

FRACTION FINDER

Feedback for Process Control During Wiped Film Evaporation



Abstract

Wiped film evaporation (WFE) is a continuous distillation process, in which a rotating wiper sends the distillate onto a heated surface within the system, thinning the material and separating it into two different pathways that are collected in separate flasks. Currently, in WFE of cannabis oil, processors look at the color and viscosity of the fluid to determine the quality of their separation during the process. Processors can control the quality of their process using four parameters: temperature, flow rate, vacuum pressure, and wiper speed (RPM). During the process, processors primarily control and adjust temperature and flow rate, while vacuum pressure and wiper speed are fixed. The current control process is very subjective and based on experience. With the FRACTION FINDER™ system, composed of two *Sensors*, each wrapped around a WFE tube and connected to a *Display* unit, WFE processors can see the quality of their separation via chemical signatures graphed on the Display, and adjust their parameters based on that scientific data. The FRACTION FINDER system can replace subjective measurement of colors and viscosity with actual measurement of the presence of cannabinoids in the separate flasks. Essentially, the FRACTION FINDER can be used as both process optimization and a “vote of confidence” by determining that the processing conditions are actually distilling correctly.

WIPED FILM EVAPORATION

Wiped film evaporation (WFE) is a continuous distillation process, in which crude oil is fed into a main chamber where a spinning wiper sends the distillate onto a heated surface within the system. The spinning wiper thins the crude oil to a film to maximize the heat uniformity and thermal transfer of the product as well as to accelerate the heat-up times. This results in an efficient, uniform heating process. While the heated crude will fall into a flask, the vaporized crude will be sent through a different pathway that is recondensed and collected. The WFE process is commonly used for the production of refined fragrance, fats, and hemp oil, among other markets.



DIFFERENCES BETWEEN WIPED FILM AND SHORT-PATH

Other methods of refinement such as a short-path distillation (SPD) have no feed stream, and thus are considered 'batch processing'. WFE, however, is a process that is constantly separating, and thus can be operated in either 'semi-batch' or 'continuous' processing modes. Also unlike SPD, which requires sequential separation of all fractions, WFE separates in parallel, overcoming fundamental speed and efficiency limits of SPD. Furthermore, WFE has no big boiling flask, which reduces the amount of time the crude oil is kept at high temperature. This time reduction significantly decreases the thermal degradation of cannabinoids during the separation process. Lastly, while WFE is known to have higher throughput, this increase comes at a higher equipment cost.

In WFE, processors manage four different parameters:

- Flow rate
- Temperature
- Pressure
- Wiper speed (RPM)

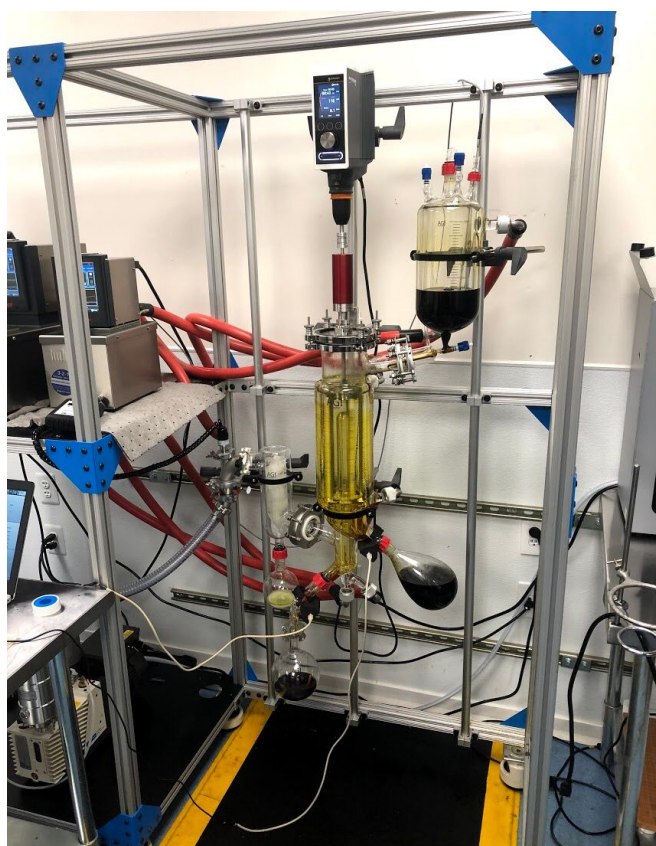
NO FEEDBACK ON WFE PROCESS PARAMETERS

The FRACTION FINDER™ is addressing the same problems that it solved in Short Path Distillation: there's a lot of "eyeballing" and guesswork involved. If a processor

were to use sub-optimal parameters during their process, they are getting suboptimal product the entire time. For example, if a processor is trying to reach 90% purity, but due to suboptimal processing conditions the cannabinoid reclamation stream yields only 70% purity, the product will end up having purity of 70% because the processor ran with those parameters throughout the entire process.

