

Livin' the High Life - Detection, Differentiation, and Quantification of Cannabinoids in Edible and Non-Edible Complex Matrices by Ambient Ionization Mass Spectrometry

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Introduction

The legalization and decriminalization of marijuana has contributed to the rise in recreational use of *Cannabis sativa* as well as to the availability of products containing cannabinoids.

CBD- and THC-infused products have imposed major challenges related to the analysis of cannabinoid content, due to the inadequacy of conventional chromatography techniques that are resource-intensive and require extensive sample preparation for each type of complex matrix that is encountered.

This study focused on devising an alternative method for the rapid **detection**, **differentiation**, and **quantification** of CBD and THC in complex matrix samples by direct analysis in real time – high-resolution mass spectrometry (DART-HRMS).

Method

DART-HRMS Analysis

All the products were screened for cannabinoids with no or minimal sample pretreatment under soft ionization conditions (orifice 1 = 20 V) at 350°C by:

- Using tweezers to present material to the DART gas stream;
- Dipping the closed end of a glass melting-point capillary tube into the sample and presenting the coated surface to the open-air gap;
- Using a semi-automated linear rail system for quantification experiments.

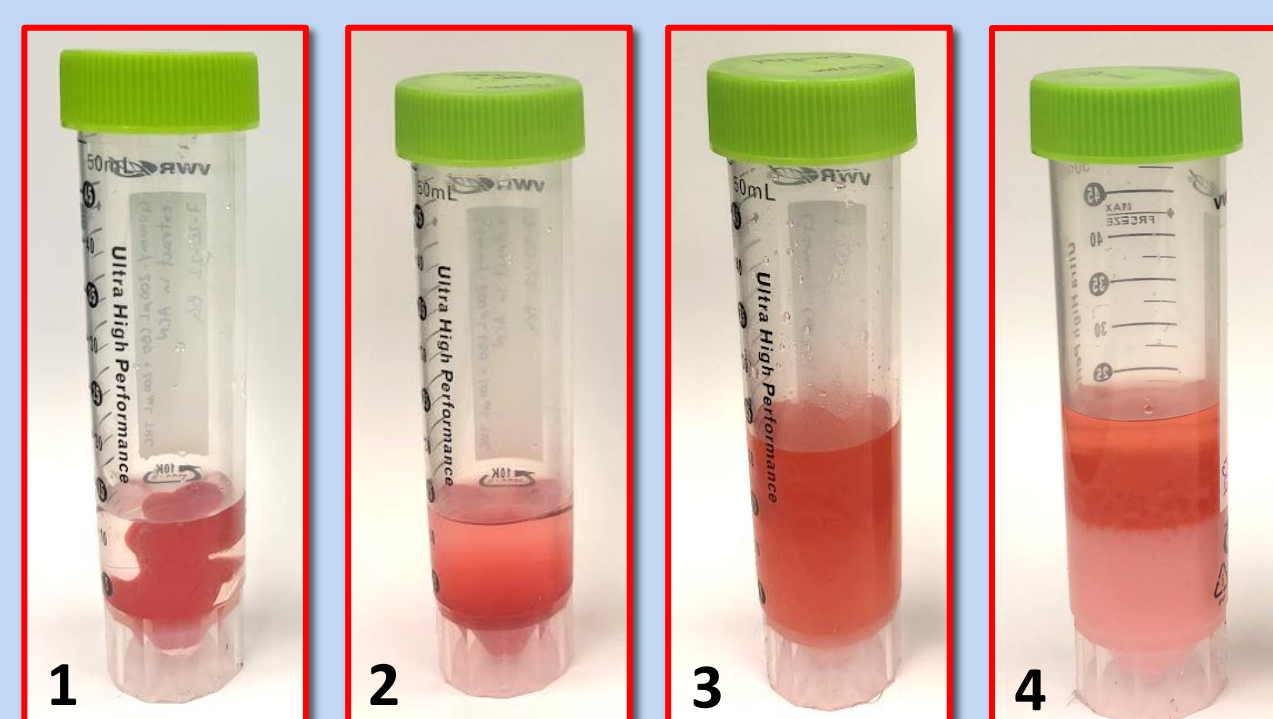
Preparation of Products

- Two gummy candies, one dark chocolate, and one marshmallow containing CBD and THC were prepared in-house;
- A non-edible commercial CBD balm was also analyzed.



