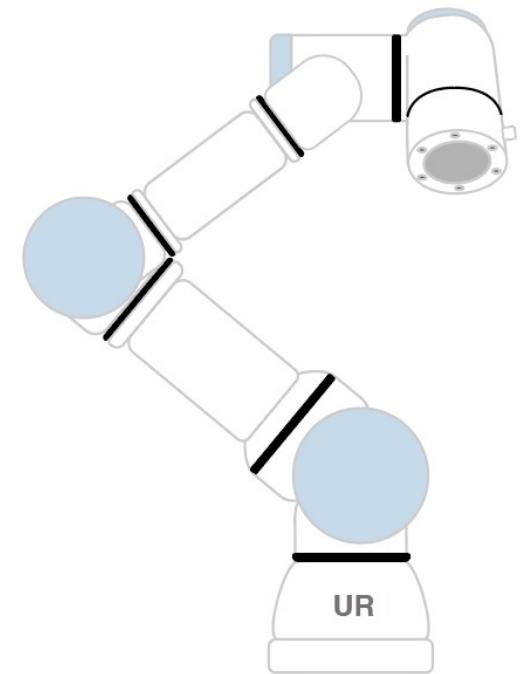
Liquid Handling



Solid Handling



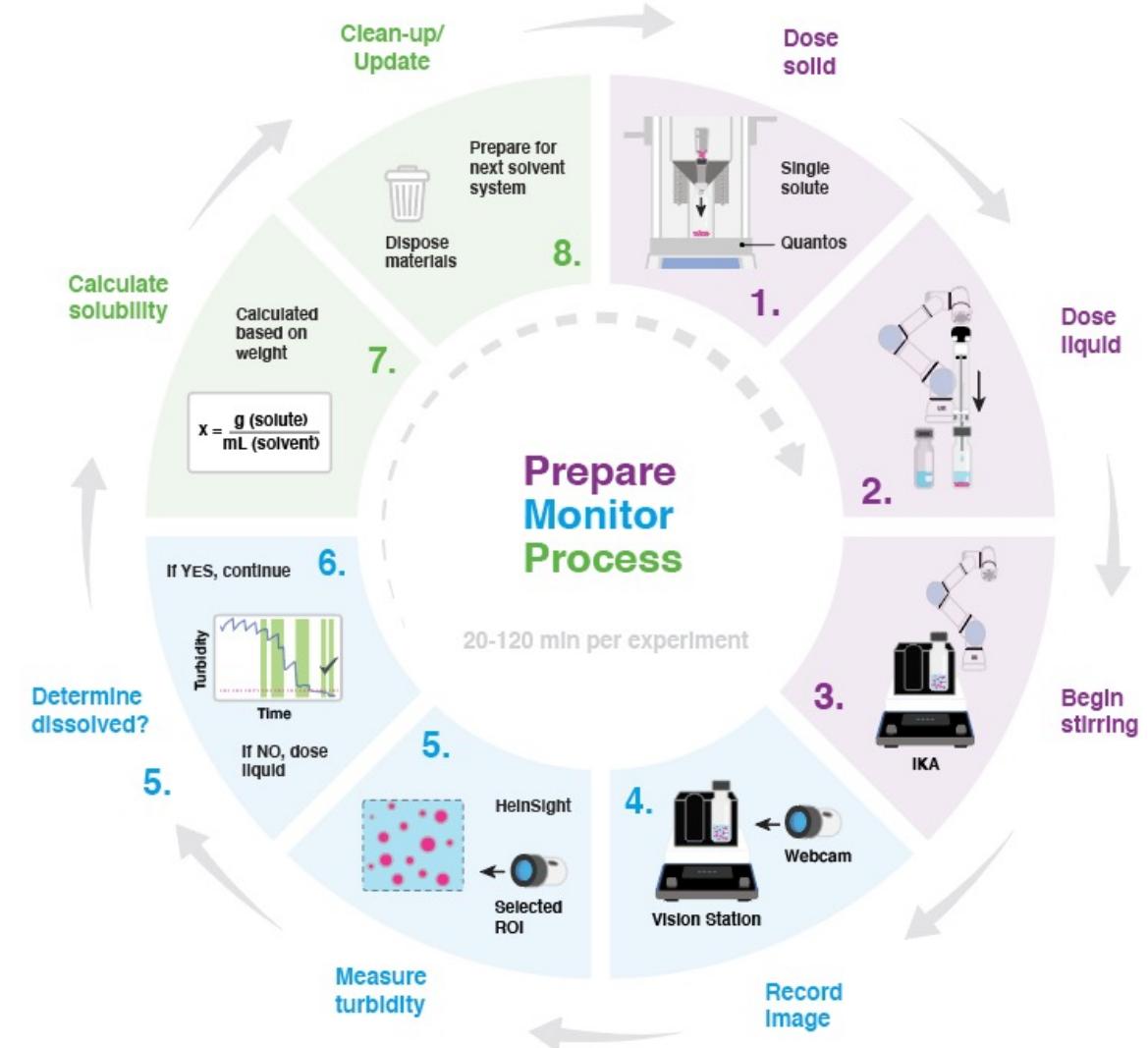
Heating and Stirring



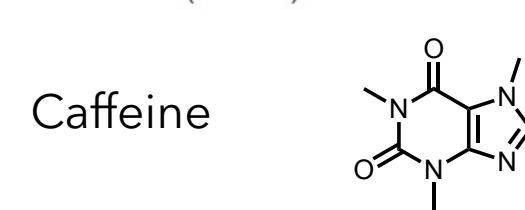
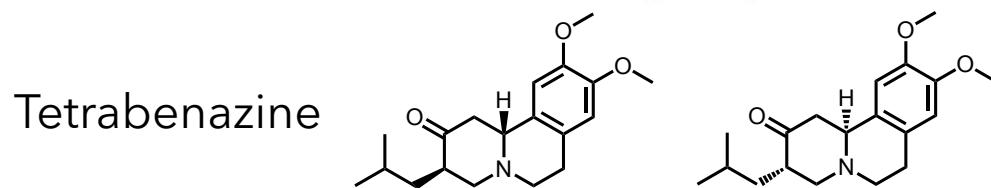
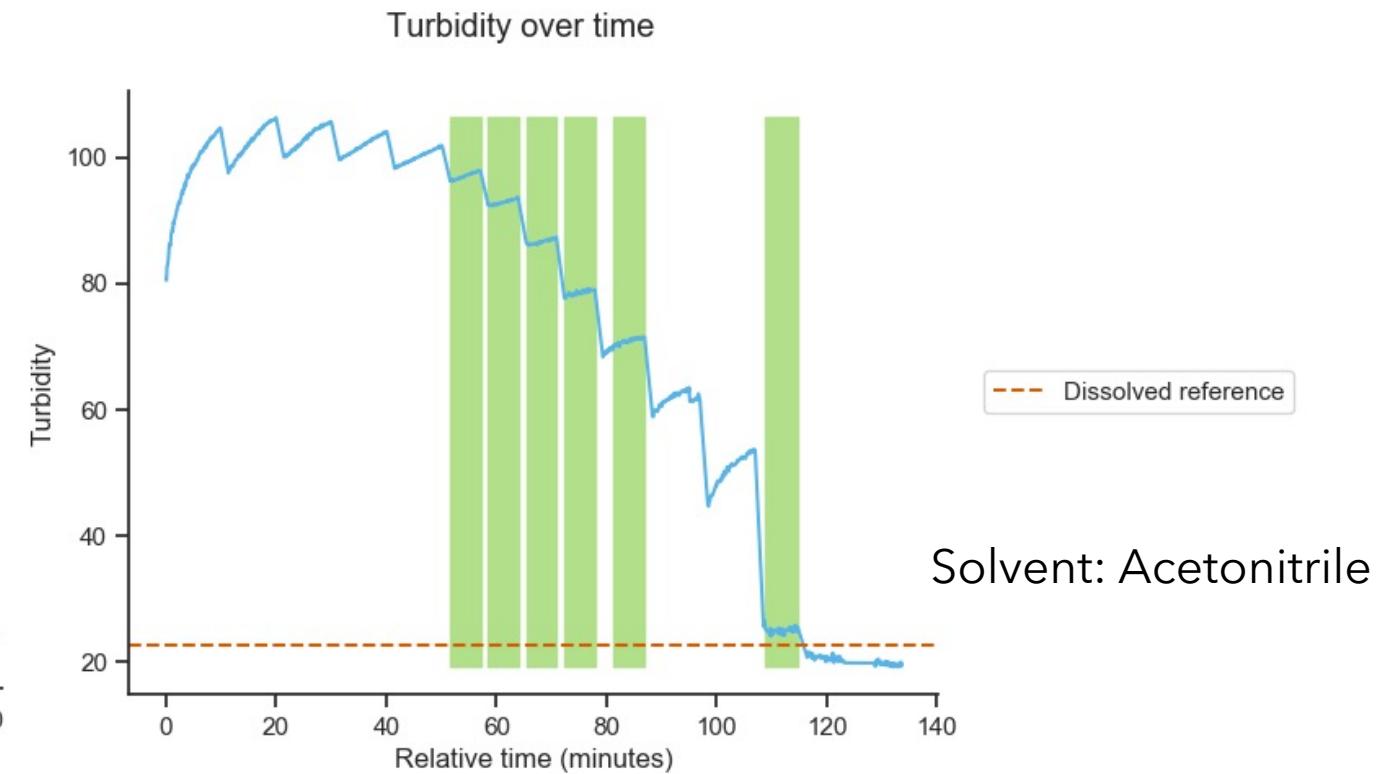
