SHIMADZU
Excellence in Science

Application News

SSI-LCMS-046

Liquid Chromatography Mass Spectrometry

Quantitative Analysis of Cannabinoids using the LCMS-8040 Triple Quad MS

LCMS-8040

Summary

Evaluation and quantitation of a variety of cannabinoids on an LCMS-8040 triple quadrupole mass spectrometer.

Method

Cannabichromene (CBC), cannabigerol (CBG) and Δ9-THC Acid A (THCA) standards were purchased from Restek (Bellefonte, PA). Cannabinol (CBN), Δ8-THC (d8-THC), Δ9-THC (d9-THC), Δ9-THC-D3 (d9-THC-D3) and Cannabidiol (CBD) were purchased from Cerilliant (Round Rock, TX). A stock concentration of 1 µg/mL for each standard was used for MRM optimization. The standards were combined into one solution and then serially diluted with 70/30 (%) methanol/water using 2-fold dilutions yielding concentrations ranging from 8192 ng/mL to 1 ng/mL. The IS (d9-THC-D3) was added to all levels. The standards (**Figure 1**) were transferred to autosampler vials and injected into a Nexera-LCMS-8040 system for analysis.

A Thermo Hypersil Gold (1.9 µm x 2.1 mm x 100 mm) was used with a binary gradient of 5 mM ammonium acetate in water and acetonitrile. The gradient conditions are shown in **Figure 2**. The flow rate was 0.5 mL/min with a run time of 6.8 min. The column temperature was 45° C and the injection volume was 5 µL.

LCMS-8040 Analysis

Dual ion electrospray ionization (DUIS) in both positive and negative modes was used for ionization of the analytes on the LCMS-80400. Multiple reaction monitoring (MRM) in positive and negative modes was used for analysis. At least one reference ion was monitored for each analyte. Details of the MS parameters are shown in **Table 1**.

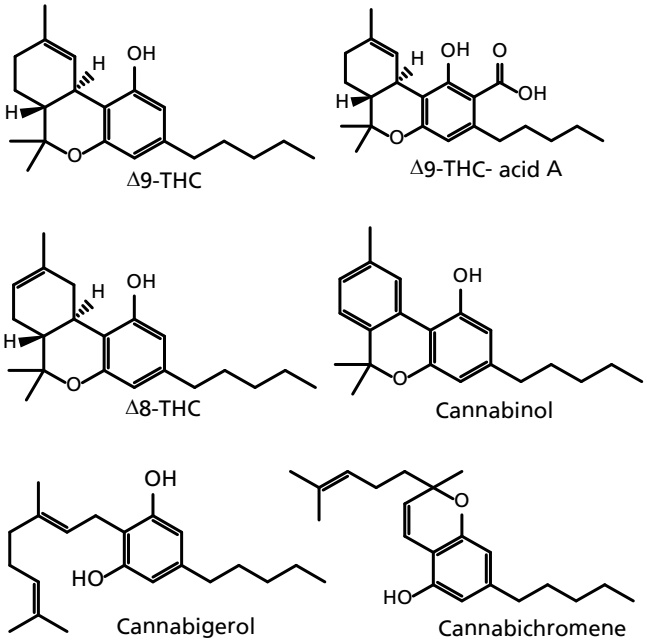


Figure 1. Chemical structures for cannabinoids.

Results and Discussion

Peaks were smoothed using the standard method set to 2 counts and 2 sec for width. The auto integration setting was used with a setting of 1 max peak and 6 sec width. d8-THC was integrated by turning off peak integration from 4.9-5.3 minutes. Linearity was achieved from 1-8192 ng/mL for CBG, 2-4096 ng/mL for CBN, 4-4096 ng/mL for d9-THC, 8-8192 ng/mL for d8-THC, 64-4096 ng/mL for THCA, 4-8192 ng/mL for CBD and CBC. The calibration curve was weighted using 1/C and not forced through zero. No standards were excluded over the included range and r^2 values ranged from 0.998-0.999. A representative chromatogram and calibration curve for each analyte are shown in **Figures 4-11**.

