Insights Into Cannabis Products Quality

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NIDA Marijuana Project Activities

- Grow, harvest, and process cannabis plant material to produce standardized marijuana of different potencies for research
- Isolate and characterize different cannabis components for pharmacological studies
- Prepare bulk quantities of extracts and specific purified cannabinoids (for example, THC, CBD, CBN, CBC, and CBG)
- GMP preparation of materials for clinical trials
- Analysis of confiscated Cannabis materials


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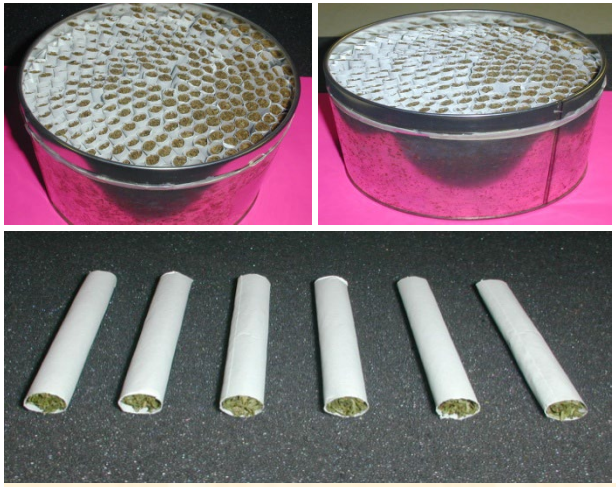
Cannabis Products

Cannabis Useable Biomass in Barrels

A : THC Derivative Crystals and B : THC from *Cannabis*



Cannabis Cigarettes

Cannabis Extract

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Quality Control: Cannabis Cigarettes

Preparation of Cannabis Cigarettes (#1104)		Lot:	
MPR 3.1.1	Revision 1	**TRUE COPY** by:	Date:

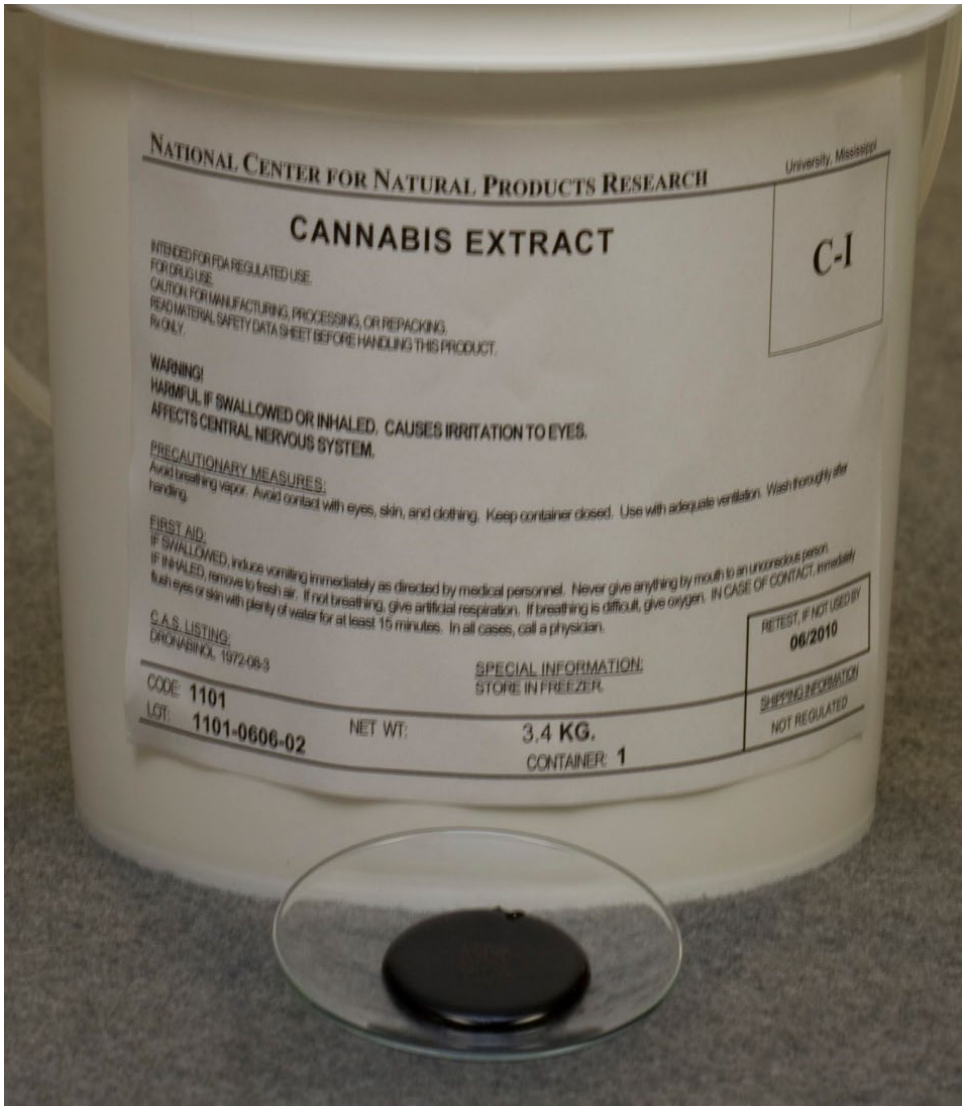
Preparation of
Cannabis Cigarettes #1104