To tell how good a separation is during the process, processors monitor certain properties of the collected distillate, such as the color and viscosity, by eye to determine proper operating conditions. This is all very subjective and based off of experience. With the FRACTION FINDER™, all of the guesswork is eliminated from the process. It allows the separation quality to be observed directly, informing the user when operating conditions should be adjusted and optimized in real time. If it shows that the right chemical signatures are present in the collection flask lines, the separation process is optimized.

Each WFE system has different parameters that they run at, so optimizing those parameters is particularly important. Furthermore, between each pass (1st and 2nd), the processor must change their parameters because they're trying to boil off completely different components. Finally, with WFE, processors don't know if their parameters are optimal to begin with and cannot always have complete and precise control of the parameters as well as correcting for abnormalities in process equipment. This is why using the FRACTION FINDER for WFE is incredibly important.



USING FRACTION FINDER FOR WFE

As opposed to SPD, where the FRACTION FINDER system is indicating to the user when the separation is over, or in other words, the endpoint of each fraction, the FRACTION FINDER for WFE is indicating to the user the quality of the separation, essentially optimal vs. suboptimal.

The FRACTION FINDER for WFE will make the user aware of how good their separation is at any point during the process. This, in turn, will lead to greater consistency of processes,

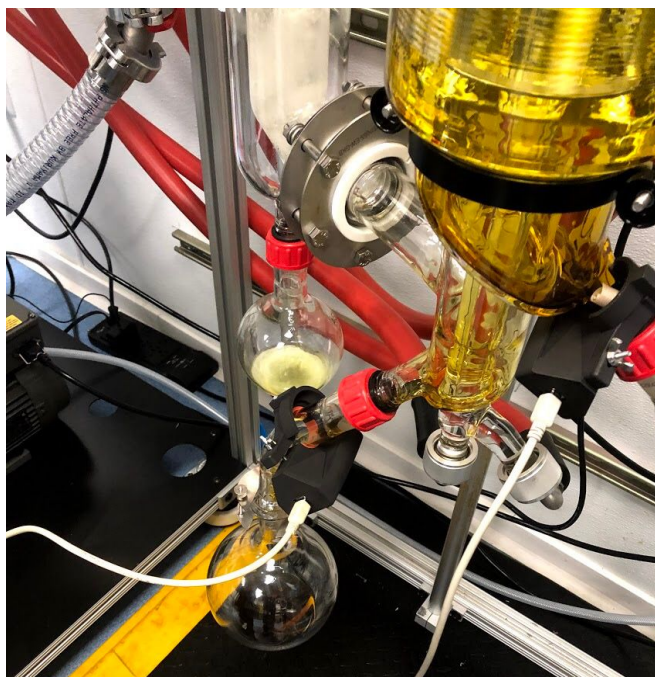
purity of end product, and improved overall processor confidence on every single run. In addition, the system will be made easy enough for any novice to use, which will make training processors on WFE easier than ever.

HOW THE SYSTEM WILL WORK

During the WFE process, processors control and adjust their temperature and flow rate. The FRACTION FINDER will help them tell whether control parameter adjustments are helping or hurting the process. Essentially, it will give them feedback about how changes in their parameters are affecting the quality of their separation. For example, it might indicate that the jacket temperature is too low, or too high.

Below is a scenario that reflects how the FRACTION FINDER could help during WFE:

During a first pass separation of CBD to boil off terpenes, a processor would look at the chemical signatures graphically shown on the FRACTION FINDER displays. In this example, the FRACTION FINDER is telling them that there is a bunch of CBD in both collection streams, which is suboptimal for separation. This would indicate to the processor that s/he adjust their process parameters to better optimize the process. Perhaps the processor decides to change their temperature and drop it down to 130°C. At this point, the processor would check his/her chemical signature, watch it, and determine if the chemical signature is getting better or worse. In essence, the operator is using the FRACTION FINDER to increase the separation efficiency and yield.



TECHNOLOGY AND ITS FUTURE

The technology and configuration used in the FRACTION FINDER is a patented solution for use in distillation and extraction. The pending patent will allow