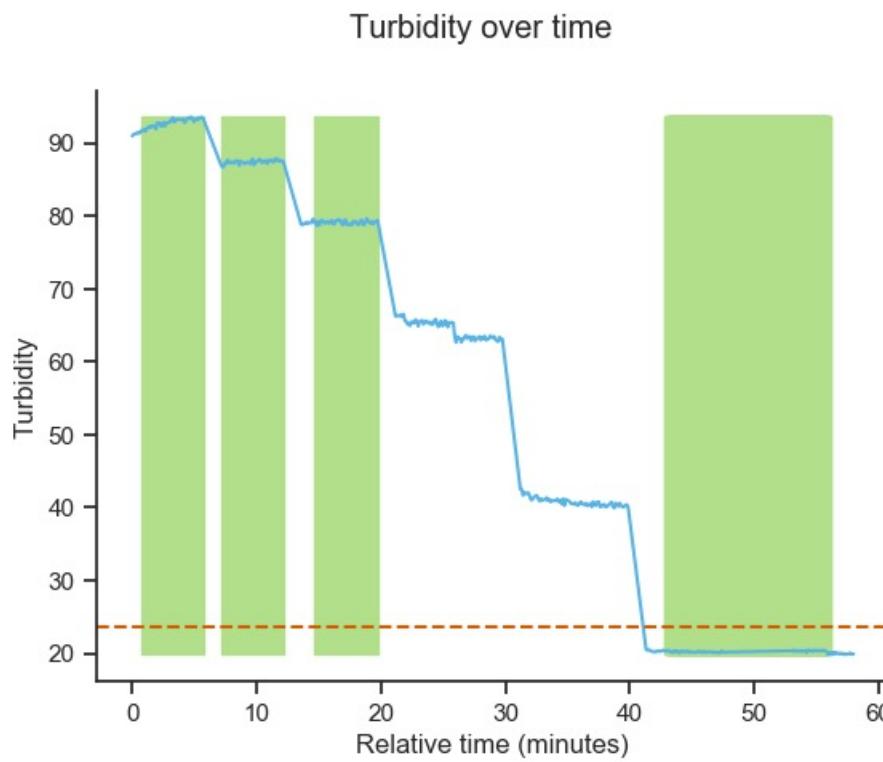
Arm 4

# Qualitative Analysis - Solubility Tests

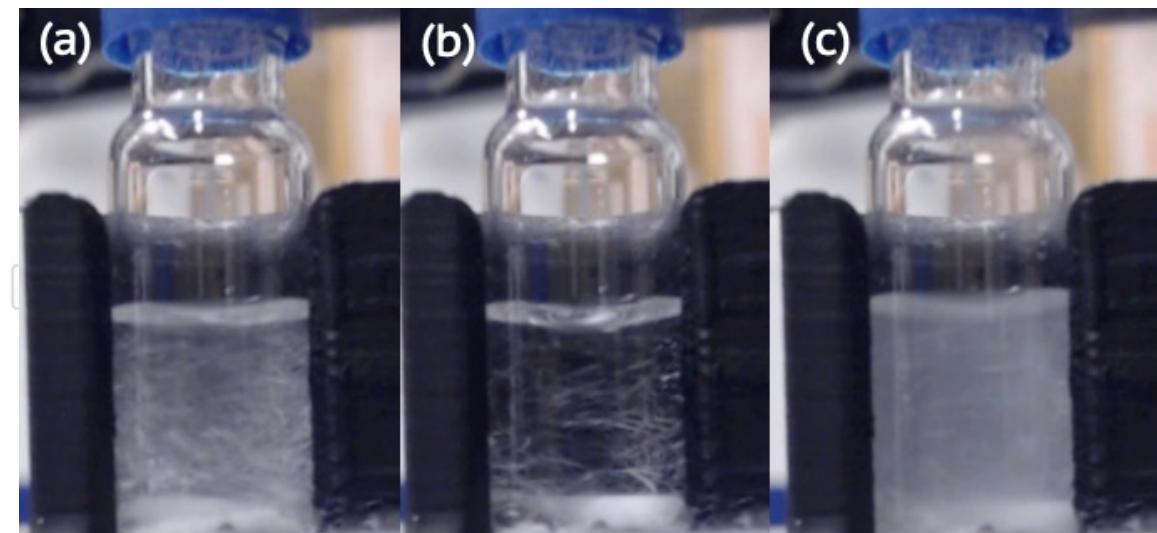
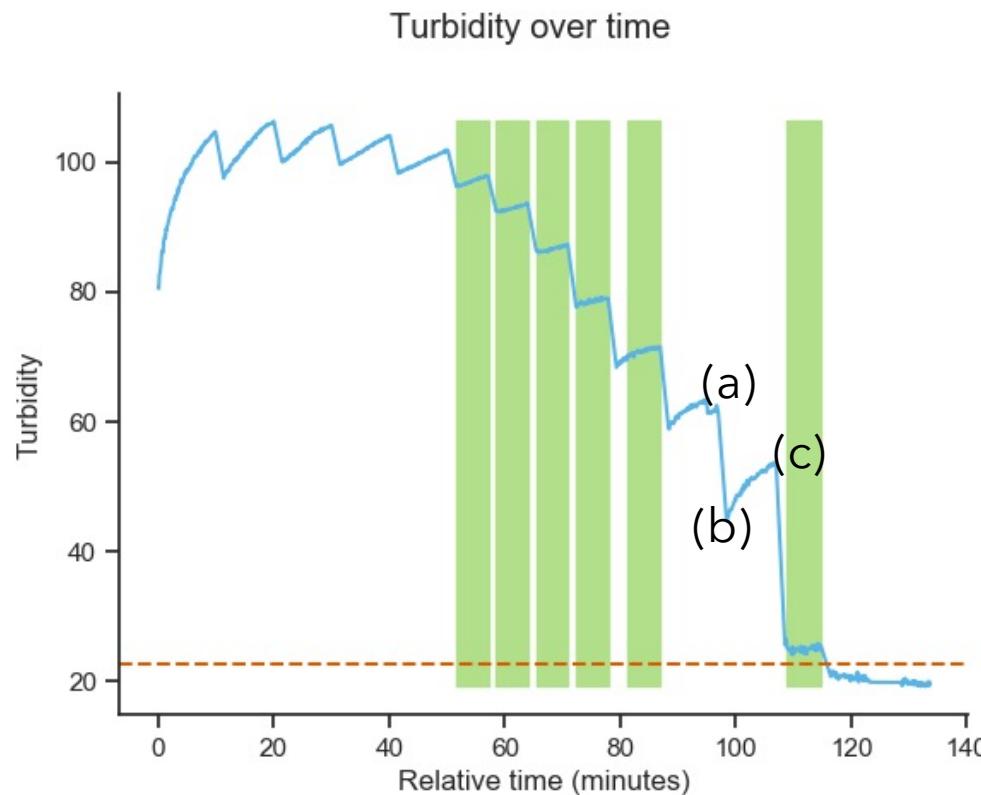
- Solute/solvent
- Important for the solvent system choices
- Titration-like procedure