Time (min)	%B
0	69
1.6	69
3	72
5	80
5.1	90
6	90
6.1	69
8	69

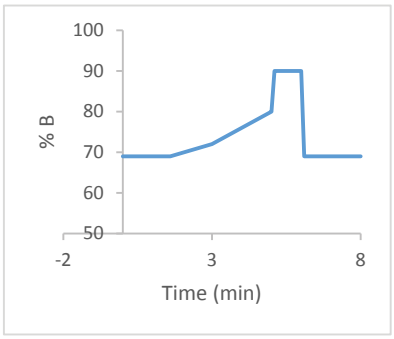


Figure 2. Gradient conditions.

MS Interface Parameters	
Interface	DUIS
Nebulizing gas flow	2 L/min
Drying gas flow	15 L/min
DL Temperature	300 °C
Heat Block Temperature	500 °C
Polarity	(+) CBD, CBG, CBN, d8-THC, d9-THC, CBC (-) THCA

Table 1. MS Interface parameters.

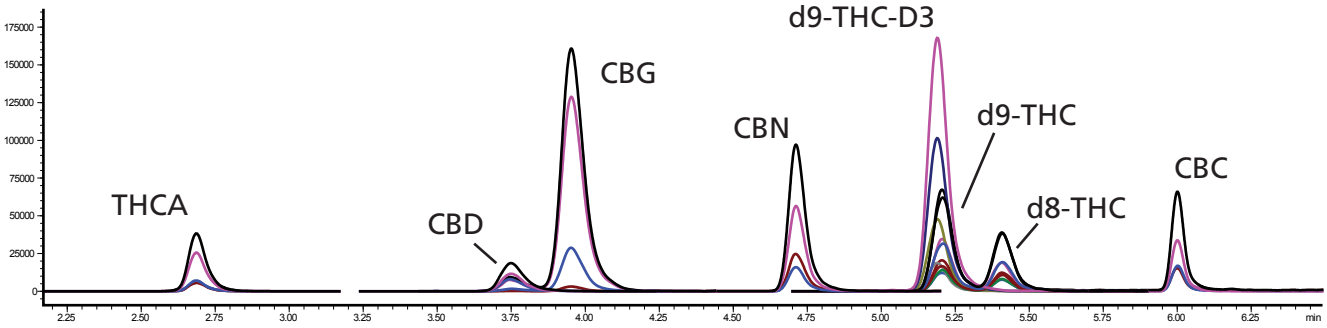
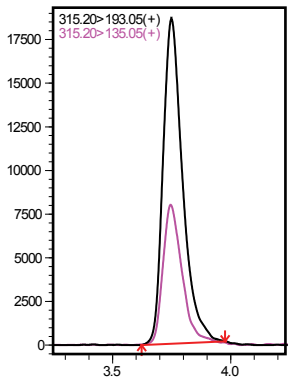


Figure 3. Representative chromatogram cannabinoids at 64 ng/mL.



CBD - LLOQ: 2 ng/mL
Linear Range: 4-8192 ng/mL
r^2 = 0.999

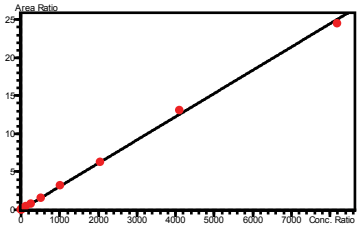


Figure 4. Chromatogram and calibration curve for cannabidiol (CBD).

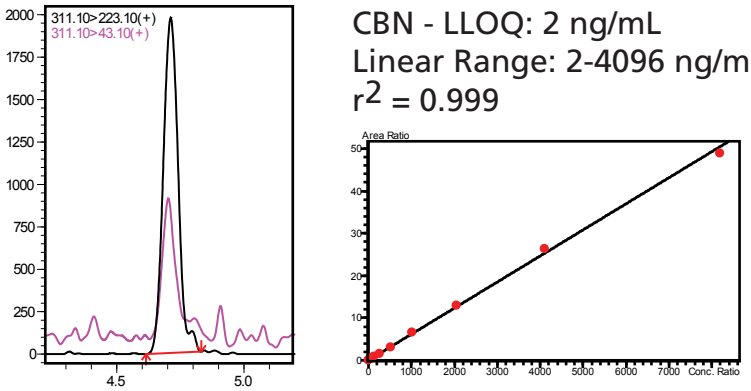


Figure 5. Chromatogram and calibration curve for cannabinol (CBN).