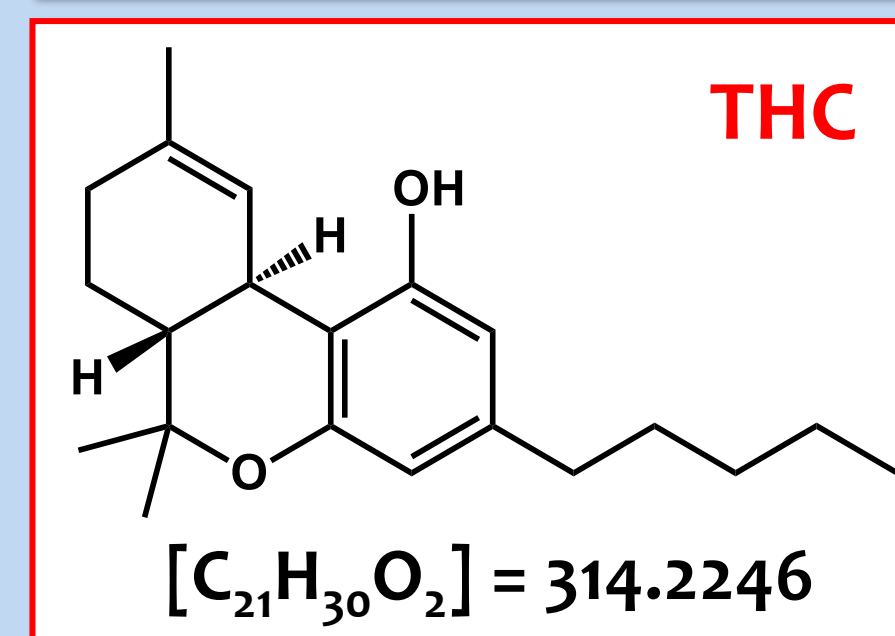
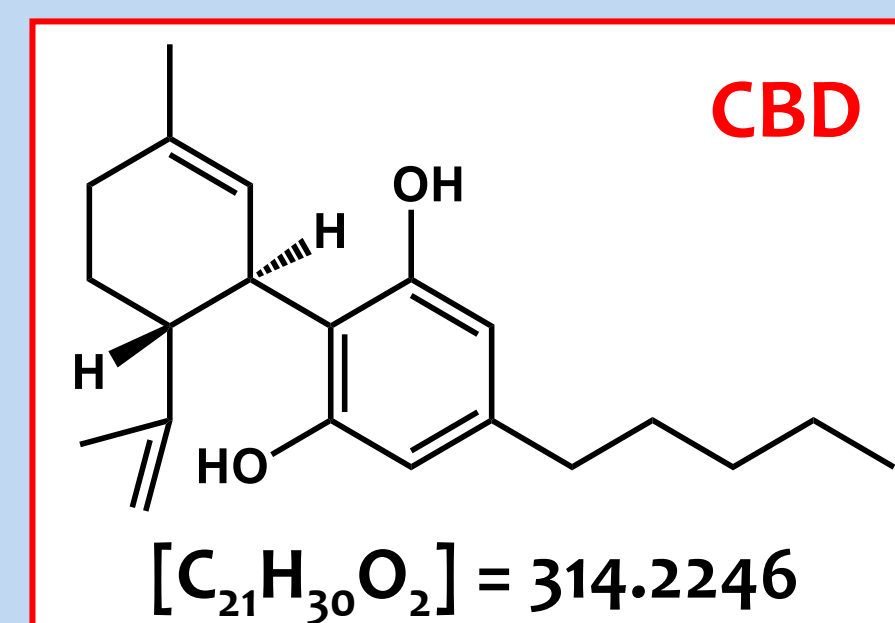
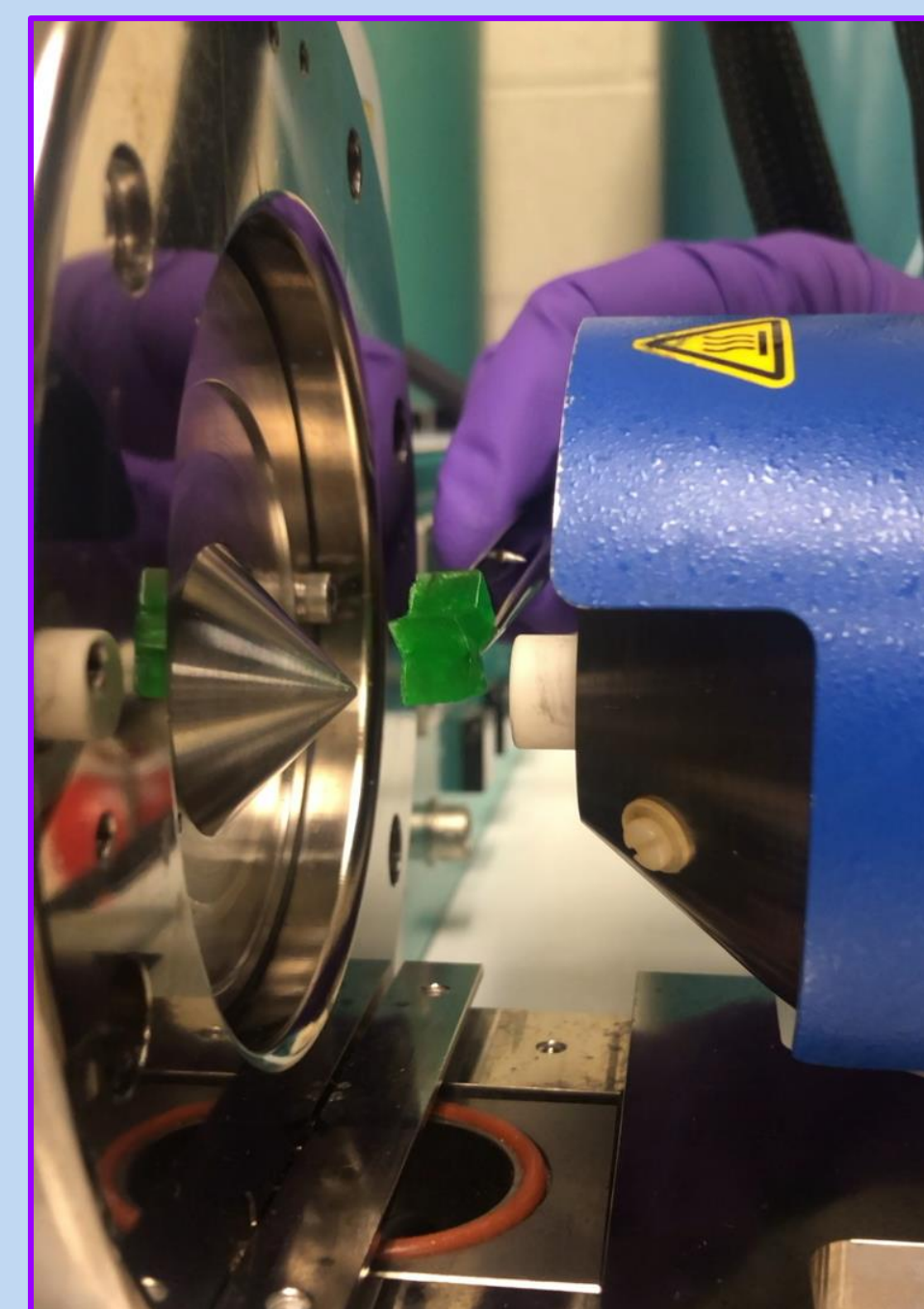
Extraction of CBD and THC

