AROMETRIX

FRACTION FINDER **ULTRA**

PROVISIONAL APPLICATION NOTE FOR COLUMN CHROMATOGRAPHY AND CONVERSION REACTION

WARNINGS: YOU MUST READ THIS MANUAL BEFORE USE | NEVER LOOK DIRECTLY INTO THE LIGHT SOURCE

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Acknowledgments

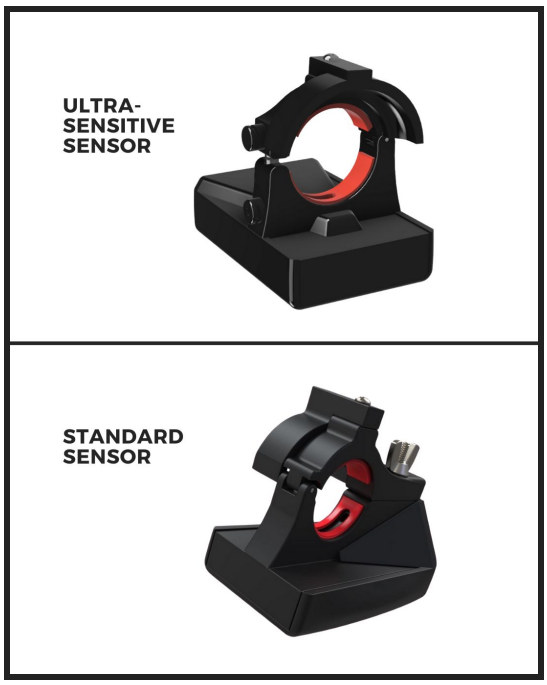
The Arometrix team would like to thank all members of the “Fraction Finder for Chromatography” and “Fraction Finder Findings” Instagram group chats for their support and feedback during the testing and validation of this new sensor.

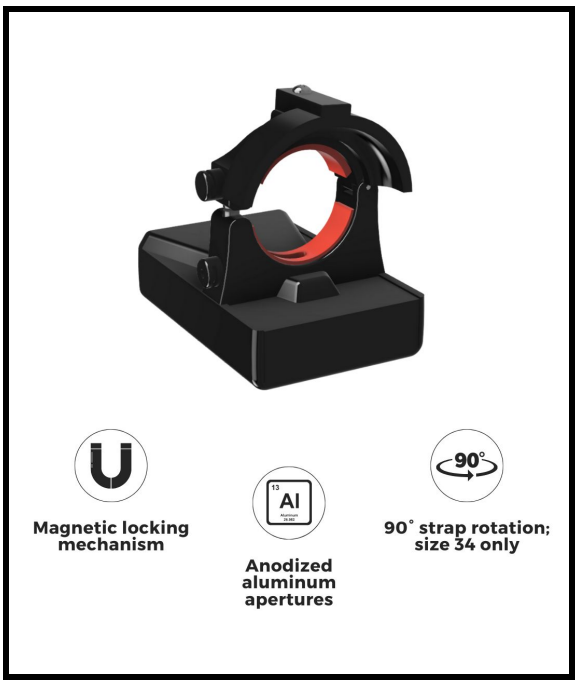
Arometrix extends its special gratitude and appreciation to its R&D collaborators, **Breaking Dabs, Lab X Oil, HX Labs, and Roberto Leslie of Clear Natural CBD** for their crucial work on testing and validating the FRACTION FINDER **ULTRA** technology for these new use cases. Additionally, we would like to thank Summit Research for working with us to develop a new adapter for Chromatography columns.

We are excited to finally present these initial FRACTION FINDER **ULTRA** learnings with our entire user base, and look forward to continuously updating this document as we gain new insights.

Section 1: Description and Principles of Operation

The FRACTION FINDER **ULTRA** consists of a ***new, significantly more sensitive sensor,*** and in most cases, a GL18 Chroma Adapter or sanitary flange Sight Glass. However, please note that it uses the same touch-screen digital display and software as the standard FRACTION FINDER package.





We encourage you to join our Instagram group chats (such as “Fraction Finder for Chromatography” and/or “Delta-8 Fraction Finder Findings”) to share relevant Fraction Finder and process insights with other users. If you’d like, you can also email saved run data to brains@arometrix.com.

