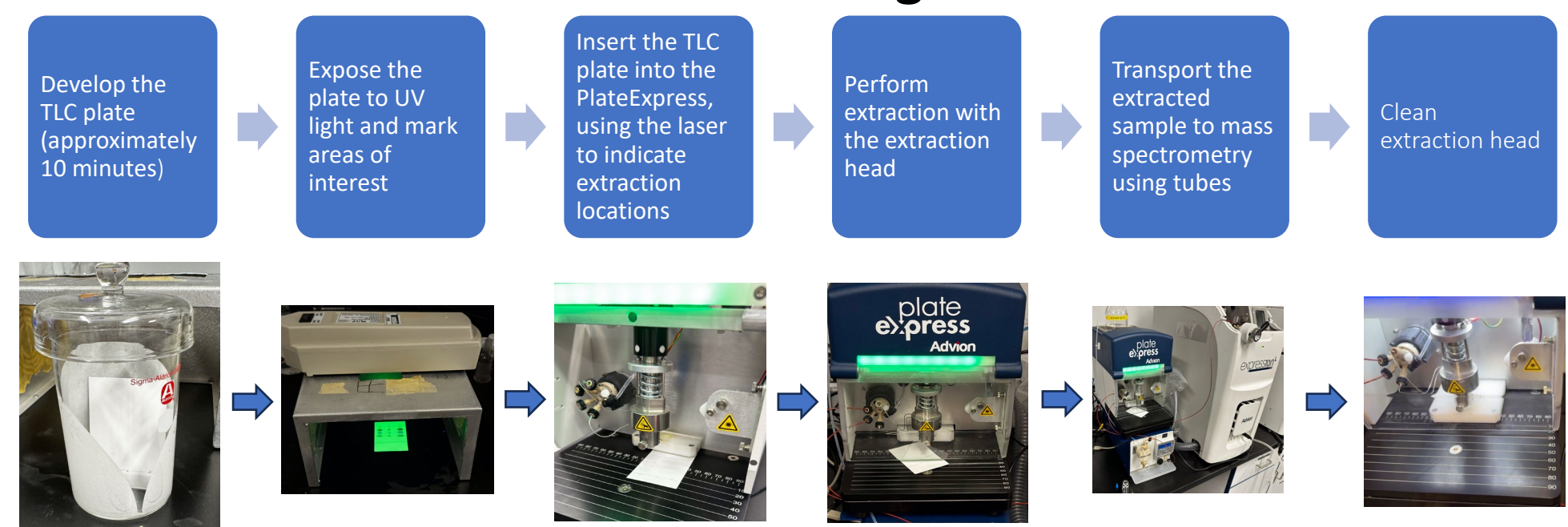


Automated Thin-Layer Chromatography (TLC) Analysis

Project Description

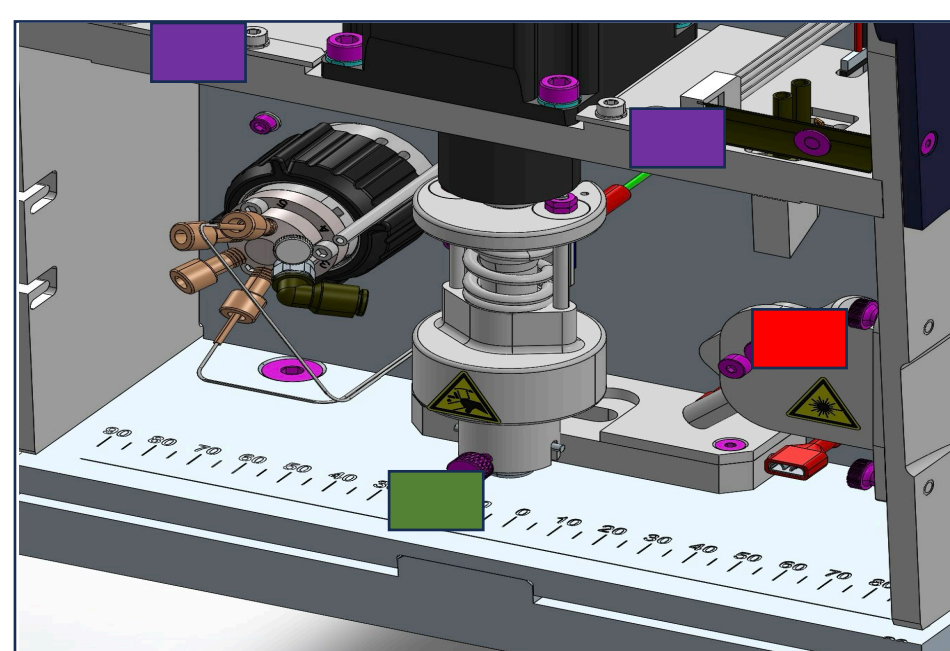
Thin-layer chromatography (TLC) is a standardized analytical technique employed by synthetic organic chemists to detect molecules of interest. Our team aims to automate the manual process of extracting compounds. We will incorporate UV lights within the enclosure to facilitate the camera in capturing images of the TLC plate. Once the image is obtained, our code will direct the XY table to position each compound precisely under the extraction head for transfer to the mass spectrometer for further analysis.