# Turbidity Versus Time Results



# Further Look into the Caffeine's Turbidity Plot



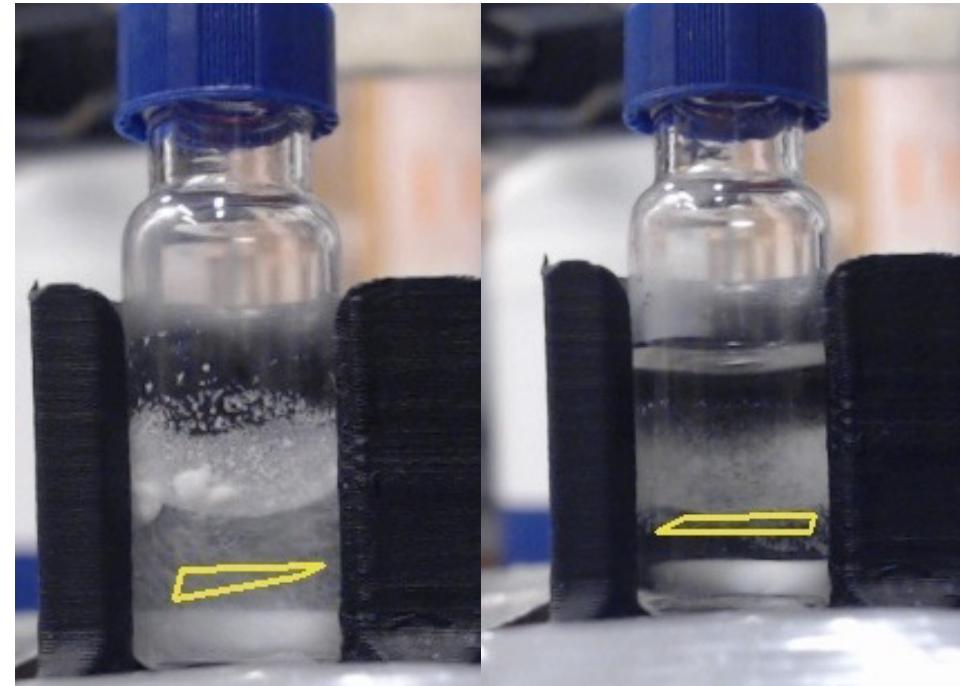
# Robotic and Manual Data Comparison of Tetrabenazine Solubility

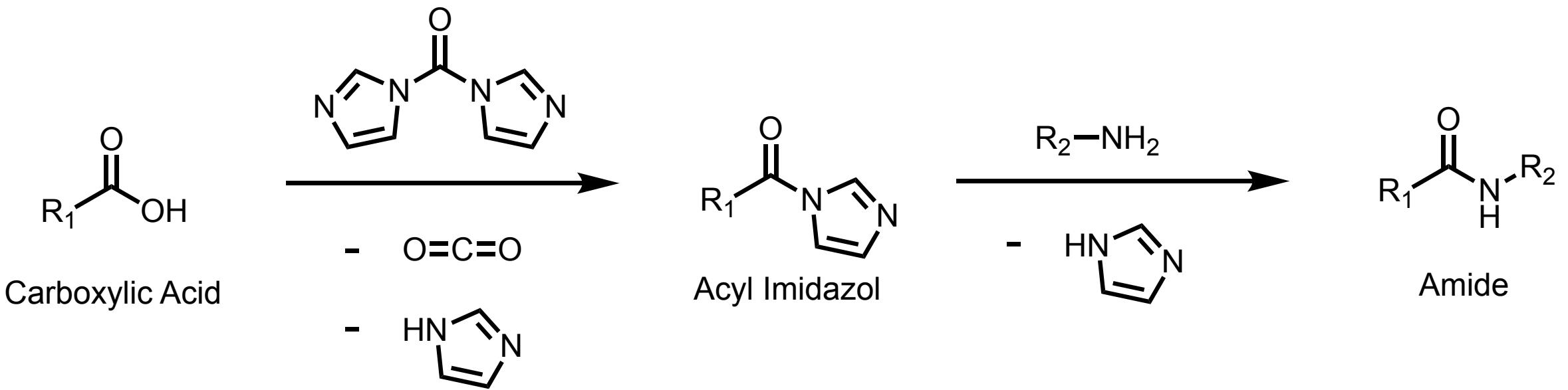
Solvent	Ethanol	Isopropanol	Ethyl Acetate	Methanol	Acetonitrile	Acetone
<b>Robotic ± SE (mg/mL)</b>	<b>16.18 ± 0.79</b>	<b>9.72 ± 0.18</b>	<b>64.54 ± 1.75</b>	<b>24.51 ± 0.206</b>	<b>64.54 ± 1.75</b>	<b>87.97 ± 0.88</b>
Manual (mg/mL)	17.08	9.74	65.29	24.63	65.29	88.34

SE: Standard Error

# Limitations

- Only suitable for white/whitish chemicals
- Needs colorless dissolution
- Requires uniform particle size