Purpose of using the FRACTION FINDER ULTRA:

For certain processes, such as **Column Chromatography** and **Conversion Reaction**, highly sensitive detection of individual fractions is essential. These processes typically use a high amount of solvent, which means the sensor needs to be more sensitive. With this in mind, the FRACTION FINDER **ULTRA** was made. *This provisional application note was created to educate early adopters on best practices.*

- ***Chromatography*** *- Indication of the presence of individual Cannabinoids*
    - **Reverse-Phase or Normal-Phase**: Indicates (1) when CBD or THC is present and (2) when THC or CBD is present; validated for the purpose of THC remediation
    - **Color-Remediation:** Detects dark pigments such as Degradates & Chlorophyll
- ***Conversion/Synthesis Reaction*** *- Indication of the conversion of Cannabinoids*
    - Detects when the first Cannabinoid appears and monitor its conversion/synthesis to another Cannabinoid

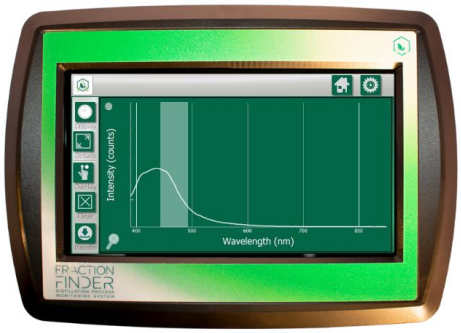
The most **relevant molecules** that the unit can detect for the processes are listed below:

- **Reference Peak** @ 360-370 nm; **sharp** peak structure
    - The Reference/Excitation peak is from the sensor device and is not a process indicator
    - Our **ULTRA** sensor is so sensitive that this peak is typically ***filtered out*** (i.e. removed or partially removed from view) once the sensor starts detecting fluorescent molecules
- **CBD Indicator** @ 450-490 nm; **sharp** peak structure
- **Delta-9 Indicator** @ 440-500 nm; **broader/shorter** peak structure (relative to the CBD Indicator)
- **Degradates** @ 510-550 nm; left-skewed peak structure
- **Chlorophyll**; may show 1 or 2 peaks @ 680 nm and 710 nm; doublet peak structure
- **Lipids** @ 530-630 nm; broad peak structure
- *For a complete list of molecules the unit can detect, please visit our **Chemical Cheat Sheet***

Section 2: Screenshots - Relevant Molecules

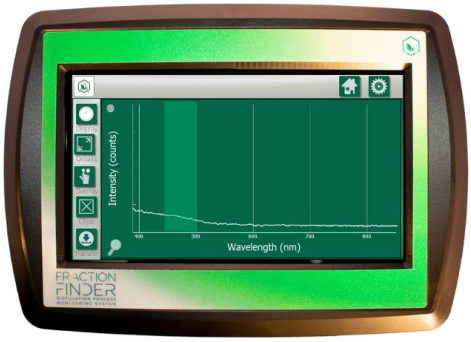
The screenshots below show the display's Spectrum graph with the Reference Peak removed from view. This can be done by tapping the Reference Peak Remover (small circle in the top-left corner).

CBD Indicator | Peak Structure: Sharp | Wavelength: 450-490 nm



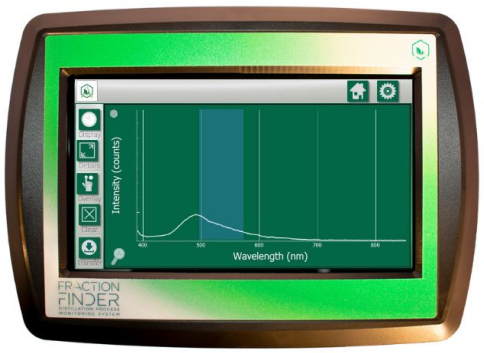
Tip: *The CBD Indicator's peak structure is sharp, which is associated with a very strong Intensity signal. For example, the signal shown in this guide has an Intensity Value of 2390.*

THC Indicator | Peak Structure: Short, Broad |Wavelength: 440-500 nm



Tip: *The key takeaway here is the intensity and peak structures of each Cannabinoid Indicator. Note how short and broad this peak structure is, relative to the CBD Indicator's peak structure. The unit is not intended to distinguish between CBD and THC simultaneously. However, if one Cannabinoid elutes before the other, which is the case for Column Chromatography, the unit will display the change in peak structures, which can then be used as an indicator of when each starts and ends.*

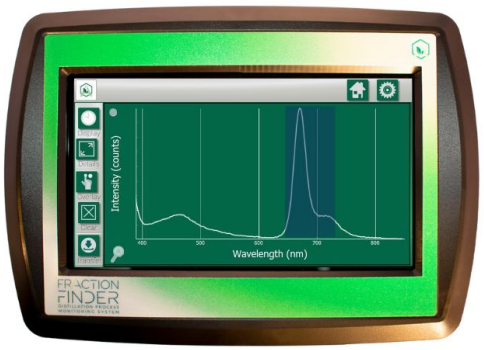
Degradates | Peak Structure: Left-skewed |Wavelength: 510-550 nm



Tip: *Consider editing factory defaults to 500 - 600 nm to track for any dark pigments. The intensity value of the signal shown is 81.*

This is especially relevant to Color Remediation Chromatography processes.