Advion's Existing Process



Design Options

Option 1



Option 1 for improving the existing design by adding the following components to the enclosure. (See colored figures below)

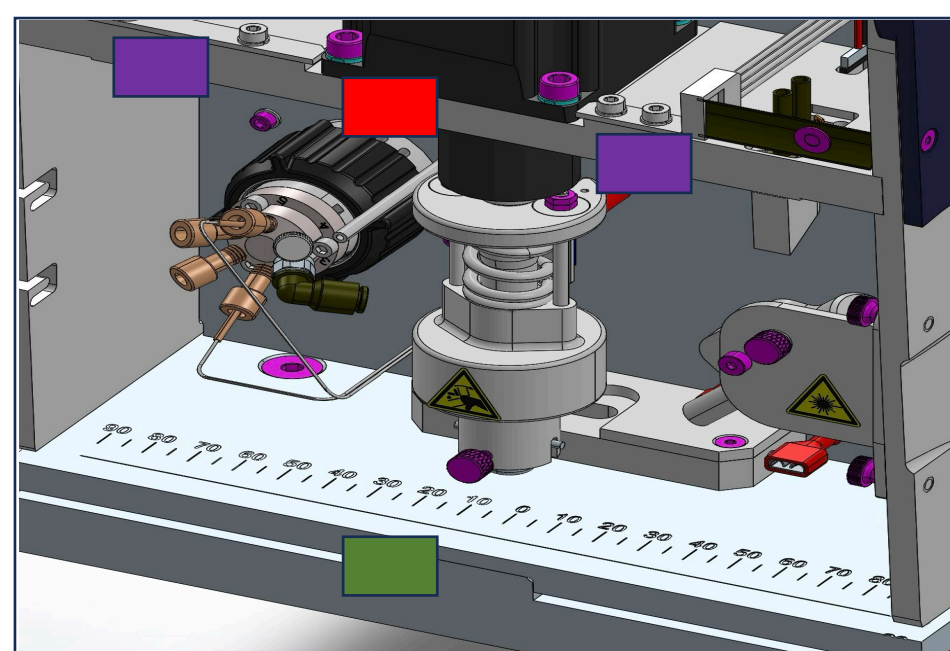
UV Lights
365nm – To excite the compounds
254nm – To excite TLC plate

Camera
To take an image of the location of each compound

XY Table
To move each compound under extraction head

Coding to instruct XY table to move to the correct coordinates

Option 2



Option 2 for improving the existing design by adding the following components to the enclosure. (See colored figures below)