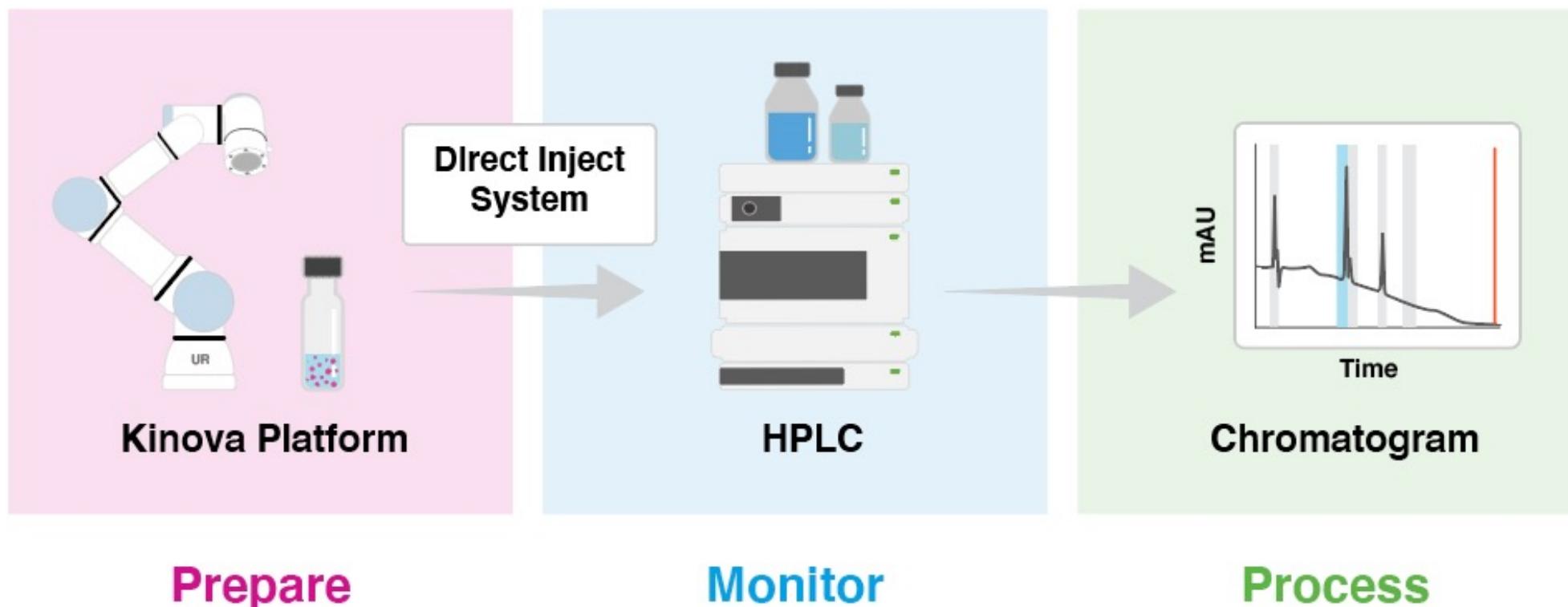




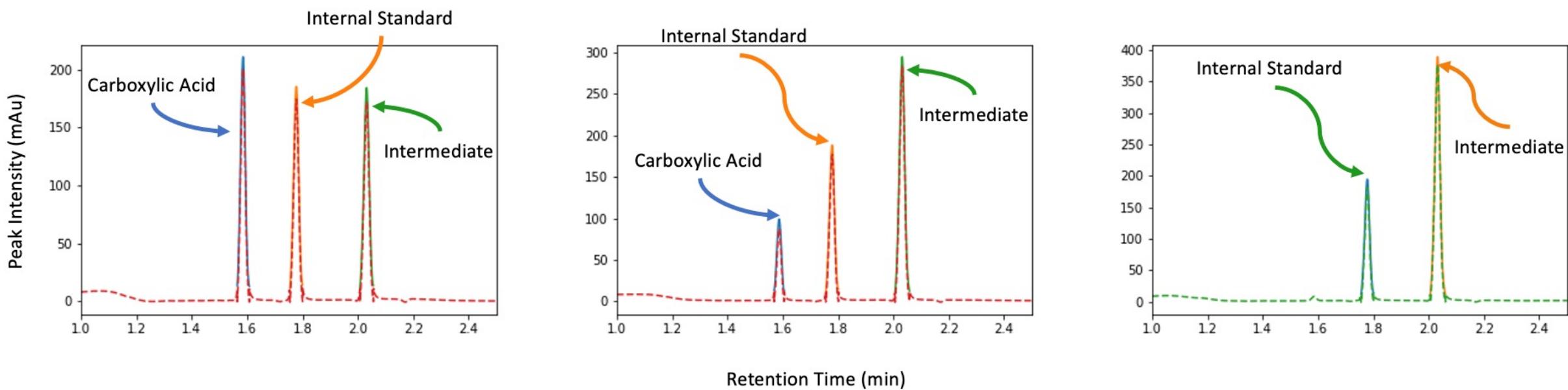
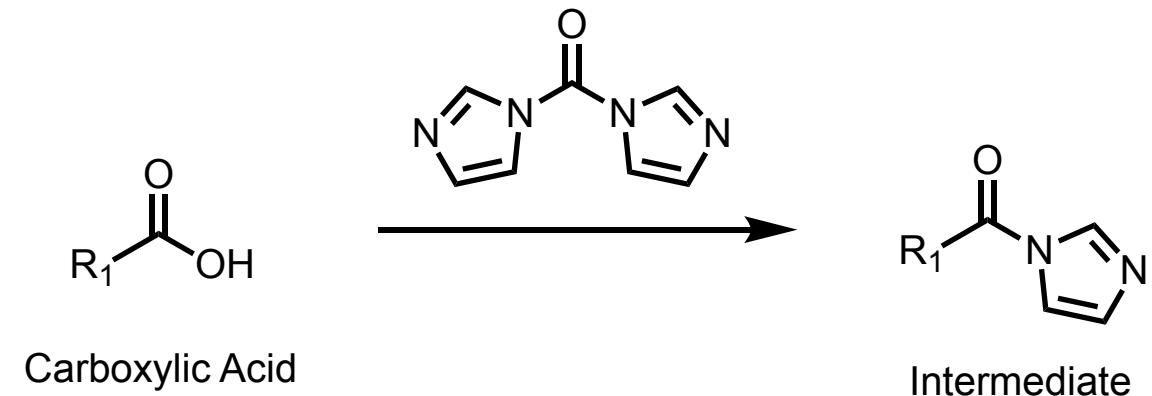
## Quantitative Analysis - Amide Bond Formation

- Important synthesis in industrial and pharmaceutical sectors<sup>1</sup>
- Involves two reaction steps

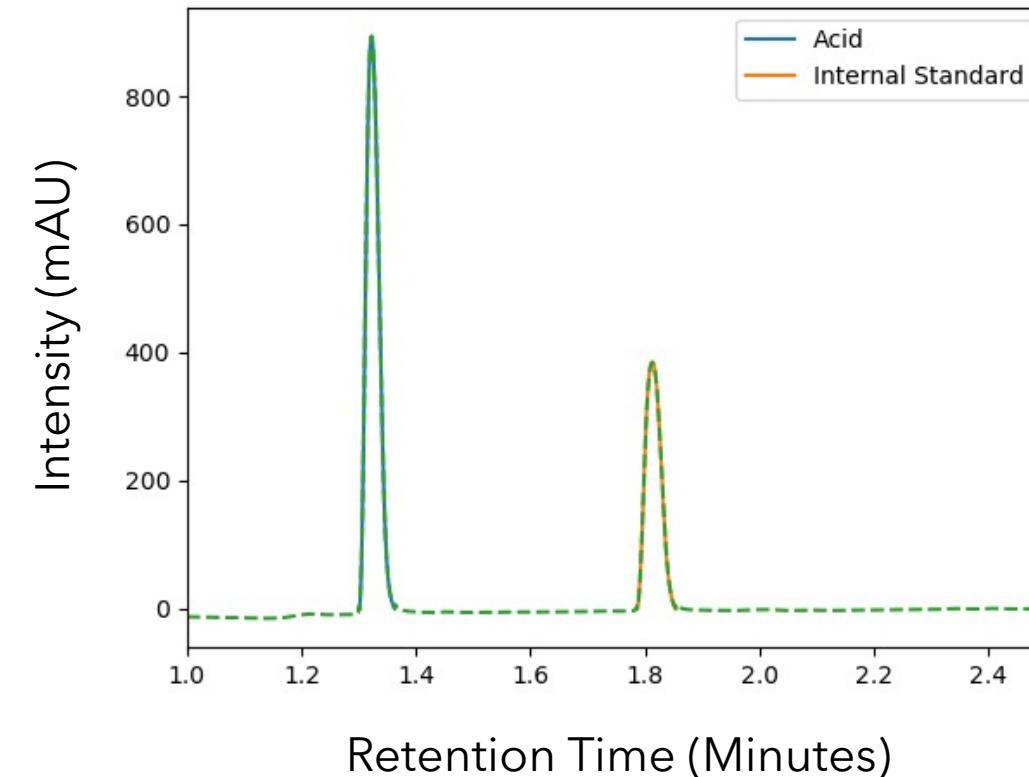
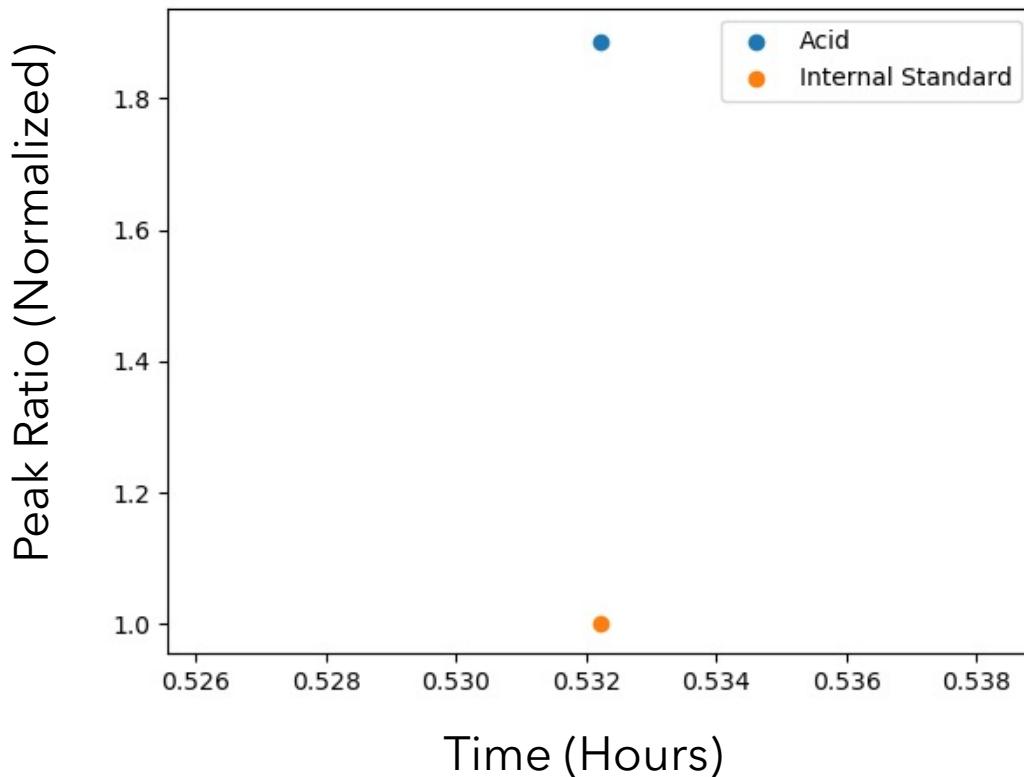
# Reaction Inspection Method - HPLC



