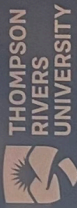
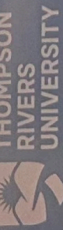


# Determination of Cannabidiol in Various Cannabis Flower Buds using Liquid Chromatography – Mass Spectrometry



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## Objective

Develop a sensitive and accurate method to detect the amount of cannabidiol in various cannabis flower buds, using liquid chromatography – mass spectrometry (LC-MS).

## Introduction

CBD is an active component in cannabis that is responsible for its calming properties, acting as an entourage to reduce psychoactive components commonly found in cannabis. Pharmaceutical benefits include pain relief, anxiety, and sleep. CBD has also been used for its anxiolytic effects, as well as potential applications for some dermatitis and related dermal treatment. Cannabis sample information is found in Table 1.

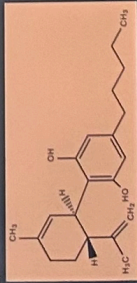


Figure 1. Structure of cannabidiol.

Sample	Labelled THC Concentration (mg/g)	Labelled CBD Concentration (mg/g)	Company
Blue Igwana	3.30	< 0.10	Weed Me
Wappa	15.0	0.00	Reddcan
Mandarin Cookies	3.80	< 0.10	Weed Me
Miracle 15 x Allen Cookies	5.19	< 0.50	Holy Mountain

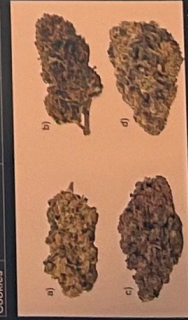


Figure 2. Cannabis samples. a) Blue Igwana b) Wappa c) Mandarin Cookies d) Miracle 15 x Allen Cookies.

Standardization of testing is required to ensure accurate product labelling. In previous literature, LC-MS was chosen as it was found to be the most sensitive at detecting cannabis in multiple matrices<sup>1</sup>.

## Experimental

- Method:
  - CBD standards were prepared from a 50 ppm stock solution, ranging from 3.0 - 25.0 ppm.
  - Standards and samples were prepared and diluted to 25 mL, methanol. Samples were filtered through a 0.45 µm Nylon filter, and pre-concentrated by nitrogen evaporation. Samples were reconstituted in 4.0 mL methanol.
  - Standards and samples were diluted with 18 MΩcm water in LC-MS vials prior to analysis.
- Instrument:
  - Agilent 1260 LC-MS system.

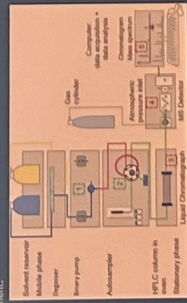


Figure 3. Schematic of the LC-MS.



Figure 4. Agilent 1260 LC-MS QTOF Mass Spectrometer.

Column	2.1 x 100 mm
Internal Diameter	1.8 mm
Ionization Source	ESI+
VCap	3000 V
Fragmentor Voltage	60.0 V
Gas Temperature	350°C
Drying Gas	8.0 L/min
Hebulizer	15 psi
Sheath Gas Temperature	325 °C
Sheath Gas Flow	8.0 L/min
Aspiration	100 - 500 m/z
Flow Rate	0.5 mL/min
Column Temperature	50°C
Solvents	A: 20% methanol and 0.3% formic acid in water B: 9.5% formic acid in acetonitrile

## Results

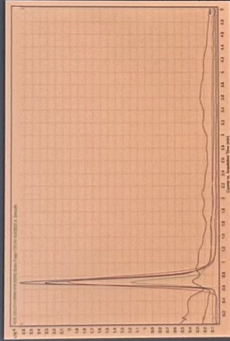


Figure 5. Chromatograms of CBD standards.

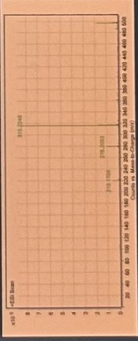


Figure 6. Mass spectra of the 10 ppm standard.

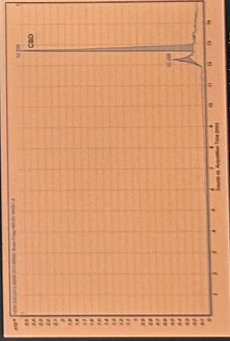


Figure 7. Chromatogram of CBD in blue igwana flower bud samples.

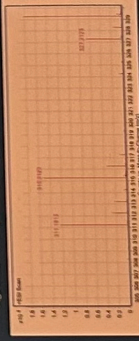


Figure 8. Mass spectra for the cannabis flower bud sample.

## Results

Samples	CBD Concentration in Samples (ppm)	Concentration in (mg/g)	Labelled CBD Concentration in (mg/g)
Blue Igwana (W)	21.195	0.325	< 0.100
Wappa (W)	21.193	0.335	0.000
Mandarin Cookies (MC)	1.302	0.010	< 0.100
Miracle 15 x Allen Cookies (MA)	11.761	0.094	< 0.500

## Conclusion

- Chromatogram results show increasing concentration of CBD.
- CBD was detected in higher values than labelled in 2 of the samples.
- The precision of this study was acceptable with percent standard deviation ranging from 2.34% to 17.82%. The percent recovery for cannabidiol was 80% for cannabis samples (ppm).

## Future Work

- Validate the method by comparing concentrations obtained using a capillary electrophoresis method to improve results.
- Work will be extended to other parts of the cannabis plant to ensure sensitivity of the method.
- Extend the study to flower buds from homegrown cannabis.

## Acknowledgements

- Thanks to Donkor for his continued support throughout this project.
- The TRU Chemistry Department for resources a grant.
- NSERC and TRU for financial support.
- Western Diversification Canada for purchase of instrument.

## References

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## Introduction

- > Cognitive reappraisal can be helpful which it is employ (2019).
- > When changing more benefits from emotions (Troy et al. 2019).
- > Experience more emotion by altering (Person & Frazier, 2019).
- > People of lower more from cognitively over their life circuit (2017), which lower reappraisal ability their SES model have reappraisal ability.