Production Records

LOT:

Master Production Record Approved By	Date
Project Director:	
Master Production Record Reviewed By	**Date**
Project Co-Director:	
Administrative Coordinator:	
Quality Control Unit:	

High THC Cannabis Extract



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Quality Control: Cannabis Extract

Preparation of Cannabis Extract #1101		Lot:	
MPR 2.1	Revision 10	**TRUE COPY** by:	Date:

Preparation of

Cannabis Extract # 1101

1 kg to 20 kg Batch

Production Record 2.1
Revision 10

LOT: 1101- -

Master Production Record Approved By	Date
Project Director:	
Master Production Record Reviewed By	**Date**

CoA: Cannabis Extract

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CERTIFICATE OF ANALYSIS

Product: **CBD Cannabis Extract**
Product Code: **1102**
Lot Number: **1102-1812-01**

TEST	SPECIFICATION	RESULT
Potency (by GC)		
Cannabidiol (CBD)	≥25% w/w	54.5%
Other Cannabinoids (by GC)		
Tetrahydrocannabivarin (THCV)	≤0.3% w/w	<0.025%*
Δ^9-tetrahydrocannabinol (THC)	≤5% w/w	1.60%
Cannabinol (CBN)	≤5% w/w	0.30%
Cannabichromene (CBC)	≤5% w/w	1.73%
Δ^8-tetrahydrocannabinol (Δ^8-THC)		0.68%
Cannabigerol (CBG)	≤5% w/w	1.08%
CBD:THC ratio	≥ 20:1	34:1
'0.025%' = Quantitation Limit		
Degradation products (by GC)		
Cannabinol (CBN)	≤2% w/w	NA
NA = Not applicable		
Terpenes (by GC)		
Total Terpenes	≤1% w/w	1.24%
Residual Solvent (by GC)		
Hexane	≥1% w/w	0.08%
Loss on Drying (by IR radiation)		
Total Moisture & Volatile Impurities	≤6% w/w	0.69%
Heavy Metals (by ICP-MS)		
Lead (Pb)	≤0.5 ppm	0.100 ppm
Mercury (Hg)	≤1.5 ppm	0.013 ppm
Cadmium (Cd)	≤0.5 ppm	0.014 ppm
Arsenic (As)	≤1.5 ppm	0.014 ppm
Aflatoxins		
AFB_1	≤5 ppb	Not Detected
AFB_1, AFB_2, AGF_1, AFG_2	≤20 ppb	Not Detected
Microbial		
Escherichia coli	Absent	Absent
Salmonella	Absent	Absent
Total Aerobic Microbial Count (TAMC) <2021>	$\leq 10^3$ cfu/g	< 10 cfu/g
Total Yeast & Mold Count (TYMC) <2021>	$\leq 10^2$ cfu/g	< 10 cfu /g
Store in freezer.		
Expires: **12/2023**		
Certified by: M. Radwan	Date: 04/16/19	

F93A-092518

Quality Control: GMP CBD

Preparation of Cannabidiol # 1003		Lot:	
MPR 2.3	Revision 2	**TRUE COPY** by:	Date:

Preparation of

Cannabidiol # 1003

0.1 gram to 500 grams Batch

Production Record 2.3
Revision 2

PRODUCT NAME:	CANNABIDIOL (CBD)
LOT:	

Master Production Record Approved By	Date
Project Director:	
Master Production Record Reviewed By	**Date**

Quality Control: GMP THC

Preparation of Δ^9-tetrahydrocannabinol #1001		Lot: 1001 - -
MPR 3.1	Revision 1	**TRUE COPY** by: Date:

Preparation of

Δ^9-tetrahydrocannabinol #1001

1 gram to 1000 grams Batch

Production Record 3.1
Revision 1

LOT:	1001 - -

Master Production Record Approved By	Date
Project Director:	
Master Production Record Reviewed By	**Date**

Development and Validation of a GC-FID Method for the Quantitation of 20 Different Acidic and Neutral Cannabinoids

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GC/FID Conditions

- **DB-1M**S **column** (15 m x 0.25 mm, and 0.25 µm film thickness).
- Helium (carrier gas) at a flow rate of **0.8 mL/**min.
- The inlet temperature was set at **275˚C** with a split ratio of **20:1**.
- The temperature program started at **190˚C to 300˚C**
- The total run time was 1**7.5 min**. **GC/FID Conditions**

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Sample Preparation

- Triplicates of the ground samples (**100 mg each**)
- Extraction with 10 mL of a **MeCN :Me OH mixture (8:2)** by sonication for 30 min.
- The mixture **was centrifu**ged for **5 min**. at 1,252 xg and transferred into pre-labeled extraction tubes. Aliquots of 10 µL, 50 µL, and 100 µL --- to GC vials for silyation.
- A solution of **4-androstene-3,17-dione** at 1 mg/mL was prepared in methanol–chloroform (9:1, v/v) is used as Internal standard .

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Silylation of the Samples after extraction

- To each vial, **50 µL of 1 mg/mL I.S**. solution and **10 µL of 2% DMAP** were added and the solvents evaporated to dryness using a gentle flow of nitrogen gas at 50° C.
- The residue was then silylated by adding **100 µL of BSTFA**, vortexed, and the capped vials were kept in a **70 ° C oven for 30 min.**
- The vials were then brought to room temperature and the contents were transferred to 100 µL GC-vial inserts and analyzed by the GC-FID.

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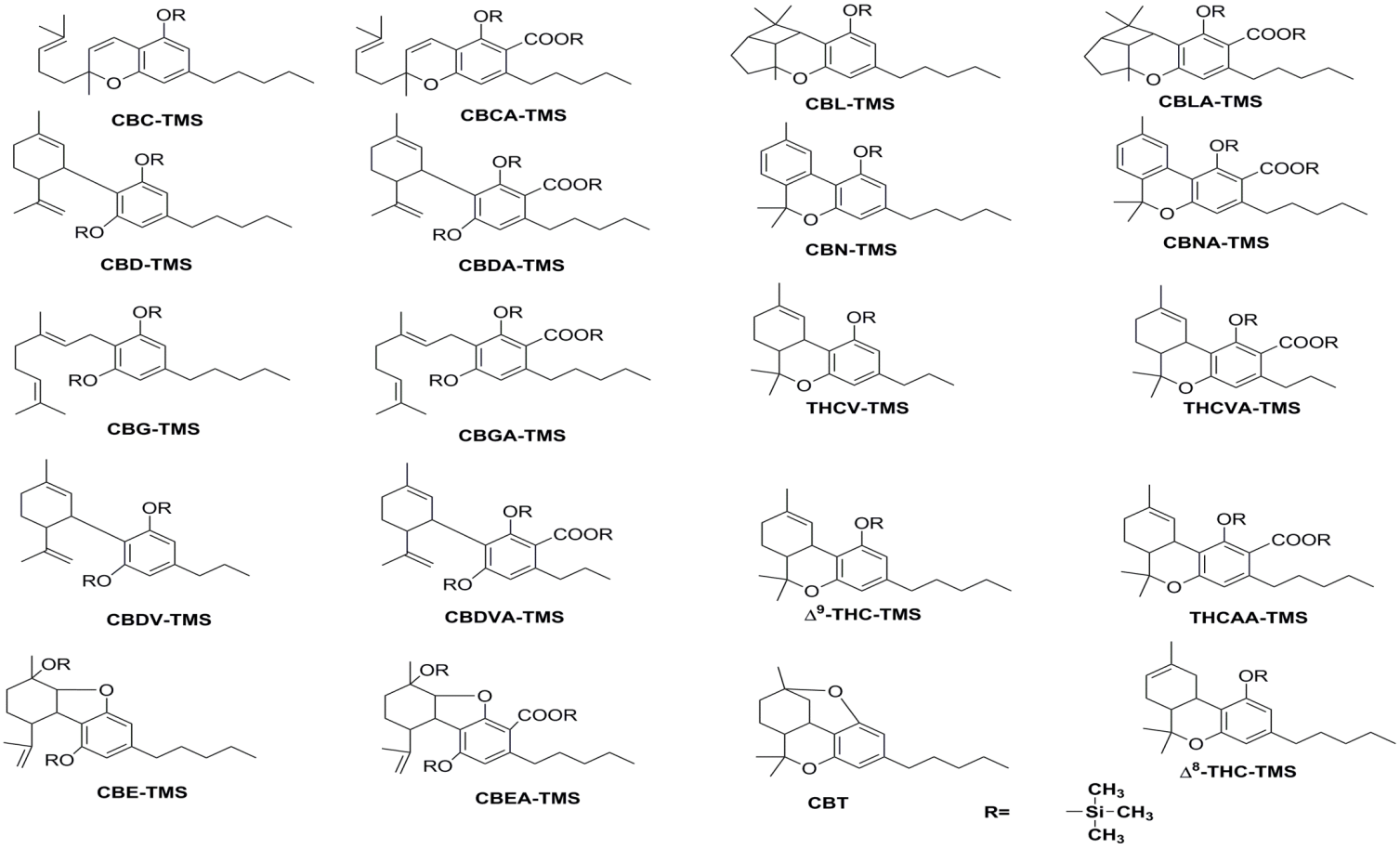