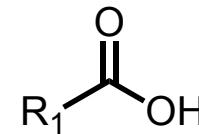
# Acid Peak Tracking



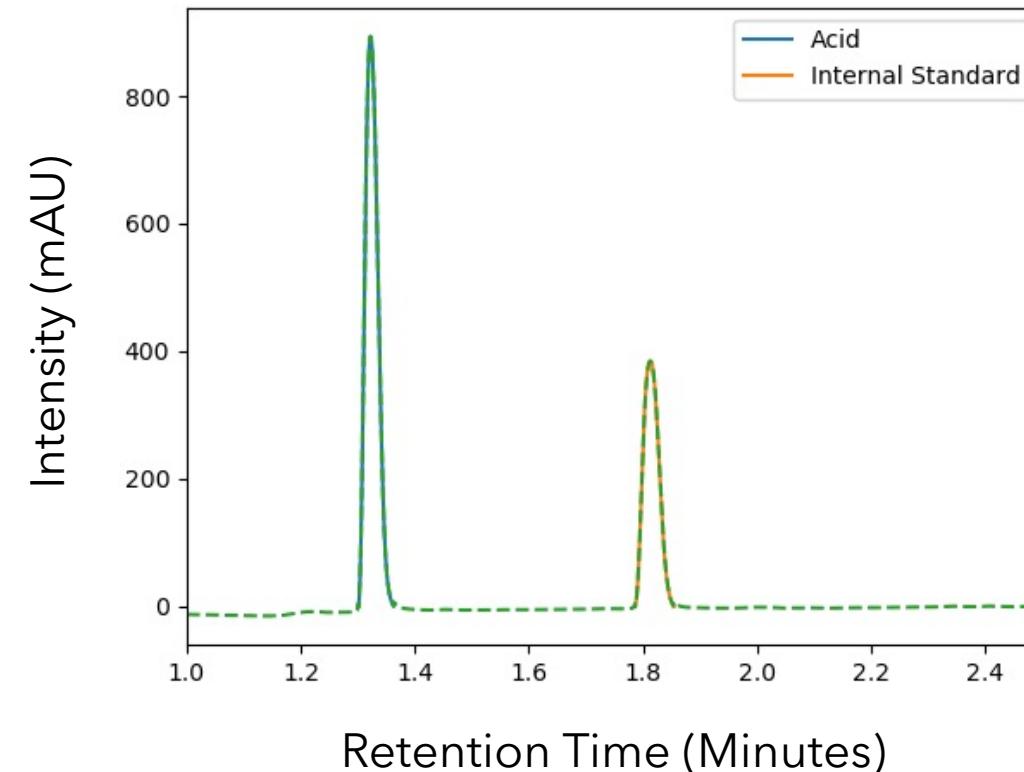
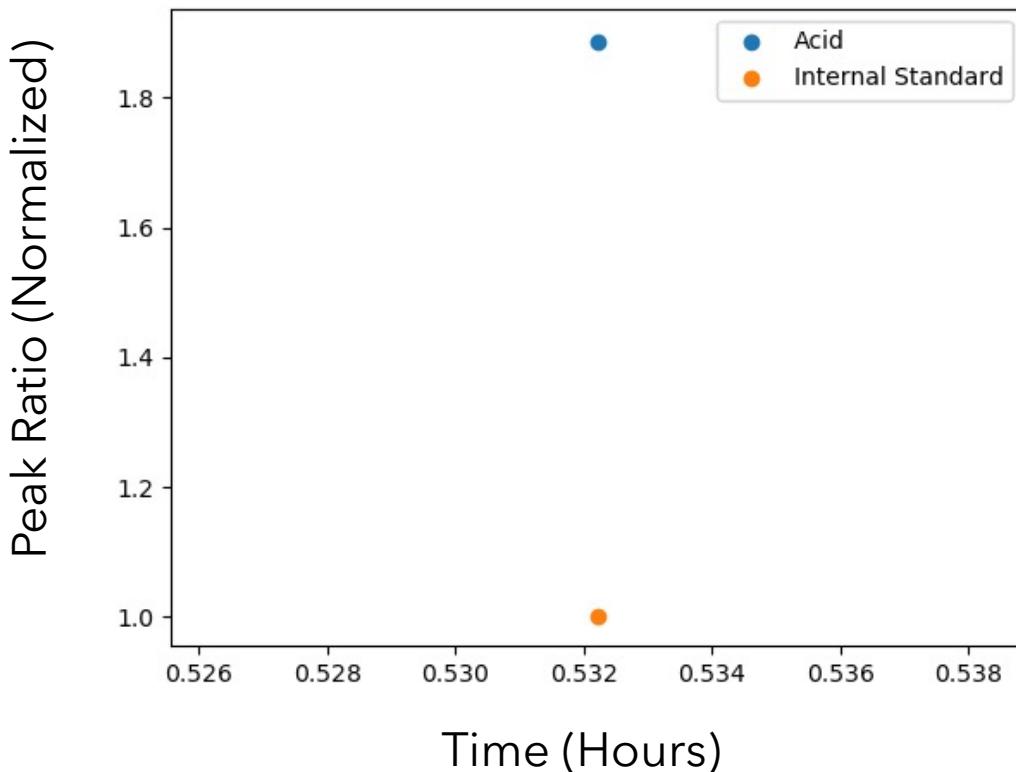
# Reaction Progress and Data Output