Chlorophyll | Peak Structure: Sharp; doublet |Wavelength: 680; 710 nm

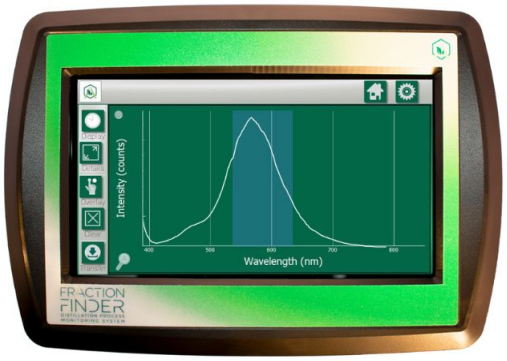


Tip: *Consider editing factory defaults to 650 - 750 nm to track for any Chlorophyll. In this screenshot, there are also Cannabinoids passing through; note the peak at 440-500 nm.*

A "doublet" peak is a peak with two conjoined peaks.

This is especially relevant to Color Remediation Chromatography processes.

Lipids | Peak Structure: Sharp; broad |Wavelength: 530-630 nm



Tip: *Lipids aren't one chemical, but a class of chemicals.*

This is especially relevant to Color Remediation Chromatography processes, or similar processes in which the goal is removing or excluding Lipids.

Section 3: Column Chromatography Application Note

Column Chromatography is a process used to purify liquids, such as individual Cannabinoid distillates. The substances to be separated are introduced onto the top of a column packed with an adsorbent (as silica gel or alumina), pass through the column at different rates that depend on the affinity of each substance for the adsorbent and for the solvent or solvent mixture, and are usually collected in solution as they pass from the column at different times.

This document will define the FRACTION FINDER **ULTRA's** use for various Chromatography processes, including:

- **Normal Phase Column Chromatography**
- **Reverse-Phase Chromatography**
- **THC Remediation**
- **Color Remediation Chromatography (CRC)**

The FRACTION FINDER **ULTRA** is highly-sensitive and was built with this process in mind.

During the process, the Spectrum graph (which tracks Intensity over Wavelength) will display a ***change in the peak structure***, as defined by the Cannabinoid Screenshots in ***Section 2*** and the pages to follow.

Note on the GL18 Chroma Adapter

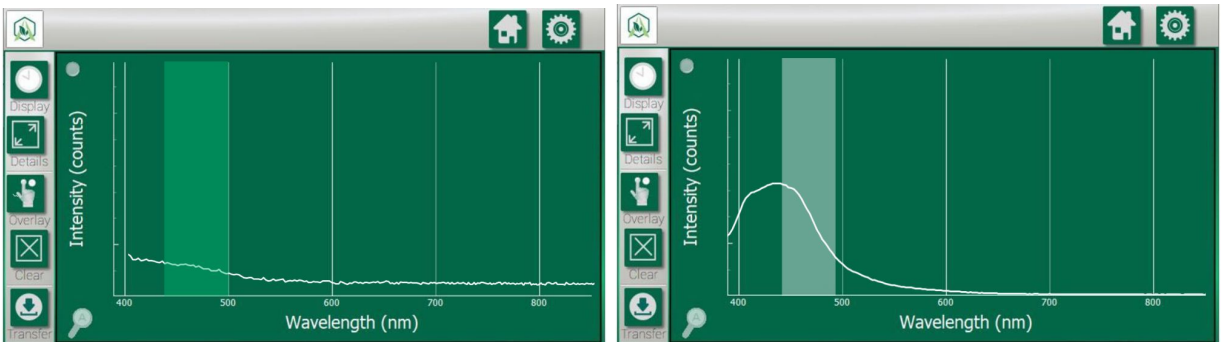
Our new **GL18 Chroma Adapter** *(pictured on the right)* allows you to easily integrate the new **ULTRA** sensor to your existing Chromatography Column (alternatively, you can purchase an AMP Sight Glass if your Chromatography Column has tri clamp connections.)