UV Lights
365nm – To excite the compounds
254nm – To excite TLC plate

Camera
To take an image of the location of each compound

XY Table
To move each compound under extraction head

Coding to instruct XY table to move to the correct coordinates

Possible Problems and Solutions

- After each extraction, the extraction head is automatically cleaned by a plastic component that is pushed upward from the back. However, this cleaning mechanism poses a challenge to our objective of installing the XY table within the Plate Express system, as it limits the available space. To address this issue, the most effective solution is to remove the top baseplate, which would provide additional clearance beneath the extraction head, ensuring a smooth integration of the XY table without obstruction.
- The current design of the PlateExpress limits the available space for positioning the camera and UV light. The extraction head, along with other components, could block the camera's view or create shadows that affect the UV light's performance. To resolve this and allow for more flexibility, we can extend the sides and top of the PlateExpress, ensuring clear visibility for the camera and optimal functionality of the UV light.
- Since the PlateExpress has a smaller size, the XY table will need to be more compact. This will allow it to fit well within the system while still meeting our operational needs.

Design for UV Lighting

365nm UV Light Specifications (Excites the Compound on TLC Plate)

realUV™ LED Strip Lights
P/N: 7021

Waveform Lighting's realUV™ LED strip lights provide high power, ultraviolet light at 365 nanometers or 395 nanometers. These wavelengths are considered true UV-A wavelengths, and are the optimal wavelengths for activating and observing fluorescence and other UV-A phenomena.

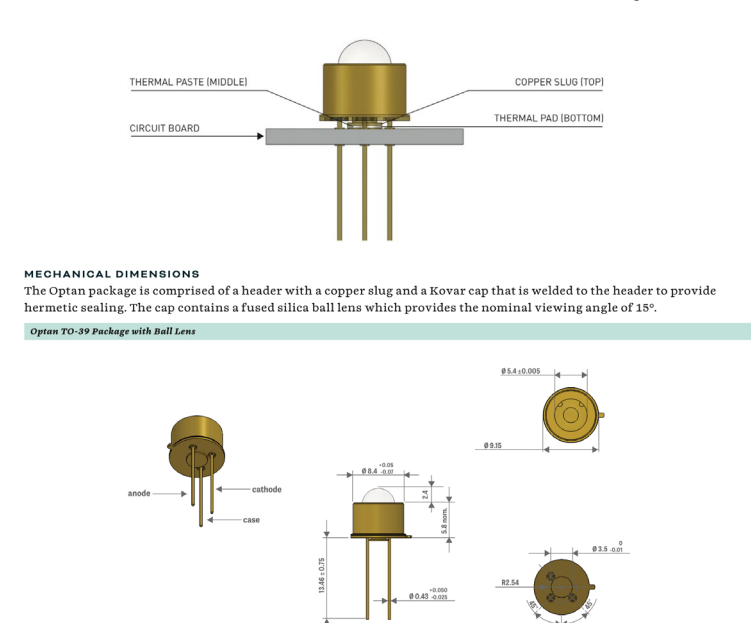
The back side of the LED strip includes pre-applied 3M VHB® double-sided tape, which provides a simple but extremely strong adhesive mounting method for all of your projects.

The LED strips are 16.4 feet (5.0 meters) in length (also available as short 3.2 ft reels), and are conveniently reeled for quick and easy application, and can be cut to length every 1-inch (25 mm) with just a pair of scissors.

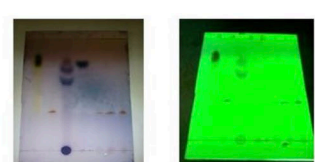
PRODUCT AND FEATURES

- Available in either 365 nm or 395 nm
- The light emitted from the 365 nm version is largely invisible, but a minuscule amount of visible light is also emitted and appears as a very dim, blue-white light.
- The 395 nm version emits a portion of its output energy in the visible wavelength range and appears as a dim, violet light.
- Available in either full reel (5 meters) or short reel (1 meter)

254nm UV Light Specifications (Excites TLC Plate to Outline the Compound)