- The cannabinoids contained in the edibles were extracted
- The process involved:
 - Addition of water
 - Sonication
 - Addition of acetonitrile
 - Addition of Waters™ salts

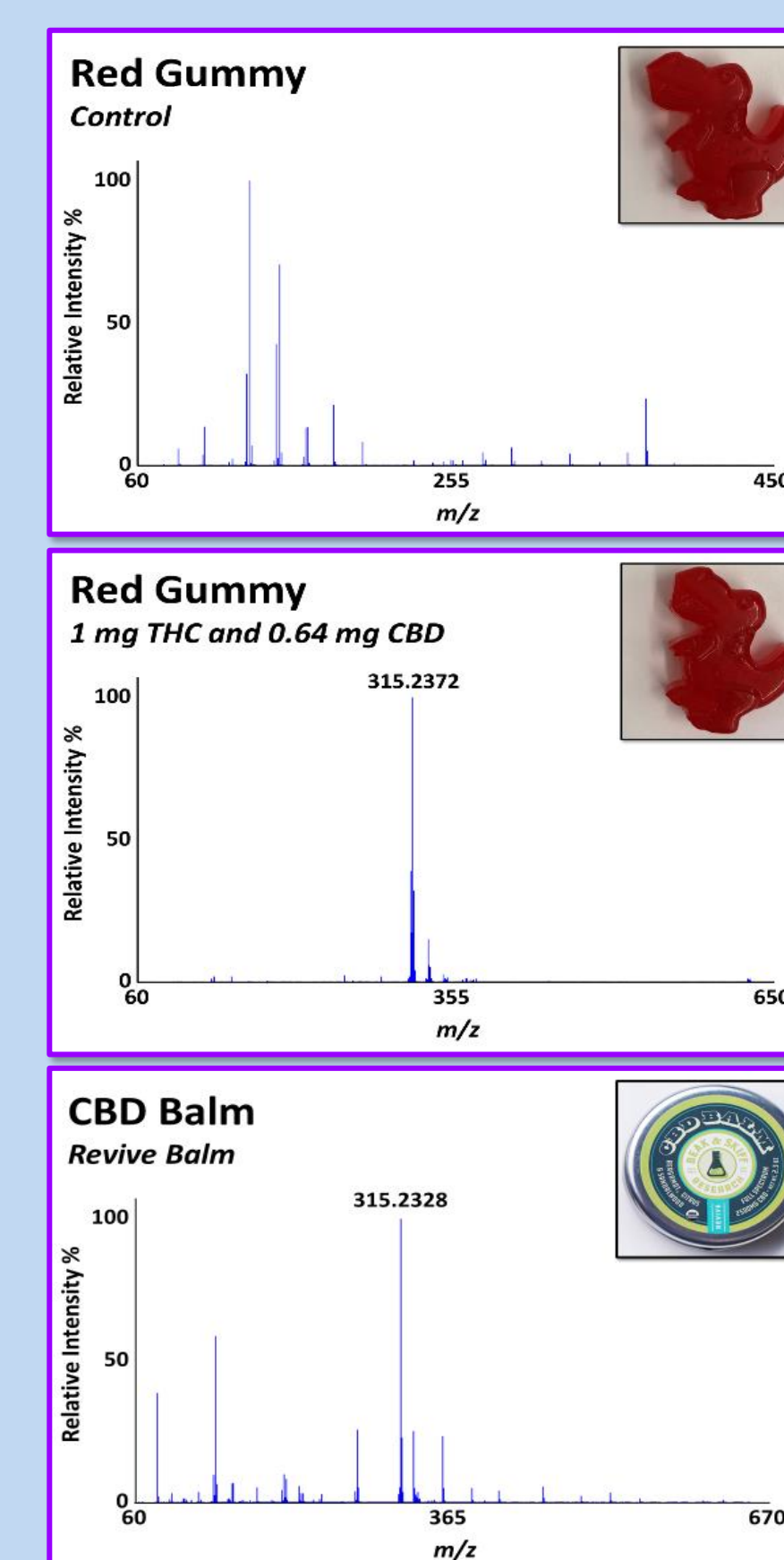
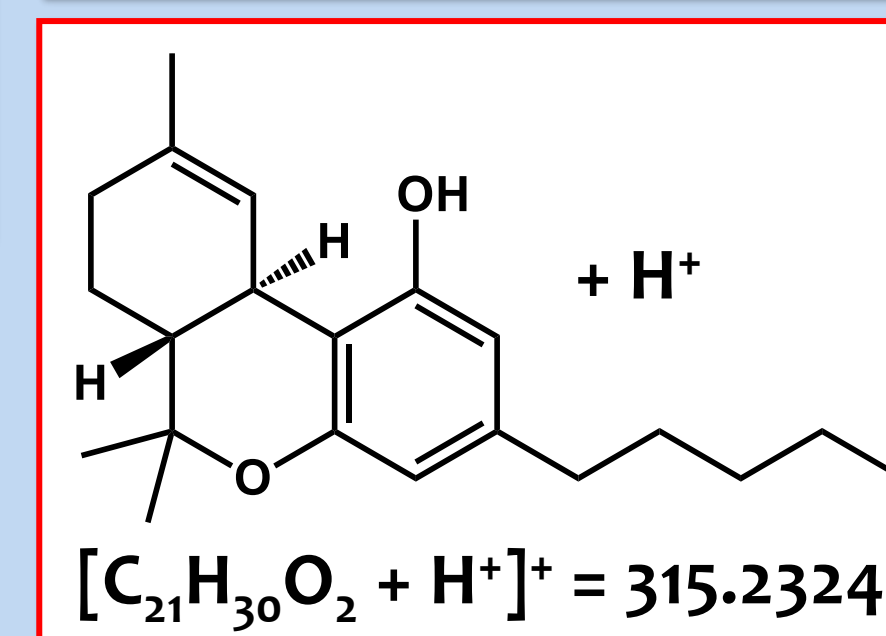
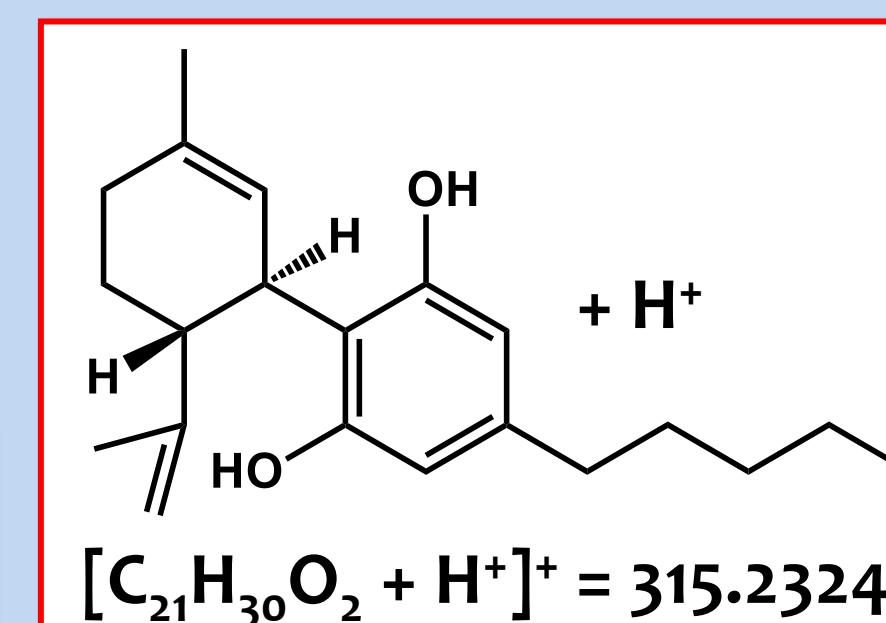