- GL18 to 34mm OD glass tube to GL18
- GL18 threads and barbed fittings on each end

The **6×48 CHROMA COLUMN FF** by Summit Research is also pictured on the right. Summit Research is Arometrix's close partner and distributor, and the team was instrumental in collaborating with Arometrix to develop this new GL18 Chroma Adapter solution for Chromatography.

Normal Phase Column Chromatography

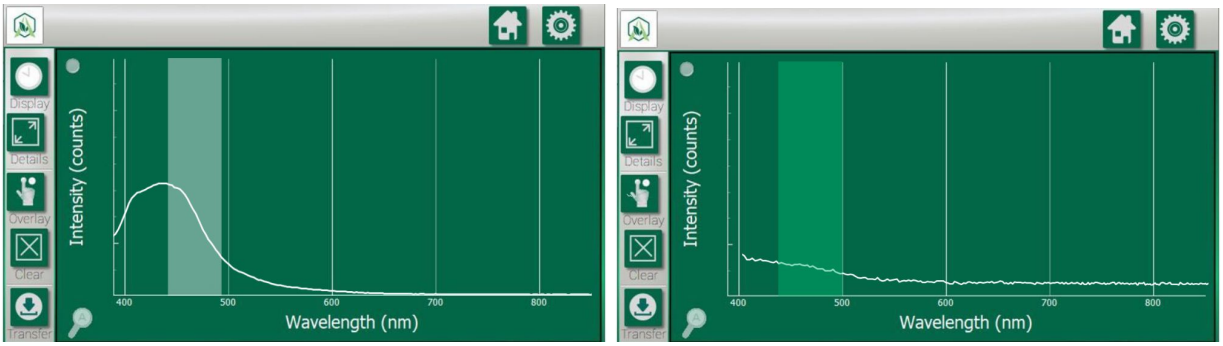
THC Indicator → ***CBD Indicator***



- ***During Normal Phase Chromatography,*** the THC fraction will elute, then later, the CBD fraction will elute.
- ***At the start of the run*****:** You should expect to see a slow rise up to ~500 or lower on the graph, indicating that the THC fraction is present and being detected.
- ***Process Indicator:*** You should expect to see the peak structure and intensity on the graph increase drastically from ~500 (THC Indicator) to ~5000 (CBD Indicator). When it increases, that indicates that CBD is present and starting to be detected. When it no longer increases (5-15 minutes later depending on process), it indicates that the CBD fraction is fully present.