Chemical structures of the 20 silylated acidic and neutral cannabinoids.

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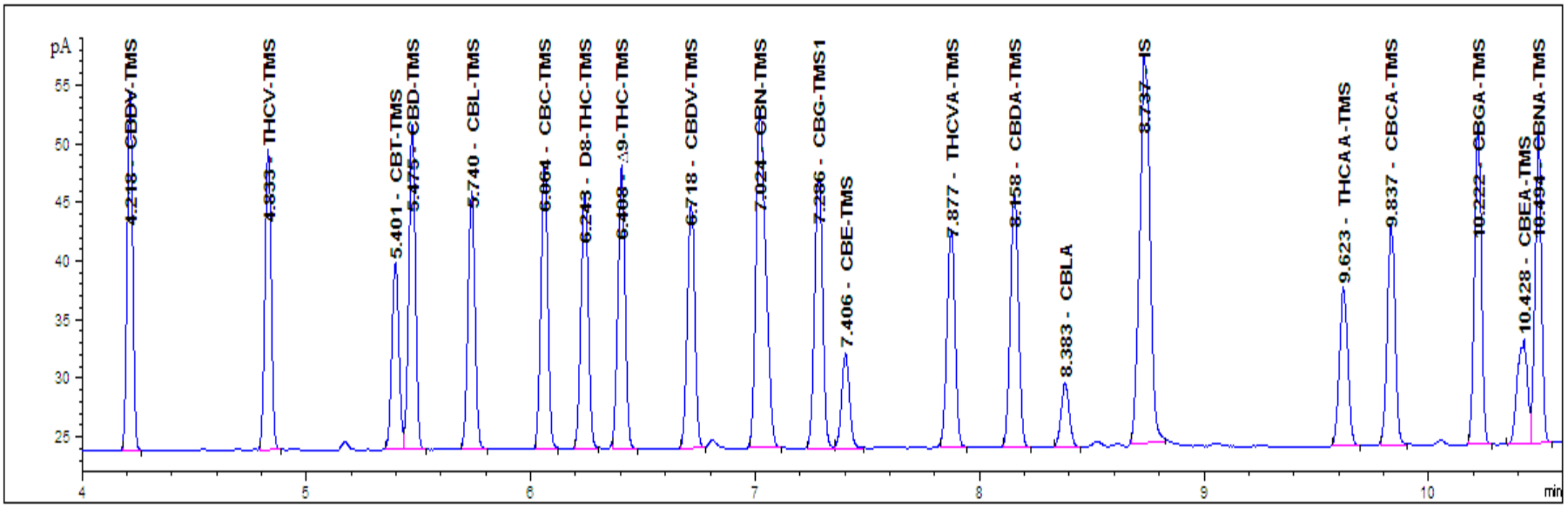
Standard 20 silylated cannabinoid mixture (25 µg/mL) and IS (50 µg/mL)