- This extraction process is necessary only for some matrices

Detection of CBD and THC



DART-HRMS analysis in positive-ion mode



Results

Detection

The rapid screening of the cannabinoid-containing products by DART-HRMS performed without sample pretreatment showed a peak at m/z 315, which is consistent with the protonated mass $[M+H]^+$ of CBD and THC.

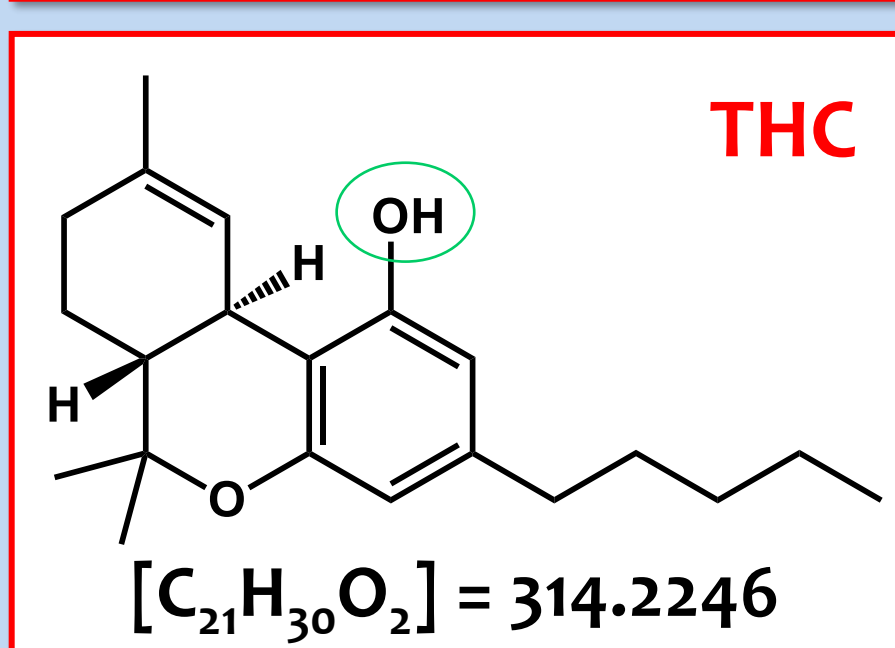
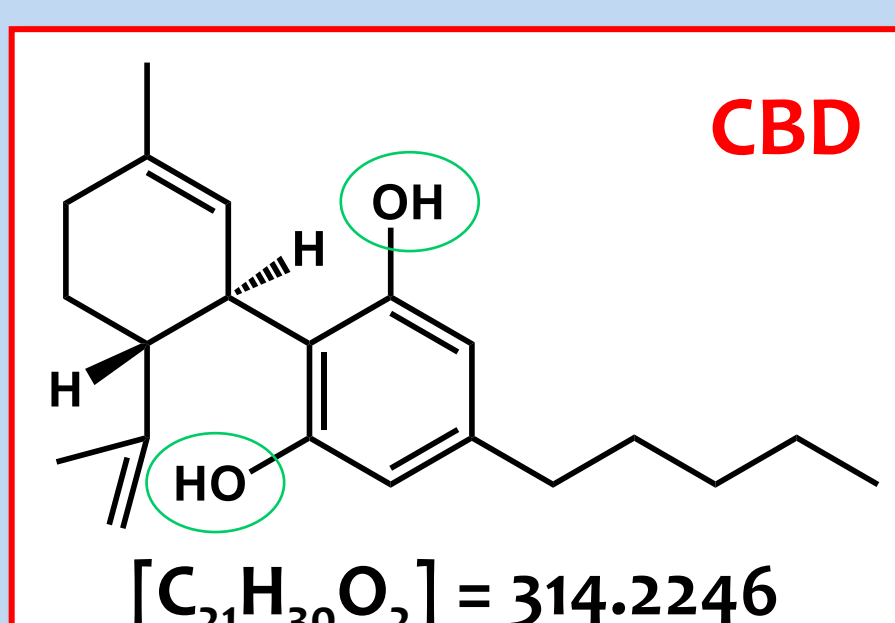
Differentiation

