	Addendum to Investigation on cannabinoids in $\Delta 8$ -THC Distillates	
		Issued: 3/12/21

1. Introduction

As the interest on $\Delta 8$ -THC product keeps increasing more people are becoming aware of the testing challenges these samples pose and the need for rigorous and reliable testing is growing.

Specifically, the major challenge resides in the correct determination of the cannabinoid profile, rendered complicated by the presence of many different by-products. The main questions, and area of disagreement between laboratory results are two:

- The presence/absence of $\Delta 9$ -THC
- The quantification of $\Delta 8$ -THC

These two points are of crucial importance and the lack of conformity in testing is creating a lot of confusion and risks stymieing this nascent market.

2. State of the art

As $\Delta 8$ -THC products started to gain traction, it quickly became clear that most of the standard “high throughput” methods for cannabinoids analysis commonly used in cannabis where not well suited for the complex chemistry of these kinds of products.

In PharmLabs’ initial report on the investigation of cannabinoids in $\Delta 8$ -THC distillates we showed that $\Delta 8$ -THC products frequently have an unknown cannabinoid, most likely another THC isomer, that typically elutes in between $\Delta 9$ -THC and $\Delta 8$ -THC and that could, at times, be mislabeled as $\Delta 9$ -THC if the HPLC method was not tuned to enhance the separation around $\Delta 9$ -THC and $\Delta 8$ -THC.

In other cases, the high throughput method does not even allow to separate the $\Delta 9$ -THC/unknown peak form $\Delta 8$ -THC, causing a severe overestimation of the $\Delta 8$ -THC potency and an oversimplification of the chromatogram.

Fortunately, overtime, many laboratories were able to modify their methods to better resolve the peaks and acknowledge the presence of the unknown cannabinoids and a few laboratories are even attempting to identify it, although there is still a lot of variability in results.

3. Recent developments

a. Spike experiment

To confirm the presence of an unknown cannabinoid, separate from $\Delta 9$ -THC, we performed a spike of a $\Delta 8$ -THC distillate.

As can be seen from figure 1, the sample spiked with $\Delta 9$ -THC shows a clear shift of the peak, confirming the presence of an unknown cannabinoid eluting in between $\Delta 9$ -THC and $\Delta 8$ -THC.



Addendum to Investigation on cannabinoids in $\Delta 8$ -THC Distillates

Issued: 3/12/21

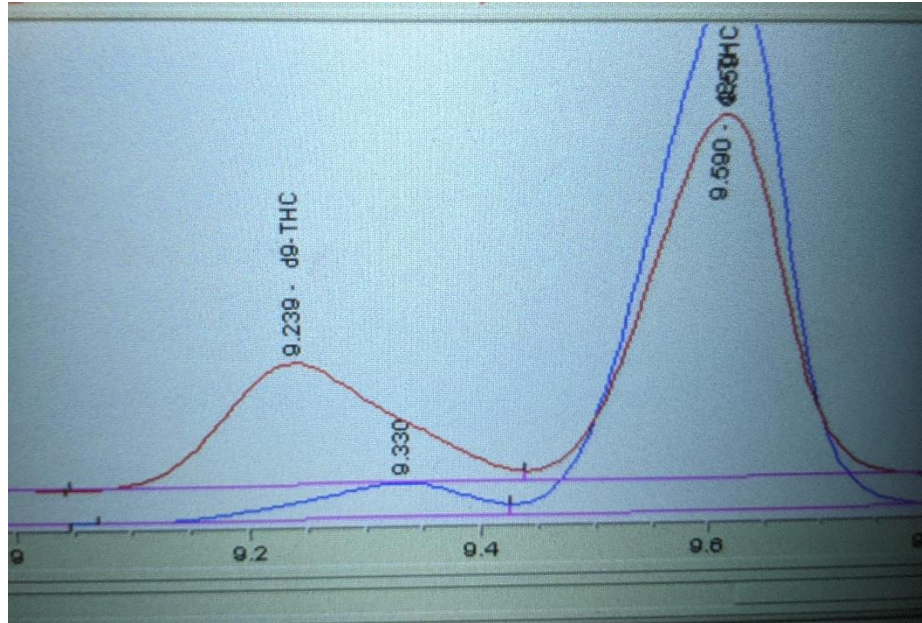


Figure 1. Overlay of a $\Delta 8$ -THC Sample (blue line) and a $\Delta 8$ -THC sample spiked with $\Delta 9$ -THC (red line).

b. Co-presence of $\Delta 9$ -THC and unknown cannabinoid

The presence of the unknown cannabinoid does not exclude the presence of $\Delta 9$ -THC in the product.

In multiple occasions, we have seen the presence of both cannabinoids in the tested samples. Unfortunately, the separation between those two compounds is not optimal, often resulting in partial coelution and complicating the analysis of these samples. When just $\Delta 9$ -THC is present, a single peak next to $\Delta 8$ -THC can be seen, and the separation between the two is marked (figure 2a). When just the unknown cannabinoid is present a single peak with a gaussian slope can be seen next to $\Delta 8$ -THC, and the separation between the two is less pronounced. When $\Delta 9$ -THC and the isomer are both present, depending on the relative concentration of the two a single weirdly shaped peak can be seen. Specifically, if $\Delta 9$ -THC and the unknown are roughly at the same concentration only one very broad peak is visible (figure 2c), if $\Delta 9$ -THC is more abundant than the unknown the $\Delta 9$ -THC peak shows a protuberance on the right side (figure 2d) and finally if $\Delta 9$ -THC is less abundant than the unknown the unknown peak shows a protuberance on the left side (figure 2e).