Reverse-Phase Chromatography

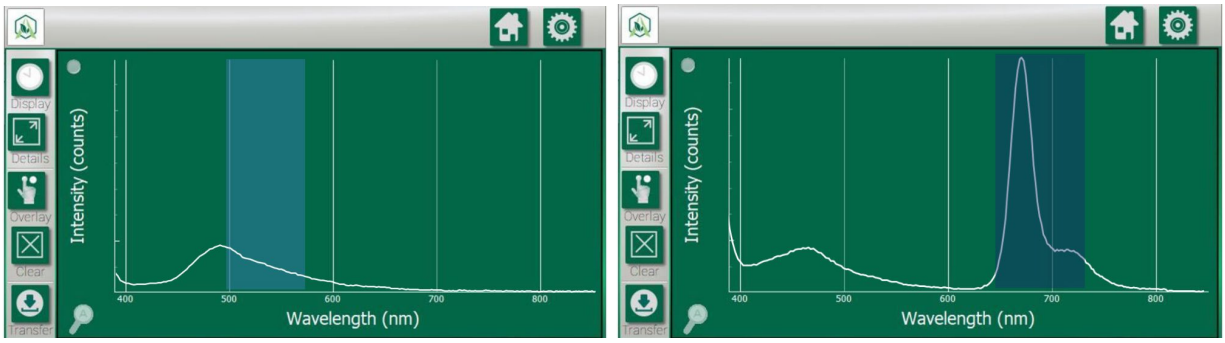
CBD Indicator → ***THC Indicator***



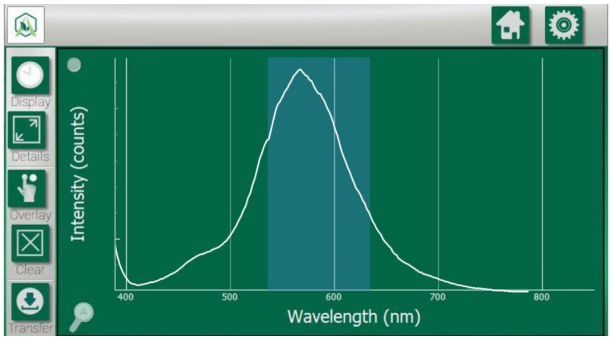
- ***During reverse-phase chromatography,*** the inverse occurs, the CBD fraction will elute, then later, the THC fraction will elute.
- ***At the start of the run*****:** You should expect to see a slow rise up to ~5000 or higher on the graph, indicating that the CBD fraction is present and being detected.
- ***Process Indicator:*** You should expect to see the peak structure and intensity on the graph drop drastically from ~5000 (CBD Indicator) to ~500 (THC Indicator). When it drops, that indicates that THC is starting to be detected. When it no longer drops (5-15 minutes later depending on process), it indicates that you are fully detecting the THC fraction.
- **Tip:** Once you achieve non-detected THC (if it is a remediation process), you can consider waiting a little longer on the CBD to minimize loss (aka optimize both potency and yield).

Color Remediation Chromatography

Degradates ***&*** ***Chlorophyll***



Lipids



- ***Color remediation*** (commonly referred to as CRC), dark colors are targeted and scrubbed throughout the standard process. The ULTRA can help ensure that Chlorophyll and Degradates (which is our broad term for heavy pigments like the “Tails” of a distillation) are optimally removed from the oil, without doing so at the expense of precious Cannabinoids.
- It is not essential to use the FRACTION FINDER **ULTRA** for this application. For this, typically, you do not need as much sensitivity in the sensor as you would if you were performing Delta-9 remediation; therefore, the standard FRACTION FINDER will work. This is because this process generally has easier separations and uses less solvent than other Chromatography processes.

Section 4: Conversion/Synthesis Reaction Application Note

Conversion/synthesis reaction is the production of a substance by the union of chemical elements, groups, or simpler compounds or by the degradation of a complex compound protein synthesis. Generally speaking, it involves one molecule that is converted into another molecule. Perhaps the most well-known method is the conversion of CBD to THC (typically either Delta-9 or Delta-8).

Most conversion reaction processes are straightforward; however, real-time molecular monitoring will allow you to optimize yield and potency, while simplifying and standardizing the process.

During the process, the Spectrum graph (which tracks Intensity over Wavelength) will display a ***change in the peak structure***, as defined by the Cannabinoid Screenshots in ***Section 2*** and below.

Featured: HX LABS SR-300 Synthesis Reactor

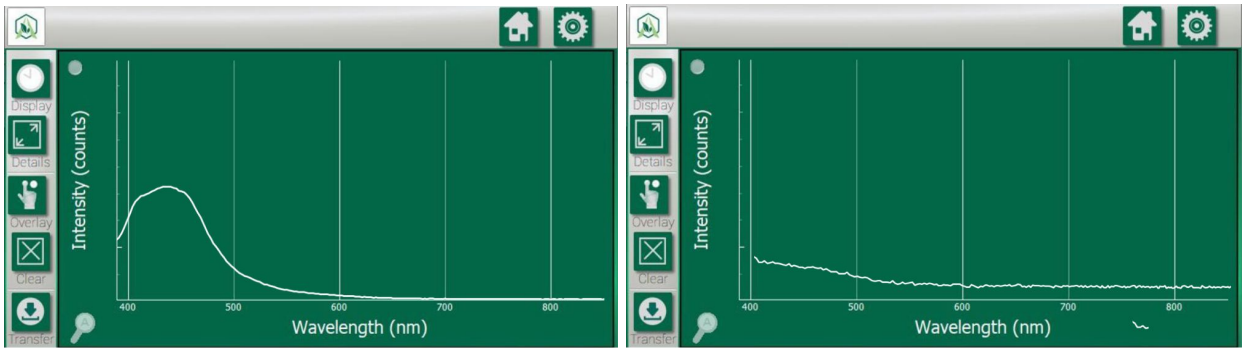
Bottom left corner of the image: The FRACTION FINDER ULTRA is installed on an AMP Sight Glass (designed for our sensor).

Top right corner of the image: The FRACTION FINDER display is clamped on to a mount.

NOTE: HX LABS is Arometrix's Conversion Reaction R&D partner and has provided valuable insight throughout the making of this application note.