Upon extraction and derivatization of the cannabinoids, the compounds became distinguishable when interrogated by DART-HRMS. Peaks at m/z 459 and m/z 387 correspond to the protonated masses of derivatized CBD and THC, respectively.

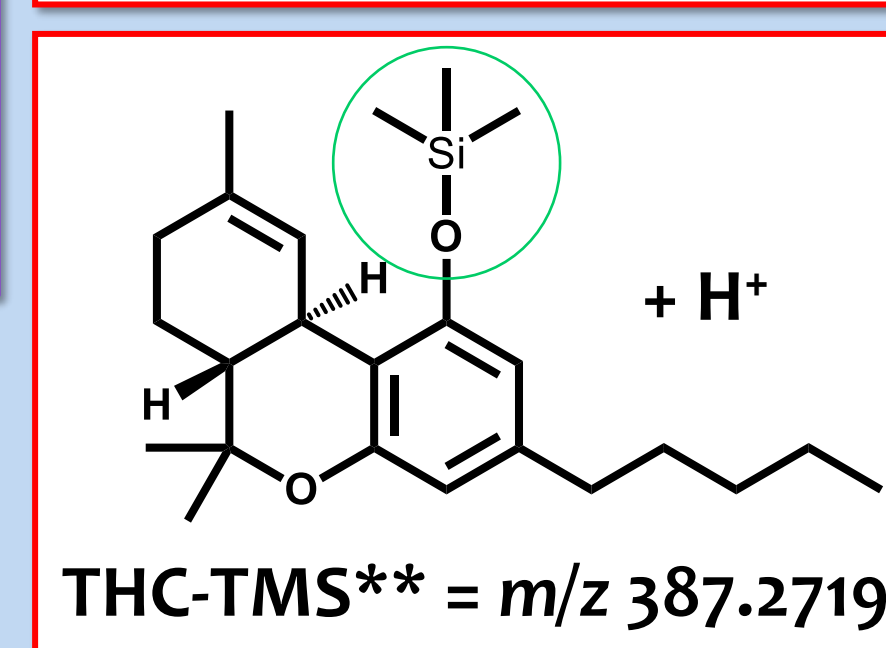
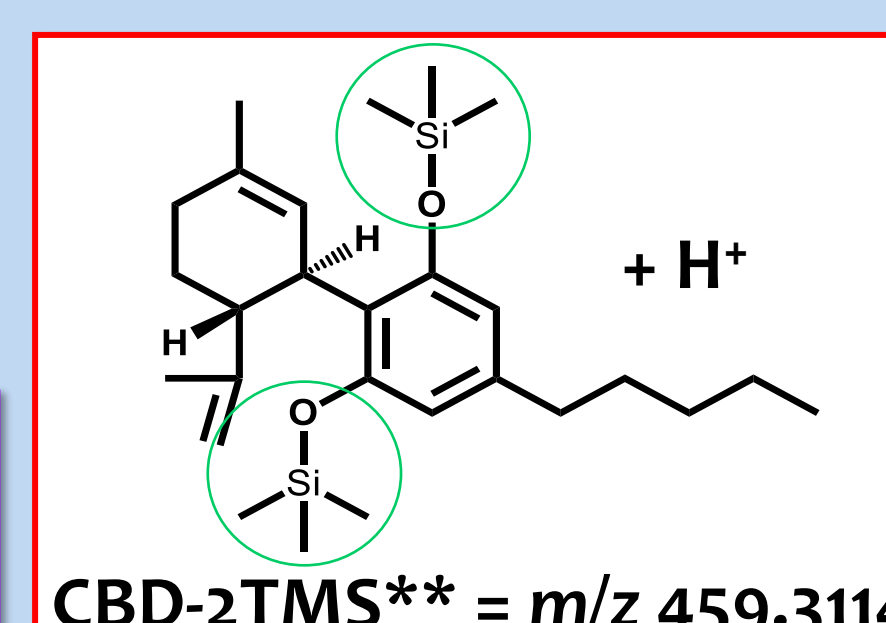
Quantification

Quantification experiments for CBD-TMS and THC-TMS showed calculated percent recoveries between 86 % and 98 % for the CBD and THC content of gummies prepared in-house and for a commercially available balm. These preliminary results are promising for the quantification of derivatized CBD and THC by DART-HRMS.