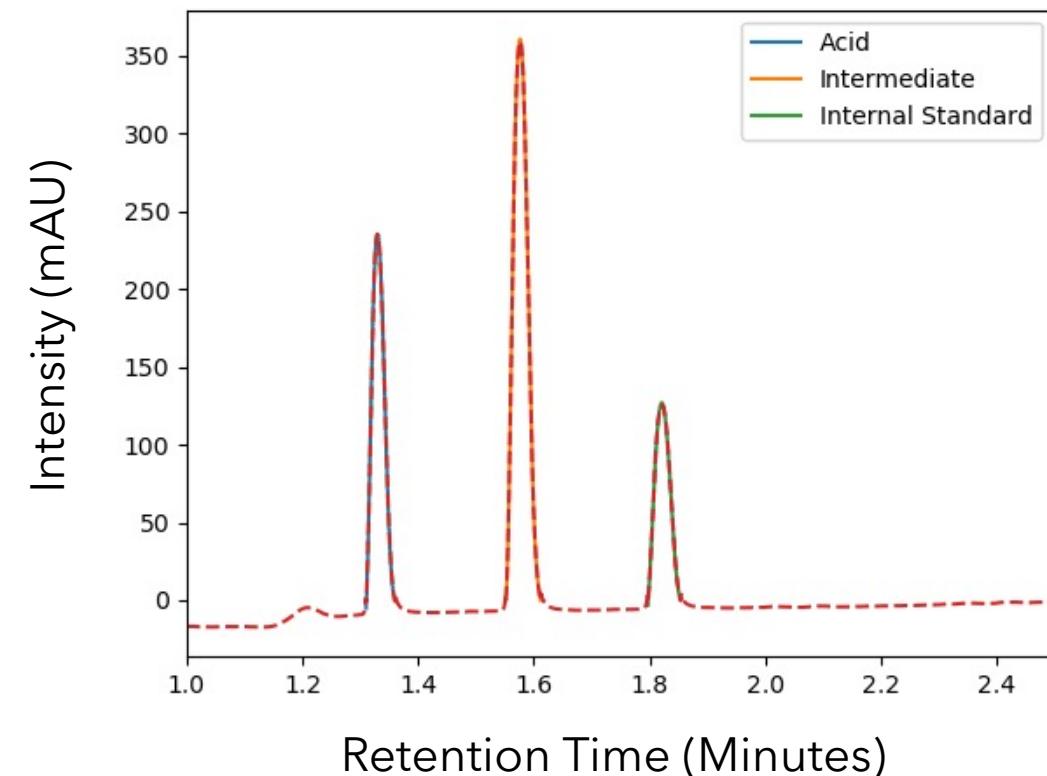
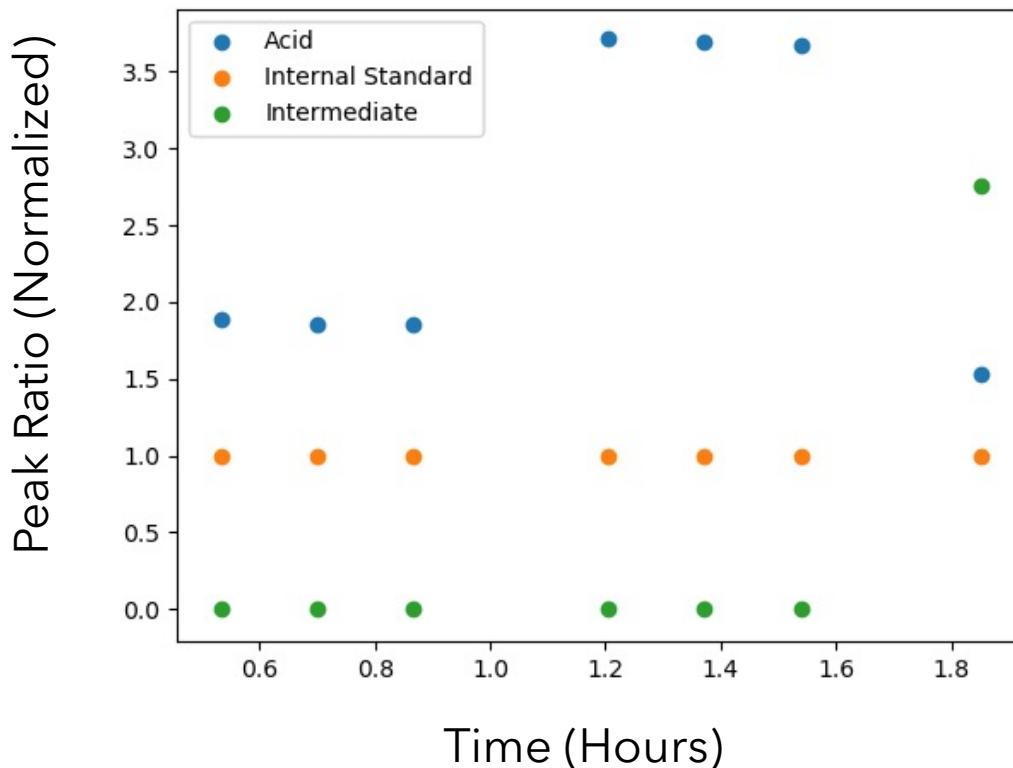
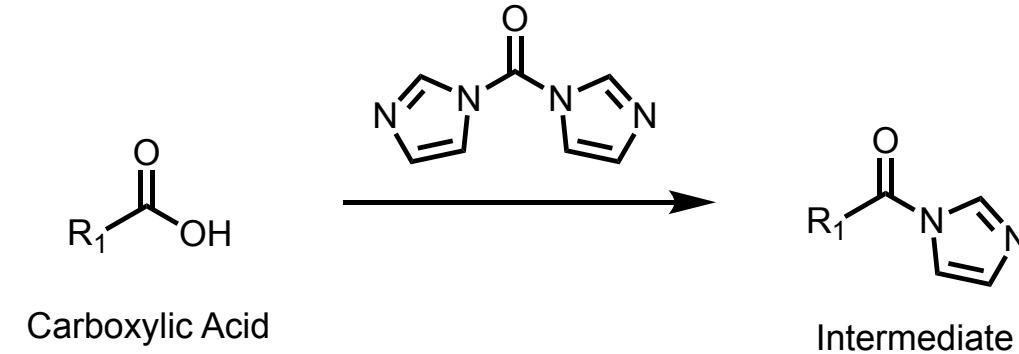
# 1: Acid Addition