Example of what to expect

CBD Indicator → ***THC Indicator***



- ***During the conversion reaction,*** the CBD fraction is pulled through and converted to THC
- ***At the start of the run***: You will see a slow rise up to ~5000 or higher on the graph, indicating that the CBD fraction is emerging.
- ***Process Indicator:*** You should expect to see the peak structure and intensity on the graph drop

drastically from ~5000 (CBD Indicator) to ~500 (THC Indicator). When it drops, you are transitioning to the THC fraction. When it no longer drops (1-3 minutes depending on your synthesis process), THC is fully present and being detected.

- **Note on Delta-8 detection:** While we are still investigating this, we've found that Delta-8 fluoresces very similarly to Delta-9. We currently hypothesize that it's wavelength region is highly similar to Delta-9's, likely between the "Fool's Gold" (405-435nm) and Delta-9 Indicator (440-500nm). Its peak structure may or may not be the same as the Delta-9 Indicator. To track Delta-8, we provisionally recommend setting Custom to a wavelength between 400-500 nm, then dialing it in and refining the region over the course of several runs. You can take a sample of pure Delta-8 THC in a vial and to try to establish a baseline by putting the vial into the sensor.

Section 5: Unpacking and Inspecting

After the instrument is received, it should be carefully unpacked and inspected for proper equipment.

Each FRACTION FINDER comes with:

- Fraction Finder Digital Display *(with pole mounting bracket)*
- Fraction Finder **ULTRA**-Sensitive Sensor *(currently only in size 34 form)*

- Adapter *(options vary depending on process/equipment)*

Sight Glass (1.5" or 2" Sanitary End Clamp) ***GL18 Chroma Adapter***

- Sensor Cable, USB, 2-10' (if using a sight glass, the cable will be hardwired into the sight glass)
- Light-Blocking Tape
- International Power Supply
- Warranty Card

Section 6: Installation

1. Apply the light-blocking tape to the glassware apparatus. NOTE: If you are using the Fraction Finder sight glass, skip this step, as the tape will already be on it.
2. Install the optical sensor (and sight glass, if applicable) with the thicker part of the sensor down. The sensor should be installed on, or directly above, the collection vessel. Position it so that the sensor's detector is aimed at the most volume of oil possible to ensure a strong reading.
3. Plug the sensor cable into the sensor and the display. Give the sensor ~2-5 minutes to boot up.
4. Mount the display to a lab pole using the mounting bracket screw.
5. Use the supplied AC adapter to power your display. Allow it to boot.
6. Ensure: (1) That the Device Status and Server Status indicator; (2) that the "Light On/Light Off" toggle button is turned on
7. Set Scans to Average to 5, then turn AutoIntegration (AID) on by tapping the checkbox

Image Set 1: FRACTION FINDER ULTRA on Chromatography Column

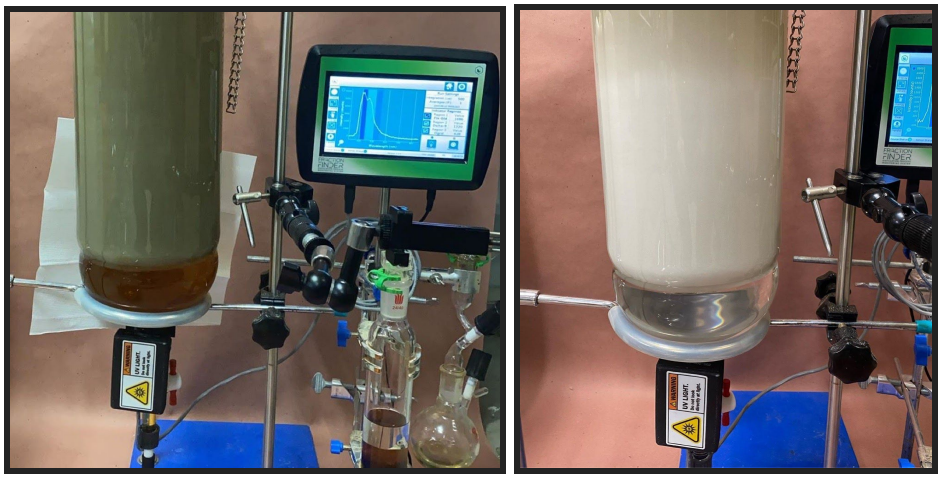


Image Set 2: FRACTION FINDER ULTRA on HX LABS SR-300 Synthesis Reactor