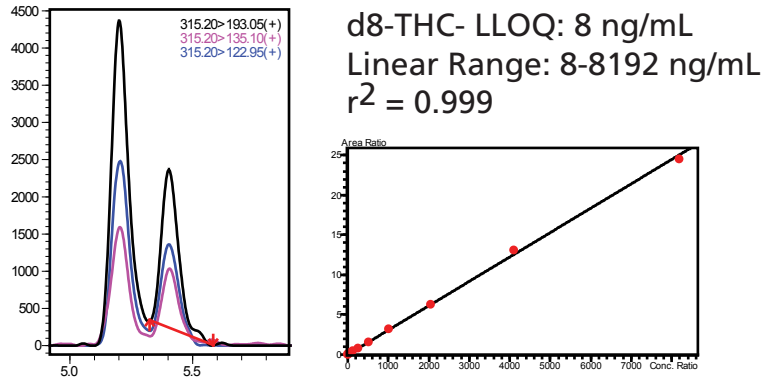


Figure 6. Chromatogram and calibration curve for d8-THC.

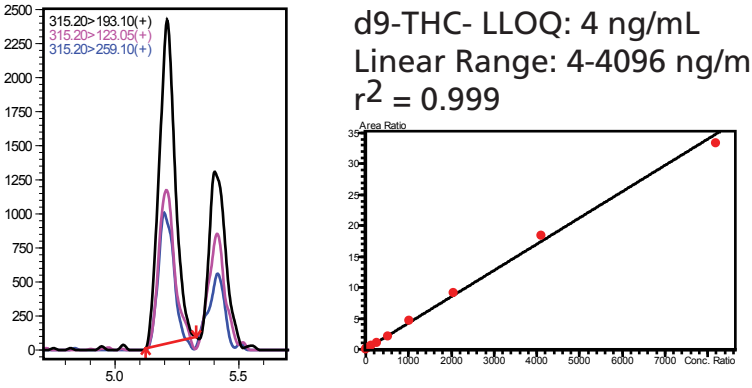


Figure 7. Chromatogram and calibration curve for d9-THC.

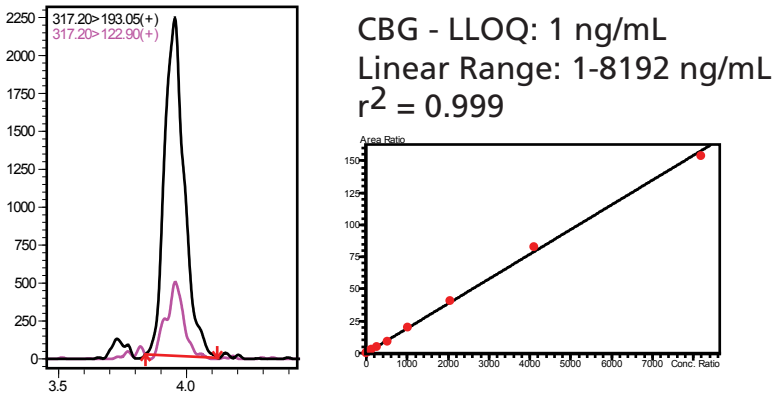


Figure 8. Chromatogram and calibration curve for cannabigerol (CBG).

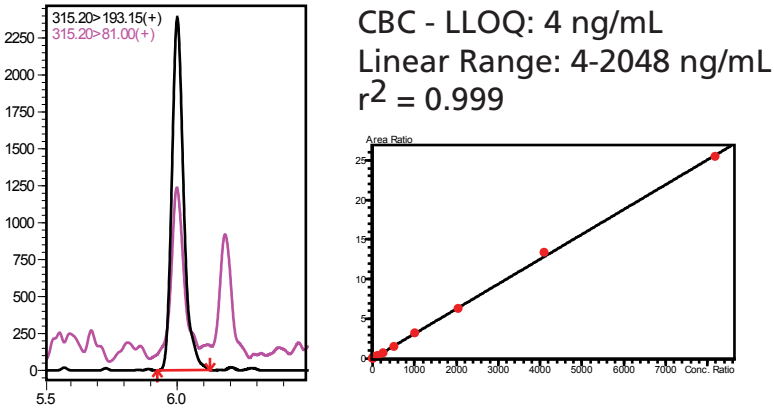


Figure 9. Chromatogram and calibration curve for cannabichromene (CBC).

