Analysis of Tetrahydrocannabinol Vape Oils Using Pyroprobe by Thermal Extraction

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Application Note
Cannabis

Abstract
This application note demonstrates a multi-step thermal extraction study on Tetrahydrocannabinol (THC) vape oils.

Introduction
E-cigarettes have gained popularity in recent years, in conjunction with the legalization of marijuana in many U.S. states. Authentic THC vape oils are not easily distinguishable from the counterfeits, which are poorly regulated and can cause severe lung injuries. There has been a growing national interest in the effective analysis of THC vape oils. One of the challenges is that vape oil comes with a complex solvent that contains a variety of volatile and semi-volatile ingredients. Before analysis via GC or HPLC, the sample needs to be either extracted or diluted before analysis, to avoid saturating the instrument. While these approaches may be adequate, they have limitations related to human error in wet chemistry and high cost through intensive labor. A direct thermal extraction of vape oils using a Pyroprobe can provide a fast and accurate solution.

Experimental Parameters
200 μg of THC Vape oil was thermally extracted using a multi-step sequence by a CDS Analytical Model 6150 Pyroprobe with an autosampler module. The instrument was interfaced to a mainstream GC/MS. A DISC tube was used as the sample vessel.

Pyroprobe:		**GC-MS**	
Setpoints:	200°C, 400°C, 600°C 60s	Column:	5% phenyl
		Inlet:	360°C
DISC Interface:	300°C	Carrier:	Helium 1.25mL/min 80:1 split
Transfer Line:	300°C		
Valve Oven:	300°C	Oven:	40°C for 2 minutes 12°C/min to 300°C
		Ion Source:	250°C

Results
Figure 1 shows a THC vape oil extracted at 3 sequential temperatures, 200°C, 400°C, and then 600°C. At 200°C, THC vaporizes. At 400°C, more THC, cannabinoids, and carrier agents are extracted, and at 600°C, a trace of cannabinoids and carrier agents are detected. From the multi-step run, it was concluded that 400°C was the optimized thermal extraction temperature.

Figure 2 shows 400°C runs on two different vape oils. The profile for THC and other cannabinoids were quite similar (Figure 2). However, the carrier of these 2 vapes differ (Figure 3).

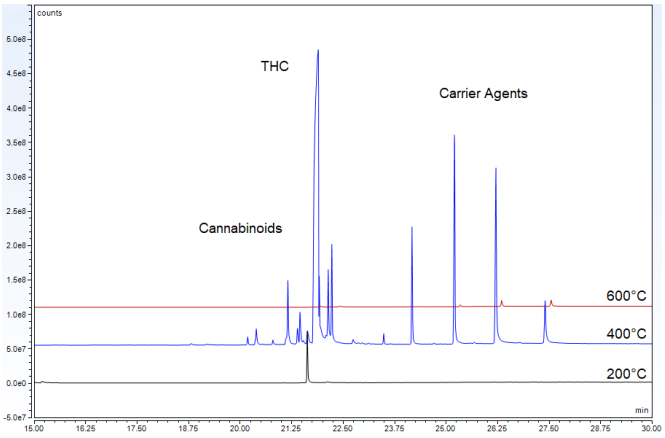

Figure 1: Time and Signal Offset Overlay of THC Vape oil externally extracted at 200°C(bottom), 400°C (middle), and 600°C (top)