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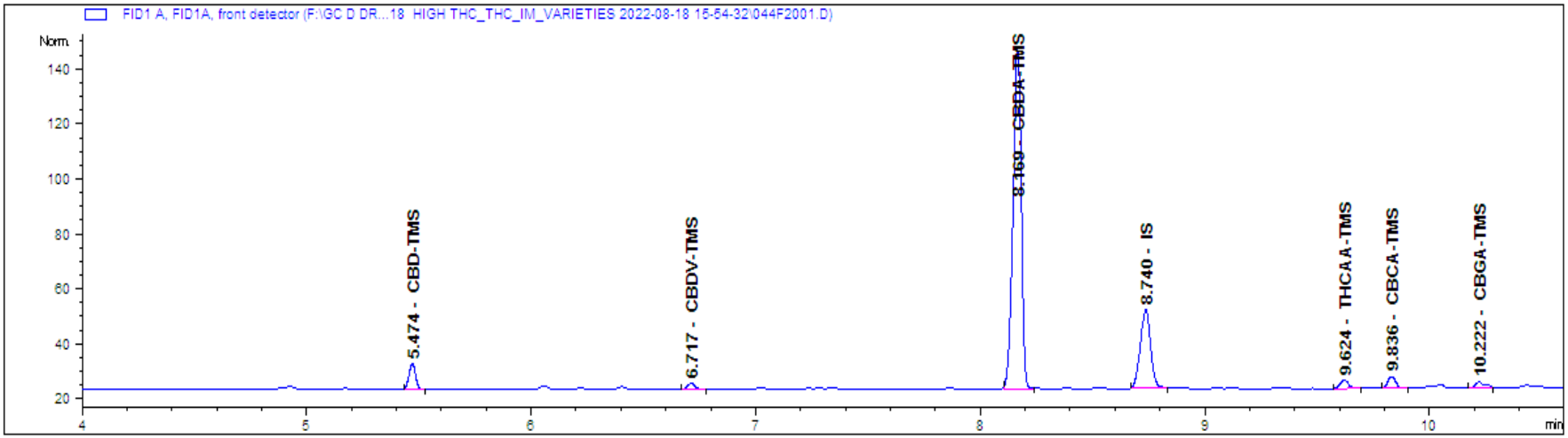
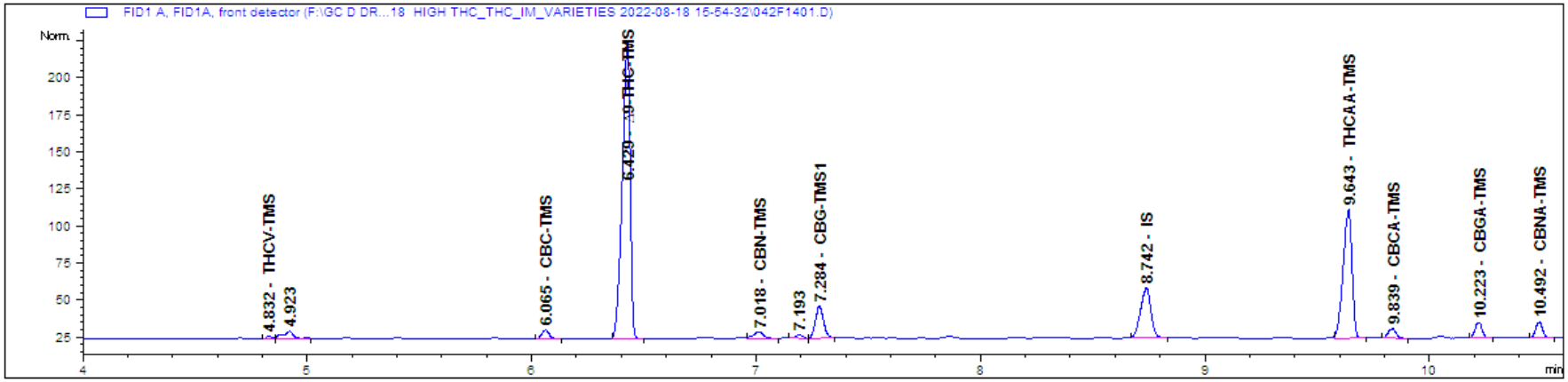
Cannabinoids Concentration (High CBD Chemovar)



Cannabinoids Concentration (High THC Chemovar)