In figure 3 a sample containing just the unknown isomer (red line) and one containing a small amount of $\Delta 9$ -THC (blue line) are overlaid to better visualize the difference between of peak shape.



Addendum to Investigation on cannabinoids in Δ 8-THC Distillates

Issued: 3/12/21

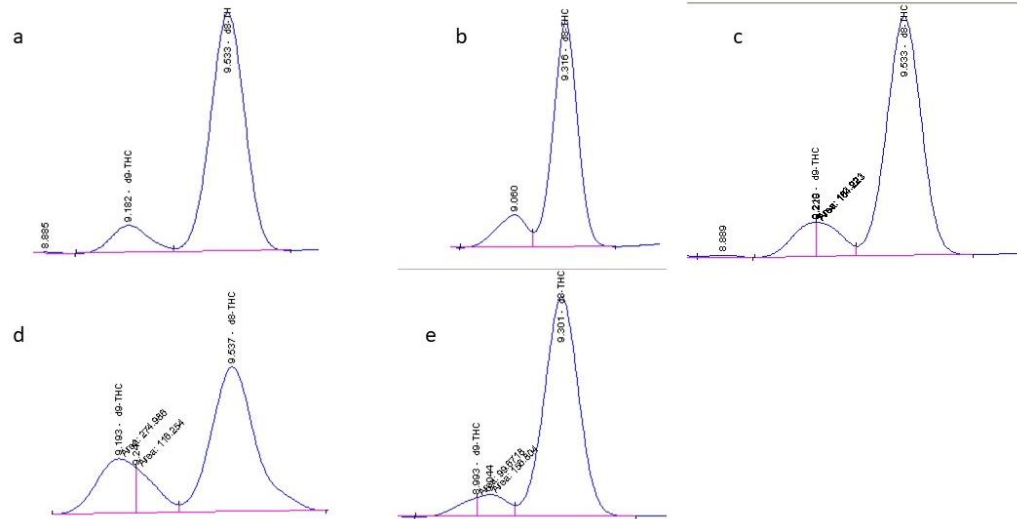


Figure 2. Examples of possible peak shapes: (a) only Δ 9-THC, (b) only unknown cannabinoid, (c) Δ 9-THC and unknown at the same concentration, (d) more Δ 9-THC, (e) more unknown.

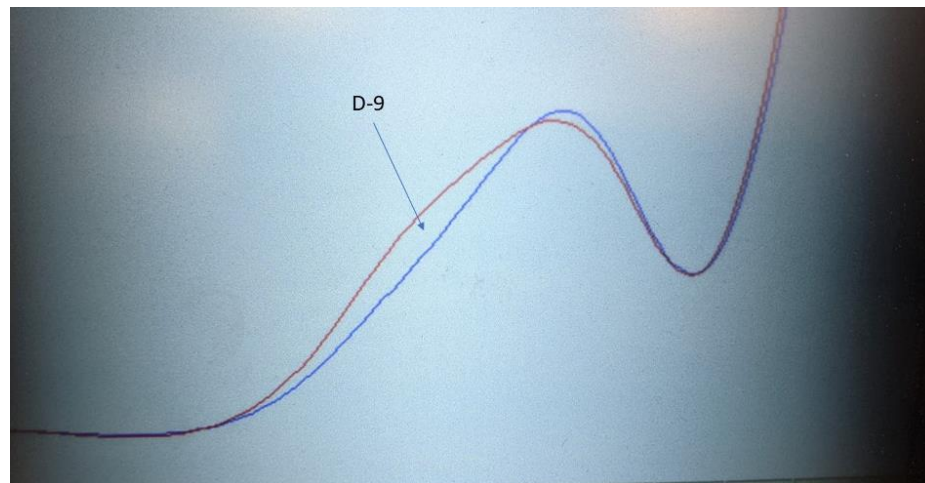



Figure 3. Overlay of a sample containing just the unknown (blue line) and one containing also a smaller amount of Δ 9-THC (red line).

We believe that the best service we can do to the industry is to honestly report the results we obtain, and specifically to report the presence of Δ 9-THC in samples when the peak shape strongly suggests the presence of two co-eluting compounds. Unfortunately, not all laboratories have reached a degree of chromatographic separation sufficient to perform this kind of analysis and this will result in a discrepancy of results.

	Addendum to Investigation on cannabinoids in $\Delta 8$ -THC Distillates	
		Issued: <i>3/12/21</i>

c. Stability of $\Delta 8$ -THC

Another issue we have noticed frequently with $\Delta 8$ -THC products is their stability over time. Testing the same sample at different time points we have seen the tendency of the $\Delta 8$ -THC to be reduced in favor of the unknown isomer peak and, alarmingly, the presence of $\Delta 9$ -THC in previously “clean” samples.

We currently do not know exactly what conditions cause the distillate to shift overtime or if anything can be done to avoid it.

Until more information is available, we would urge our clients to store the distillate away from direct light and heat sources and to use it as soon as possible after the initial test.