365nm UV-A Light

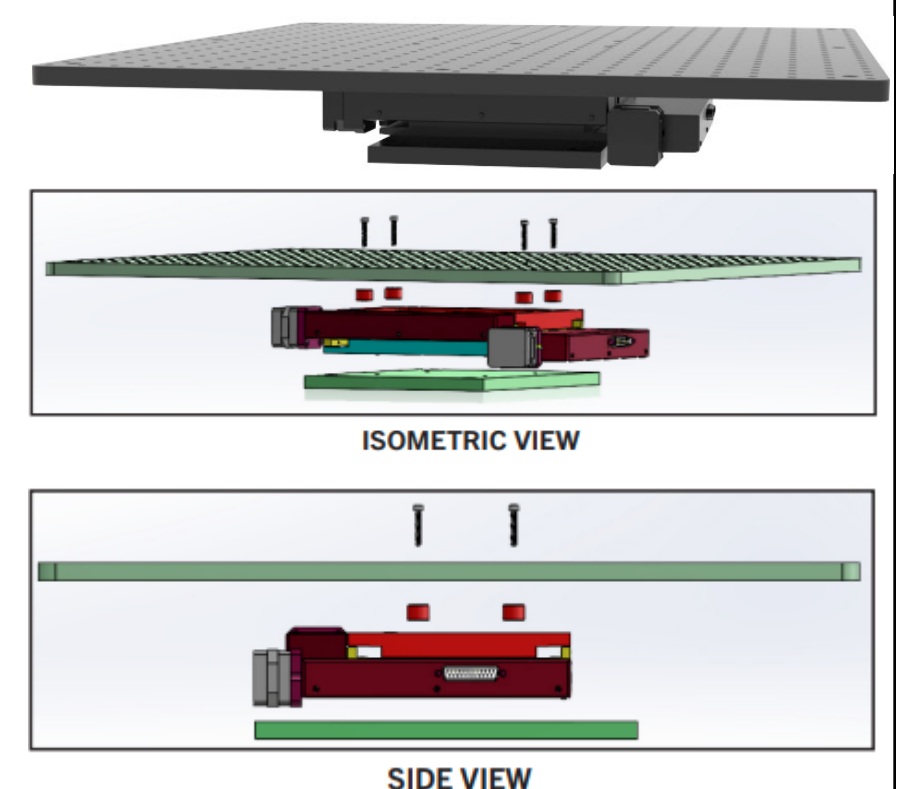


254nm UV-C Light



Designs for XY Table

- Fit for various TLC plate sizes
- Must secure the plate to table
- Table translates along XY plane
- Moves below the extraction head
- Reset for loading & unloading



Designs for Camera

- Captures visible light from the plate
- Sends the image to the computer to be processed & displayed
- Manufacturer: Basler Inc.
- Approximate dimensions: 1.15" L x 1.14" W x 0.78" H
- Resolution: 3845 x 2160
- Pixel Size: 2 μm x 2 μm



Designs for Automation

Steps the code (in C++ or python) will be required to complete

- Place the XY table under the UV lights and camera
- Activate the UV light to illuminate the TLC plate
- Take a photo of the TLC plate
- Document the locations of the relevant spots using the clustering method
- Transfer the location data to the computer
- Reposition the XY table beneath the extraction head
- Begin the extraction process (previously done by hitting a button)

Semester Deliverables:

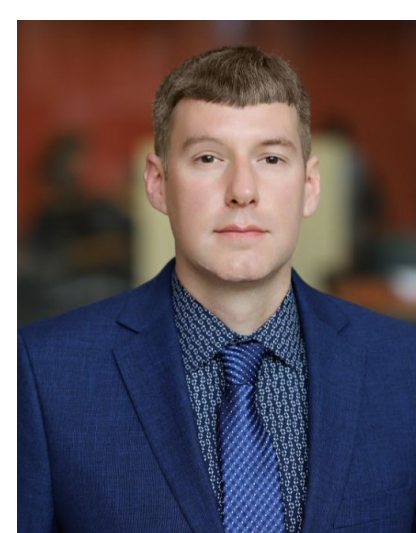
- Integrate UV light into PlateExpress to illuminate TLC plates and excite target molecules
- Add a camera system to record illuminated plates and mark positions for extraction and mass spectrometry analysis
- Incorporate an automated, programmable XY stage with 200 μm accuracy to align spots under the extraction head, supporting 200 Nm engagement force



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Mitchel James



Lee Reeves



Hope Sauberer



Mackenzie Anderson