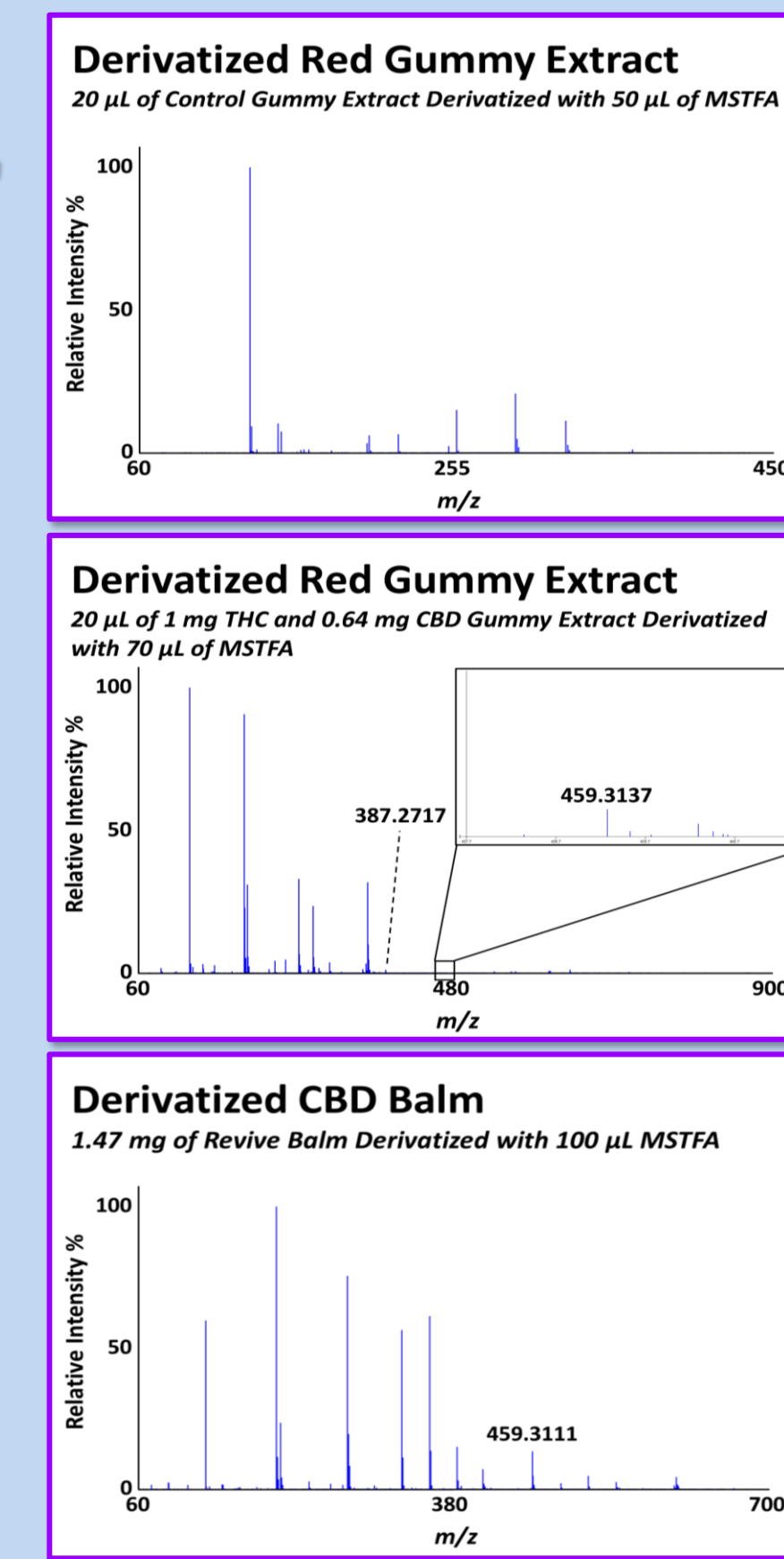
Differentiation of CBD and THC



Derivatization with MSTFA*, then DART-HRMS analysis in positive-ion mode



*N-Methyl-N-(trimethylsilyl)trifluoroacetamide
**Trimethylsilane



Conclusions

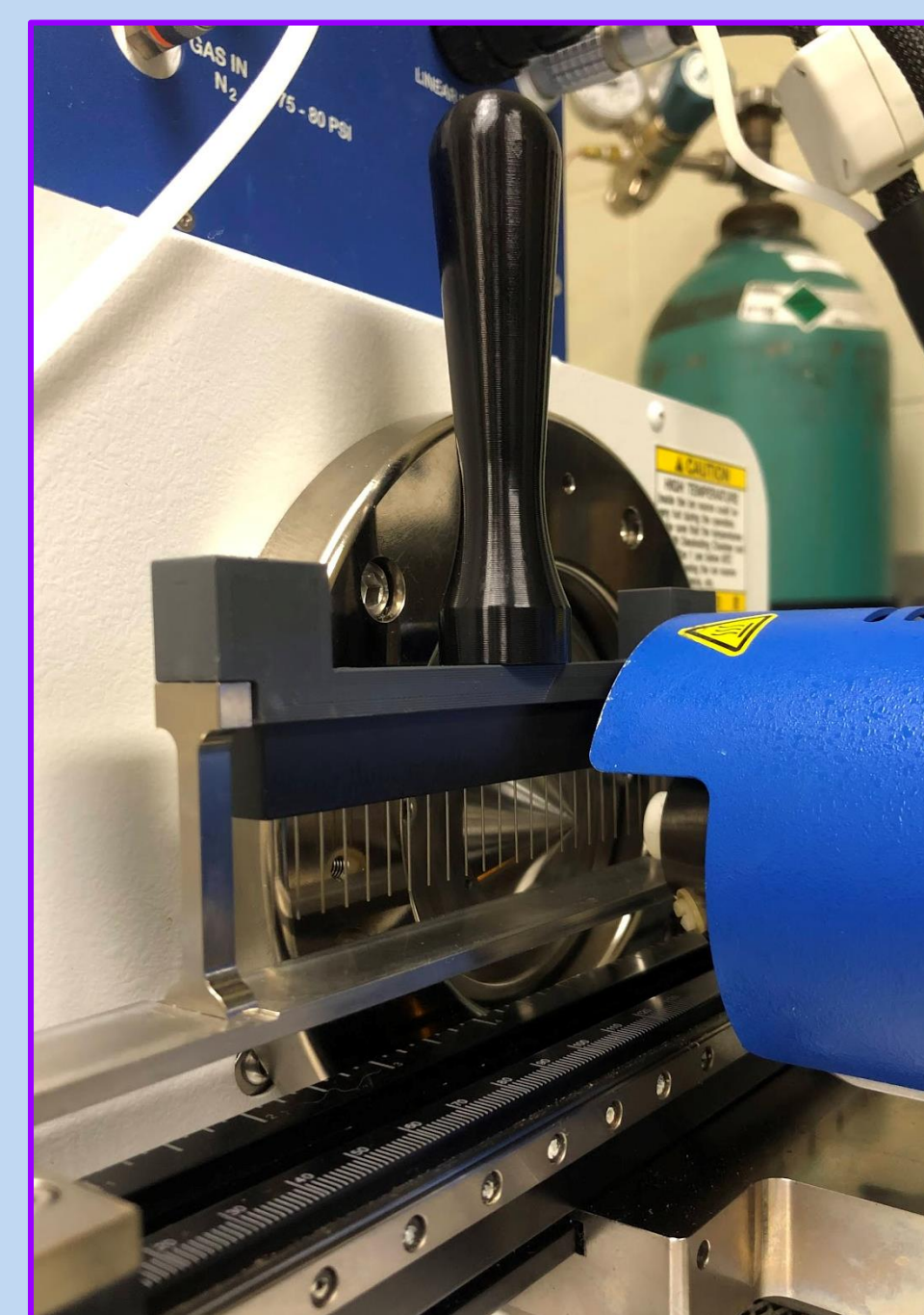
The study showed:

- The rapid **detection**, **differentiation**, and **quantification** of CBD and THC by DART-HRMS is possible;
- JWH 210 7-ethylnaphthyl isomer as internal standard is suitable for the quantification of cannabinoids;
- The method presented an advantage over conventional methods currently used in forensic practices.