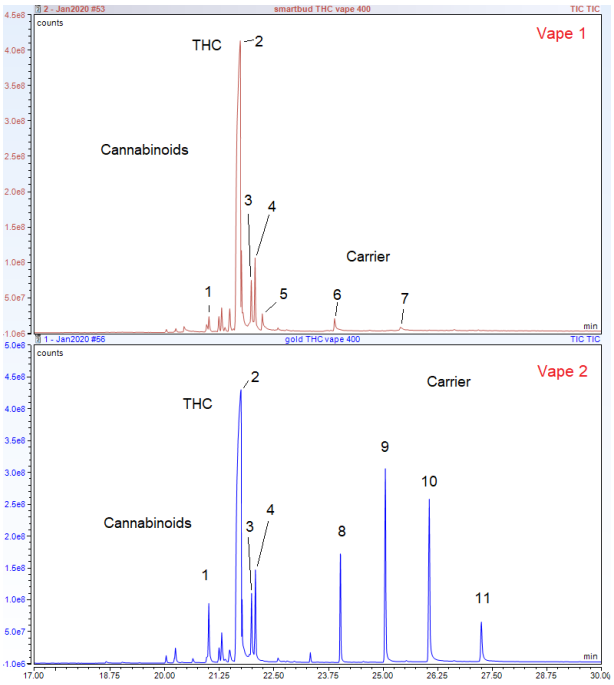

Figure 2: Two THC vape oils at 400°C (after 200°C)

Table 1: Peak Identifications in Figure 2

Peak #	Identification
1	Cannabichromene
2	Delta-9-Tetrahydrocannabinol
3	Cannabigerol
4	Cannabinol
5	Heptaethylene glycol
6	Octaethylene glycol
7	Undecaethylene glycol
8	Glycerol tricaprylate
9	2-(Decanoyloxy)propane-1,3-diyl dioctanoate
10	3-(Octanoyloxy)propane-1,2-diyl bis(decanoate)
11	Decanoic acid, 1,2,3-propanetriyl ester

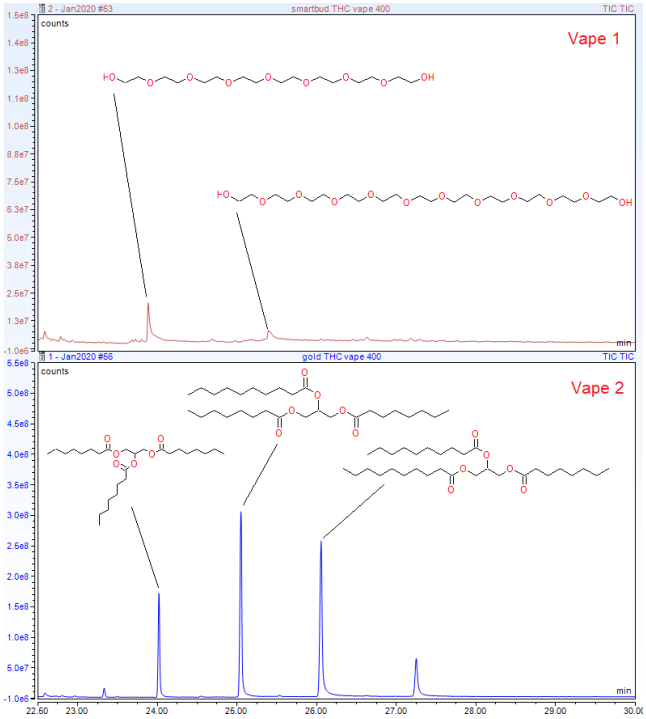

Figure 3: Magnification of two THC vape oils at 400°C

Vitamin E acetate, which is a known by the CDC to be added to illicit vapes, was not detected in either oil. Vape oil 1 contains a series of polyethylene glycols (PEG). PEG can create carcinogens like acetaldehyde and formaldehyde when heated to high temperatures.

Instead of PEG, vape oil 2 has a series of medium chain triglycerides (MCT), associated with coconut and palm kernel oils. While MCT oil is healthy to ingest, chronic vaping of this substance can cause lipid pneumonia, as oil coats the inside of the lungs preventing adequate oxygen exchange.

Conclusion

Multi-step thermal extraction by Pyroprobe 6150 allows the analysis of volatile and semi-volatiles directly to the gas chromatograph. Because there is no sample preparation step involved, thermal extraction can be an efficient way to analyze vape oil. Differences in semi-volatile ingredients, specifically carriers, were found between two different THC vape oil brands.