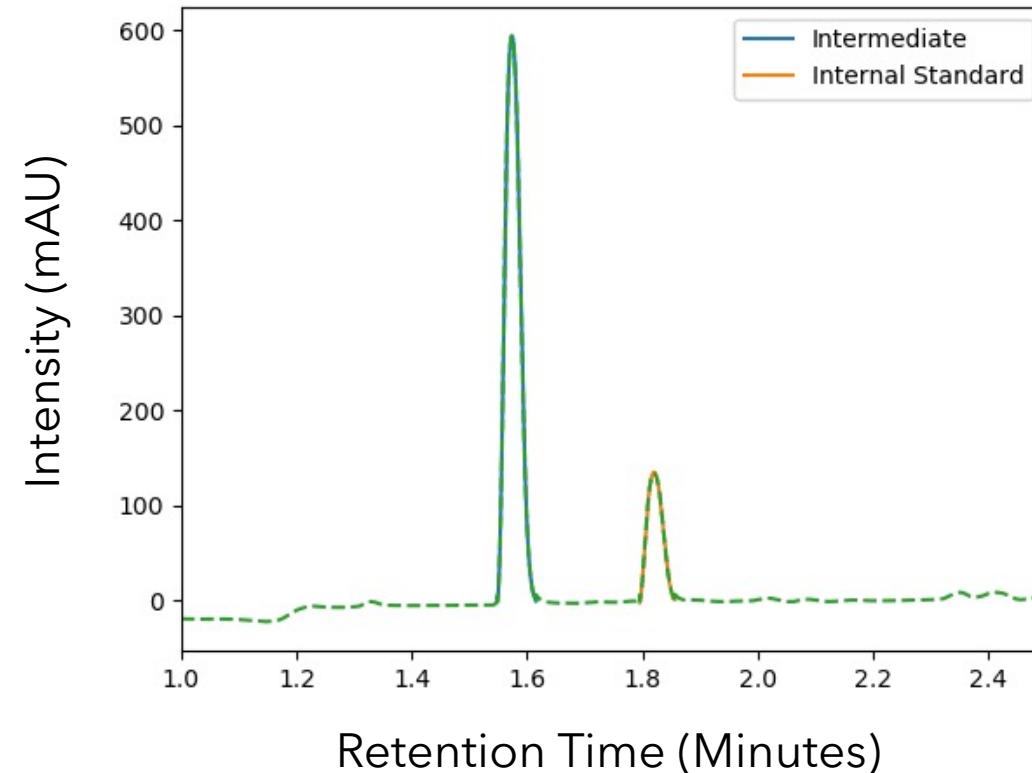
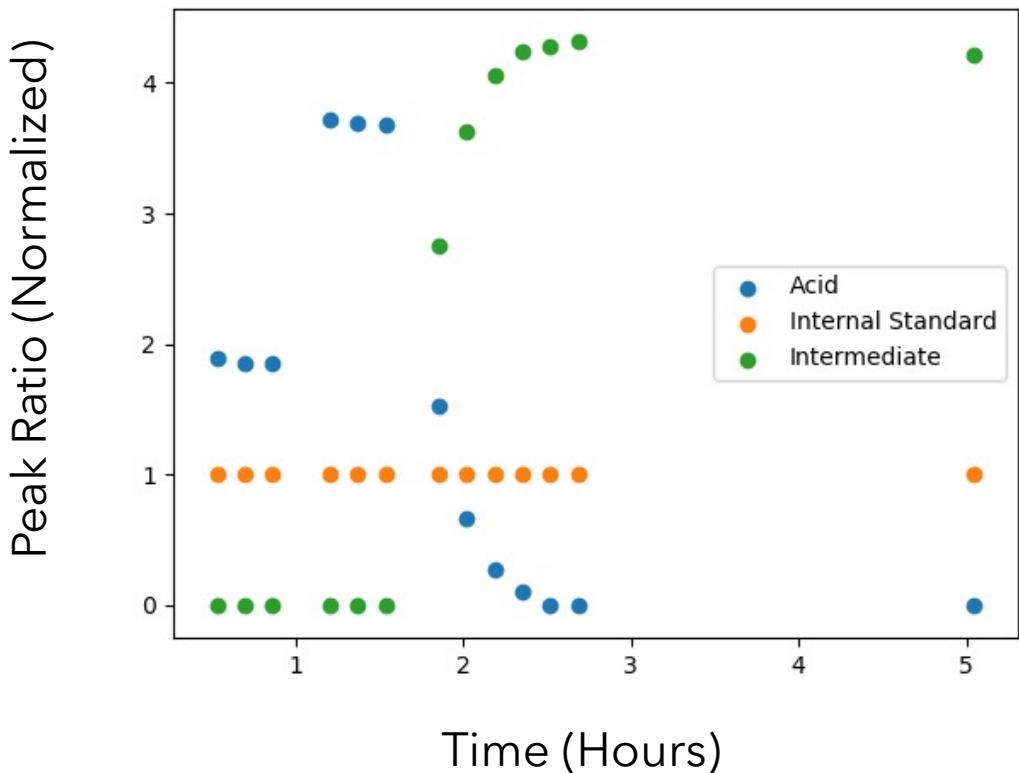
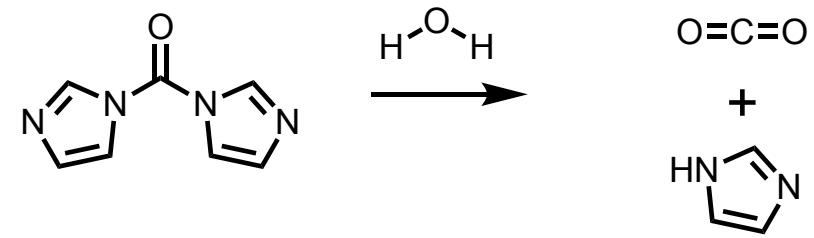
Carboxylic Acid



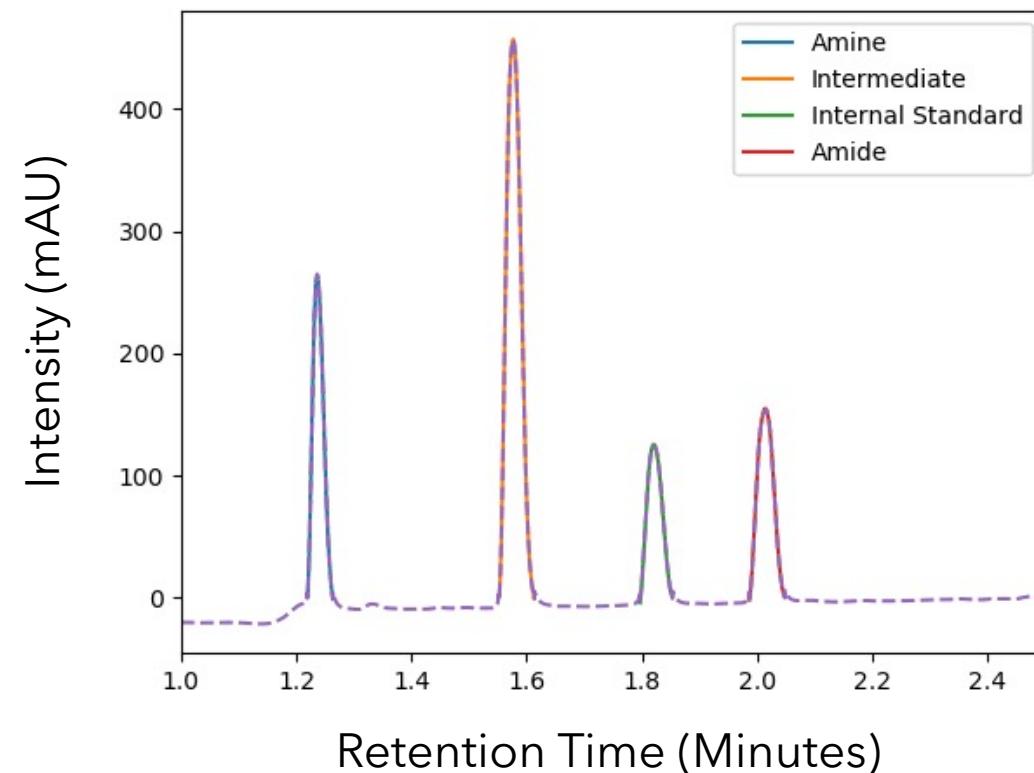
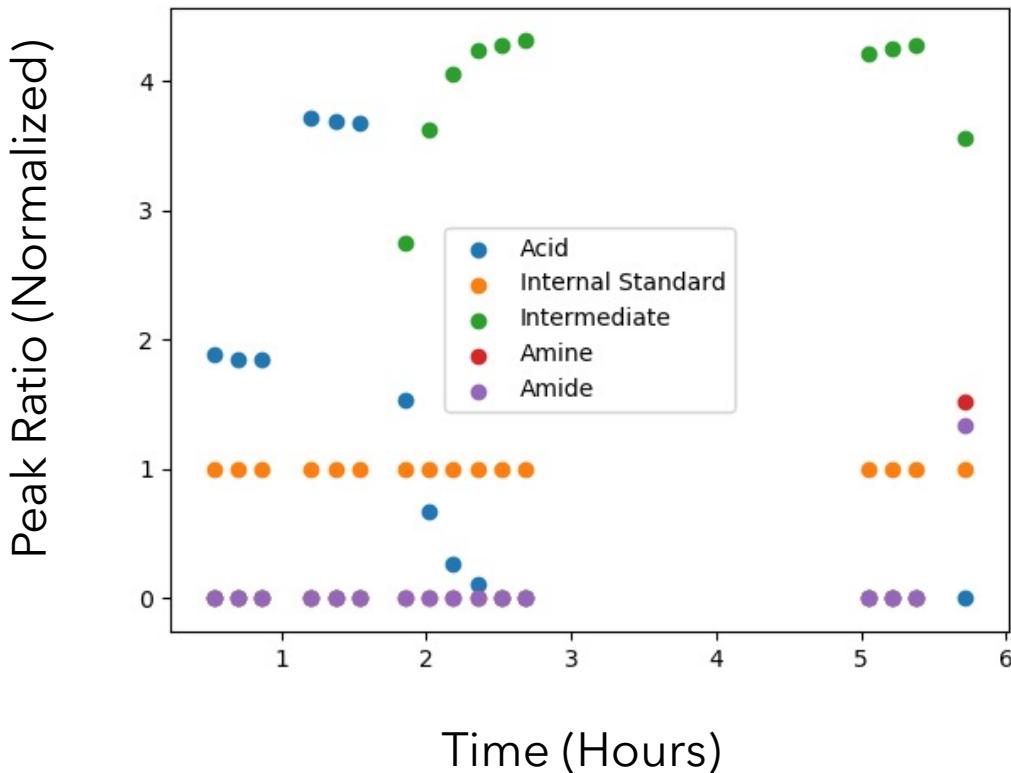
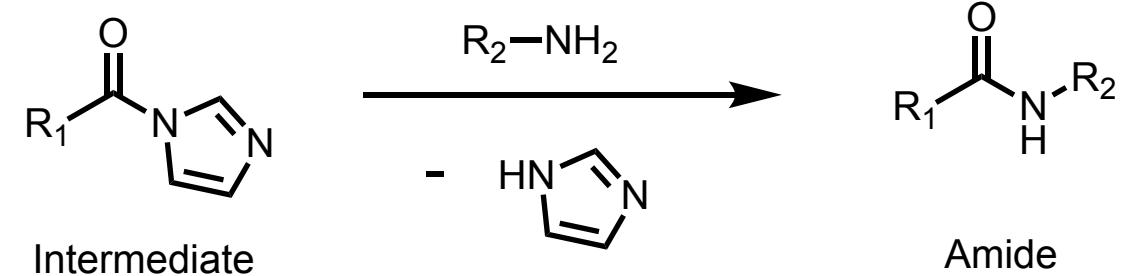
## 2. CDI Addition