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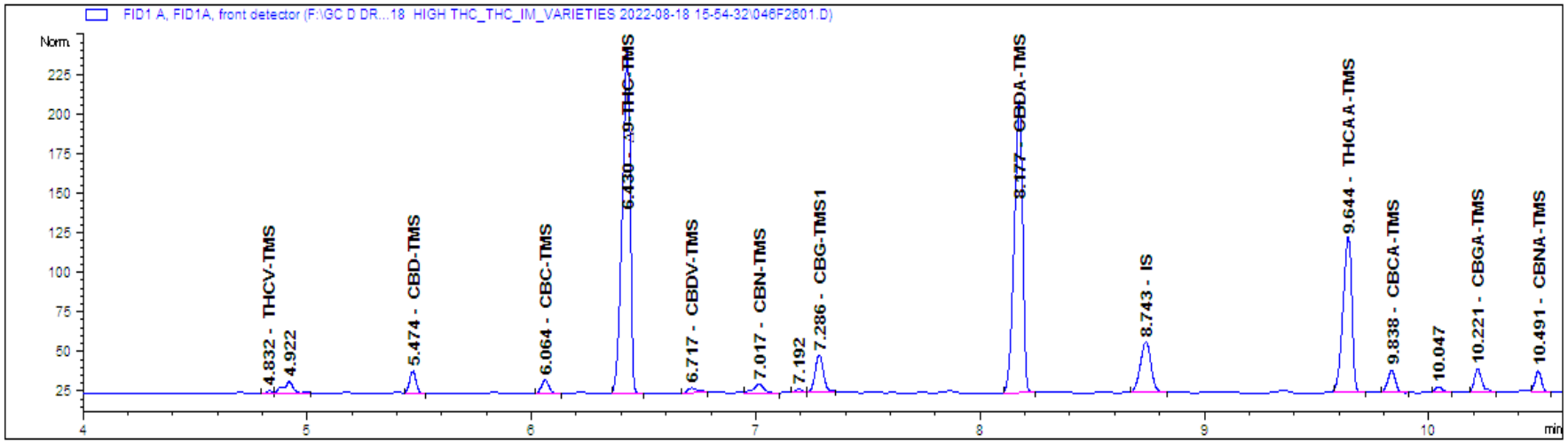
Cannabinoids Concentration (Intermediate Chemovar)



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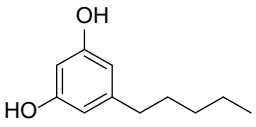
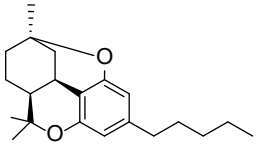
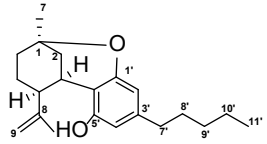
Development and Validation of a GC-FID Method for the Quantitation of Δ^8-tetrahydrocannabinol and other Cannabinoids present in commercial Δ^8-tetrahydrocannabinol



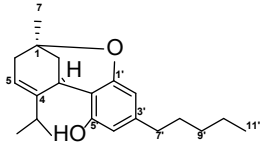
Olivetol (**1**)



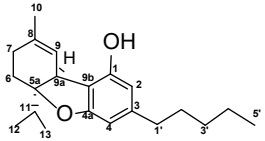
CBT (**2**)



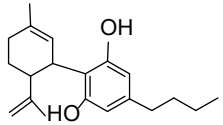
Δ^8-*cis*-*iso*-THC(**3**)



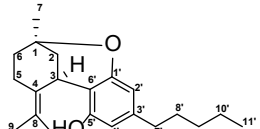
Δ^4-*iso*-THC (**4**)



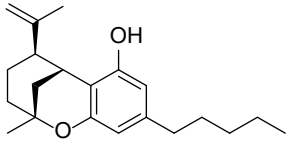
iso-THCBF (**5**)



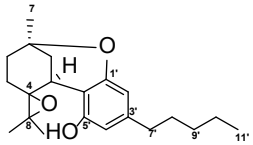
CBD (**6**)



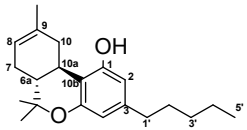
$\Delta^{4,8}$-iso-THC (**7**)



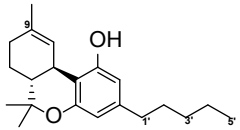
Δ^8-*iso*-THC (**8**)



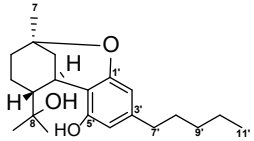
4,8-*epoxy*-*iso*-THC (**9**)



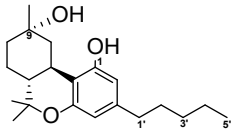
Δ^8-THC (**10**)