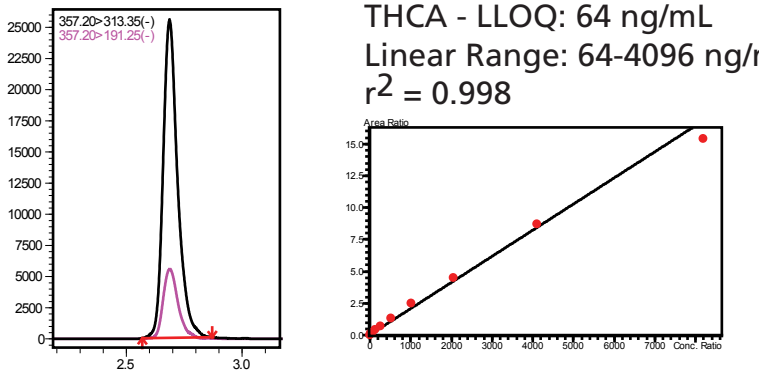


Figure 10. Chromatogram and calibration curve for d9-THC Acid A (THCA).

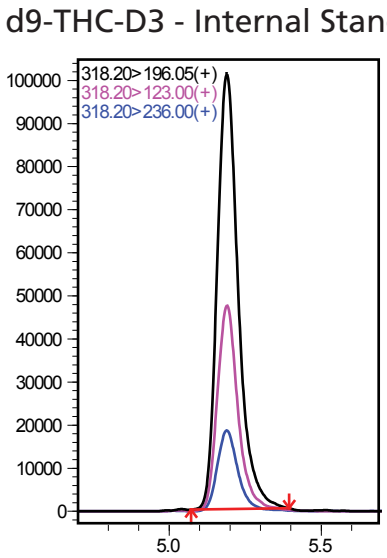


Figure 11. Chromatogram for d9-THC-D3 internal standard.

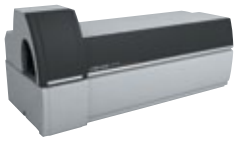
Conclusion

A method for rapid quantitation of various cannabinoids utilizing a Nexera X2 UHPLC coupled to an LCMS-8040 triple quadrupole mass spectrometer was developed. An 8 minute method was optmized, with the main limiting factor being the separation of d8-THC and d9-THC due to their structure being nearly identical.

It is important to note that these results were achieved using standards without matrix, but the ability of the Nexera X2 system and LCMS-8040 mass spectrometer to enable simultaneous, accurate measurement of many of the cannabinoids on interest is highlighted by this method.

ULTRA FAST MASS SPECTROMETRY


LCMS-8030


LCMS-8040


LCMS-8050


LCMS-2020


LCMS-IT-TOF

Founded in 1875, Shimadzu Corporation, a leader in the development of advanced technologies, has a distinguished history of innovation built on the foundation of contributing to society through science and technology. Established in 1975, Shimadzu Scientific Instruments (SSI), the American subsidiary of Shimadzu Corporation, provides a comprehensive range of analytical solutions to laboratories throughout North, Central, and parts of South America. SSI maintains a network of nine regional offices strategically located across the United States, with experienced technical specialists, service and sales engineers situated throughout the country, as well as applications laboratories on both coasts.

For information about Shimadzu Scientific Instruments and to contact your local office, please visit our Web site at www.ssi.shimadzu.com

SHIMADZU

Shimadzu Corporation
www.shimadzu.com/an/

SHIMADZU SCIENTIFIC INSTRUMENTS, INC.
Applications Laboratory
7102 Riverwood Drive, Columbia, MD 21045
Phone: 800-477-1227 Fax: 410-381-1222
URL http://www.ssi.shimadzu.com

First Edition: October, 2012