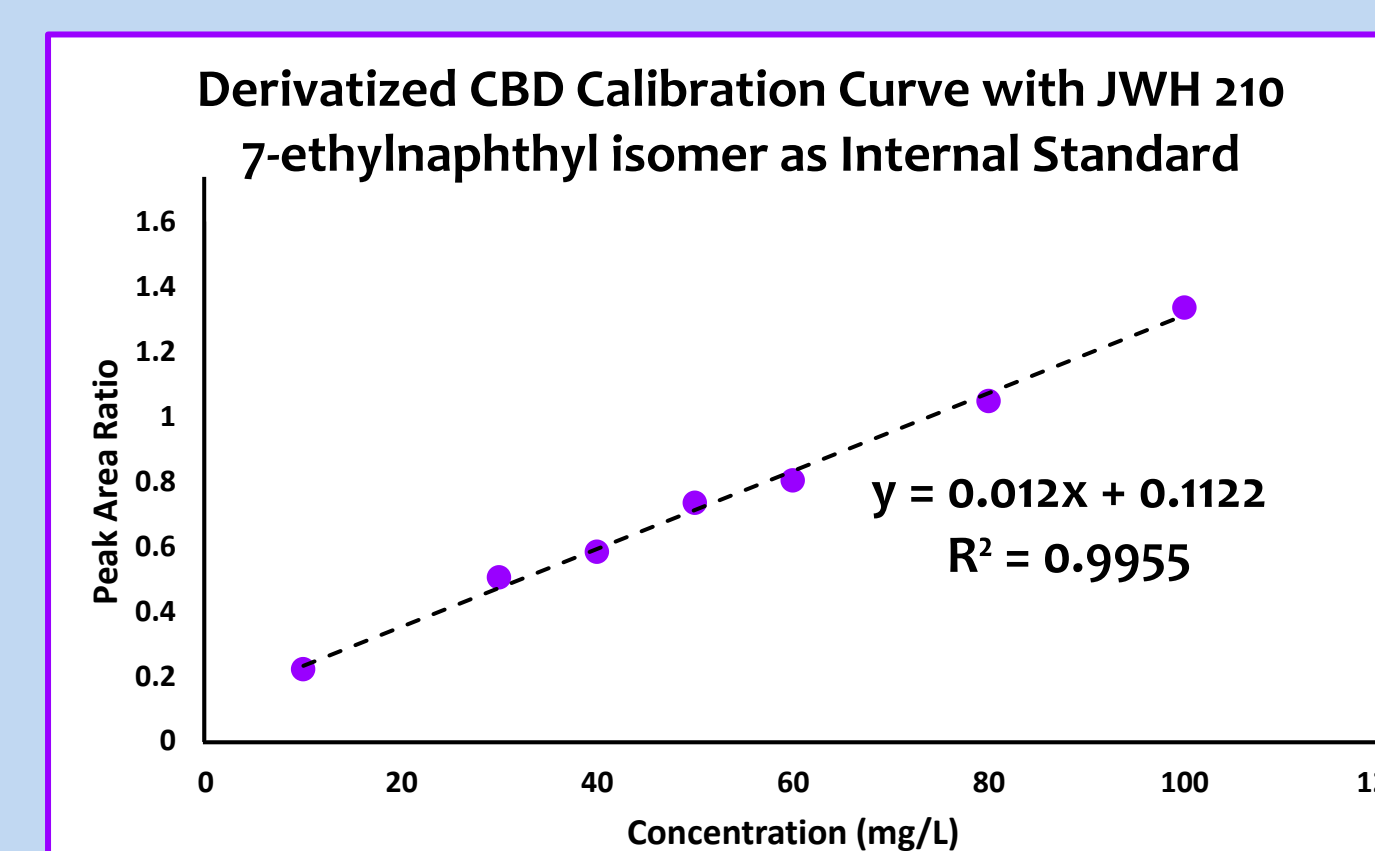
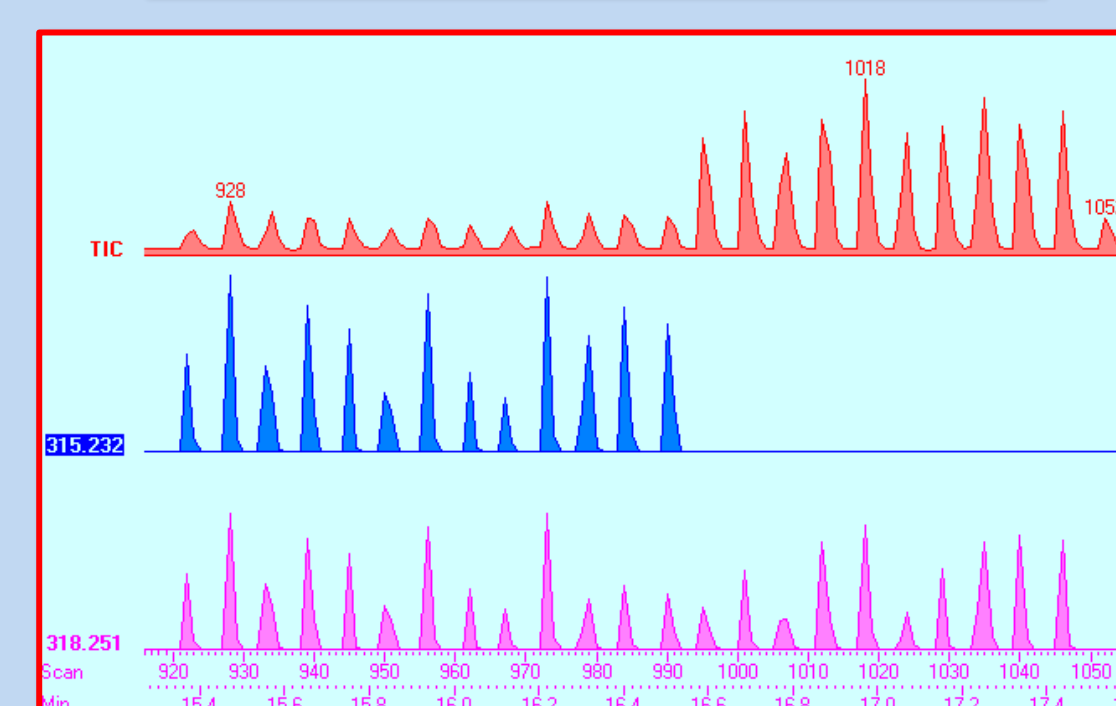
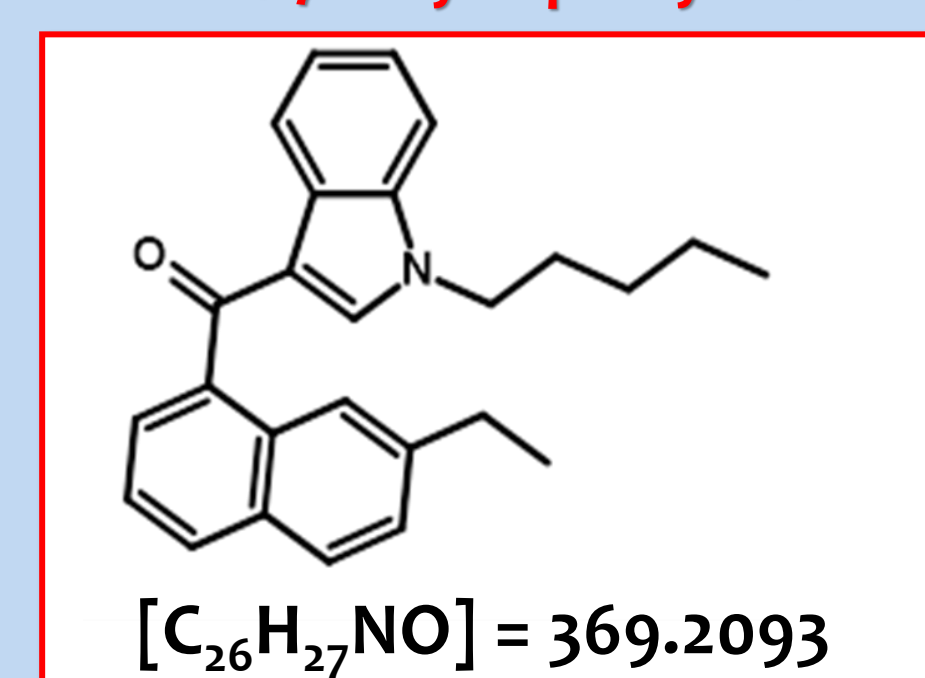
Future work:

- Validated protocols for the quantification of derivatized CBD and THC are being developed.

Quantification of CBD and THC



JWH 210 7-ethylnaphthyl isomer



Acknowledgements

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DART-HRMS Triage Approach Part 2 – Application to the Detection of Cannabinoids and Terpenes in Recreational Cannabis Products