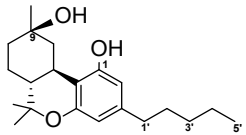
Δ^9-THC (**11**)



8-OH-*iso*-THC(**12**)



9^{α}-hydroxy-HHC (**13**)



9β-hydroxy-HHC (**14**)

Chemical structures of the identified compounds

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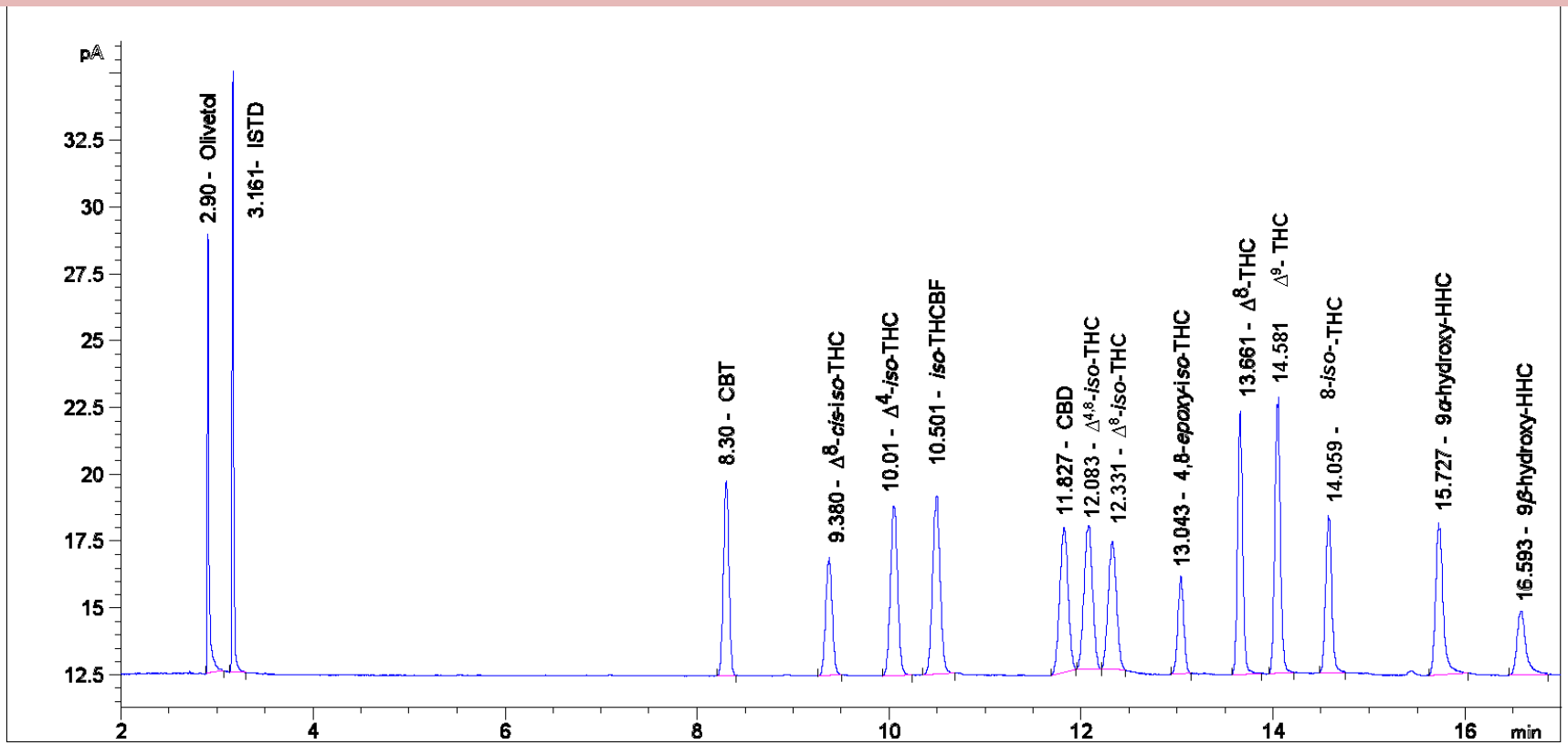
GC-FID representative chromatogram of the 14 cannabinoids at 100 µg/mL and the IS at 10 µg/mL



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Standard 20 silylated cannabinoid mixture (25 µg/mL) and IS (50 µg/mL)