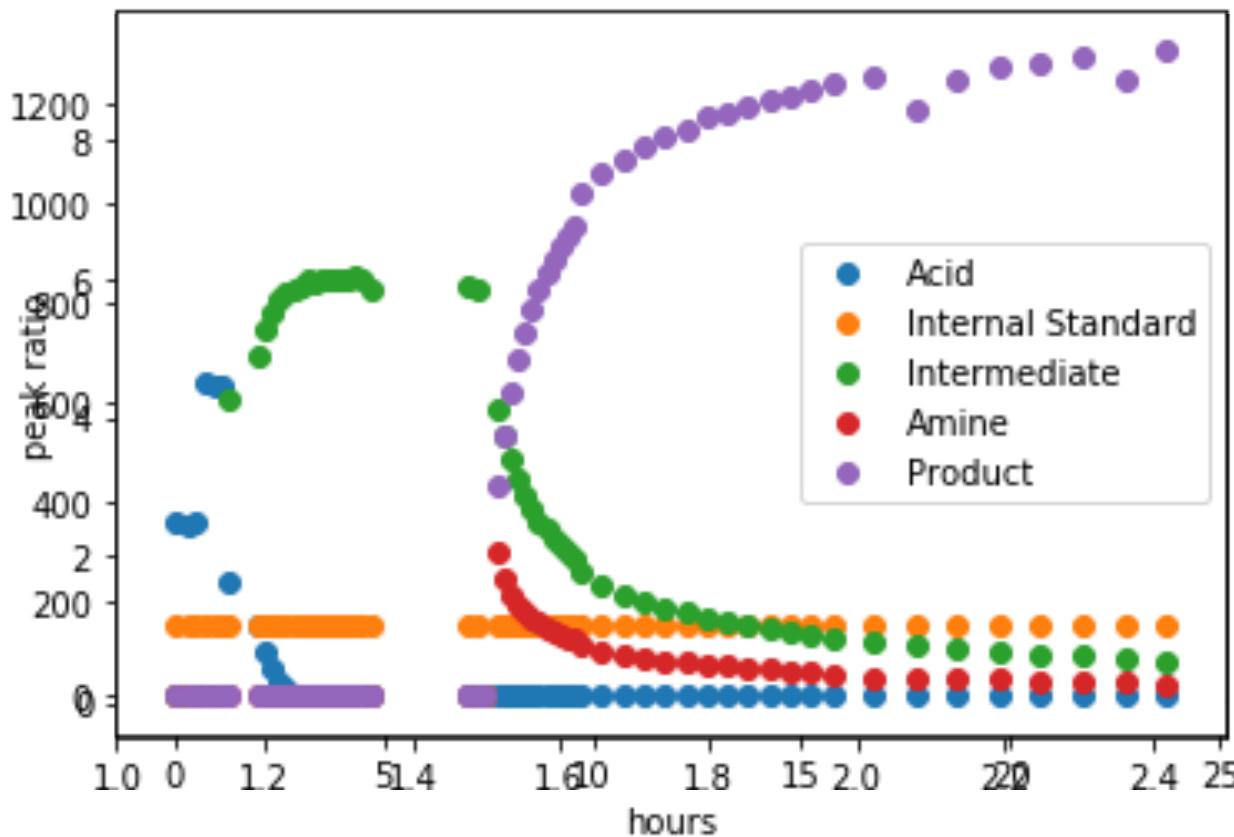
### 3. CDI Quenching



## 4. Amine Addition

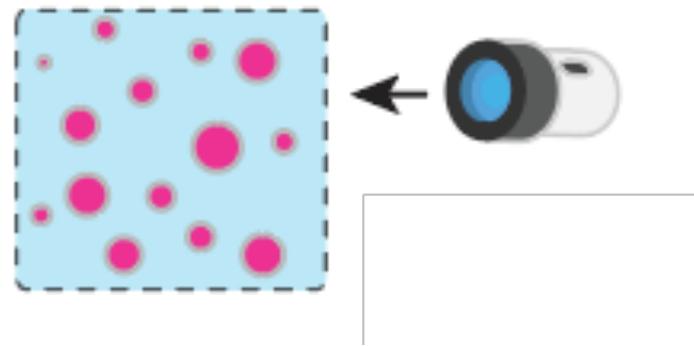


# Limitations

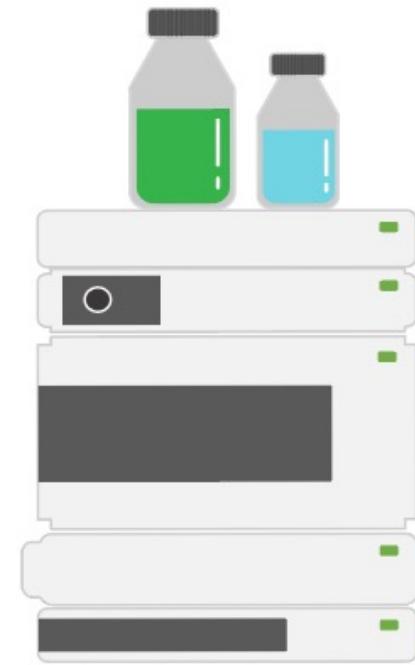


- Long computational time
- Requires clear peak separation
- Only applies in this specific experimental procedures

# Conclusion



Qualitative Analysis  
Solubility Tests via Computer Vision



Quantitative Analysis  
Amide Bond Formation via HPLC

# Acknowledgement



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