- Twenty-one Δ^8-THC vape samples were analyzed
- From each Δ^8-THC vape product, 50 mg was weighed
- Dissolved in 5 mL methanol, vortexed for 10 seconds, sonicated for 5 minutes, then transferred to a 10 mL volumetric flask.
- The volume was adjusted to mark with methanol to get a final concentration of 5 mg/mL.
- To each vial was added 10 µL of the IS (1mg/mL) and the volume adjusted to 100 µL.
- Anthracene at 1 mg/mL was used as IS

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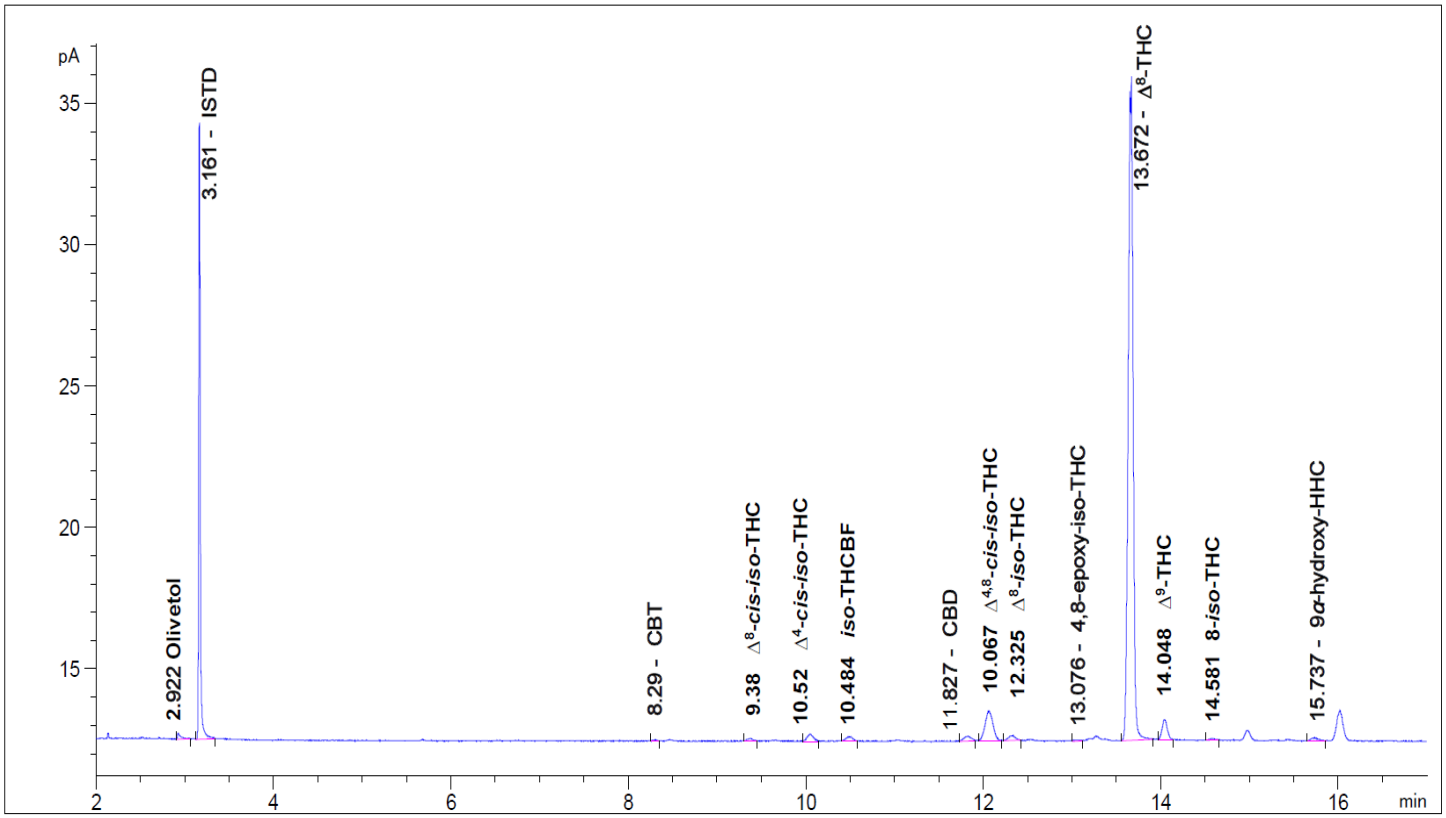
GC-FID chromatogram of a representative sample prepared at 5 mg/mL (sample # EA 324)



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The Science of Drug Abuse & Addiction

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