Form	Deviation Request Form
Title	DRF - Technical Procedure for the Examination of Items Potentially Containing Cannabinoids
Laboratory Location	Lab-wide
Discipline/Section	Drug Chemistry
A. Requested deviation applies to:	Technical Procedure for the Examination of Items Potentially Containing Cannabinoids Version 1 Section 5.6.7.2
B. Requested deviation:	Reorgnize the section to now say: 5.6.7.2 GC-MS analysis identifying either: Tetrahydrocannabinol(s) and/or Cannabidiols) 5.6.7.2.1 If Cannabinoid(s) are indicated, a derivatized extract shall be analyzed on the GC-MS and/or an FTIR shall be conducted as part of the analytical scheme for identification. 5.6.7.2.2 Retention time match to Tetrahydrocannbinol(s) and/or Cannabidol Reference Material shall be used if neither a Modified Duquenois-Levine color test was possible nor an FTIR performed. (See the Drug Chemistry Technical Procedure for Gas Chromatography/Mass Spectrometry (GC-MS)). 5.6.7.2.3 For GC-MS analysis of material satisfying 5.6.7, see the Extraction of Cannabinoid Containing Exhibits section and/or the Derivatization of Thermally Labile Compounds section of the Drug Chemistry Technical Procedure for Extractions and Separations.
C. Necessity for the deviation:	Items other than crystalline and powder materials have been confirmed to contain tetrahydrocannabinolic acid. This update will more fully identify the specific tetrahydrocannabinolic acids if present in samples that are not botanical in nature.
D: Technical Review and Authorization	
	Cannabinoid acids thermally degrade into cannabionids at the high temperatures used in GC-MS. Drug chemistry methodology now allows for the identification of cannabinoid acids from complex

matrices and mixtures through derivatization. Additionally, IR analysis can also identify specific cannabinoid acids if not in a mixture.

Identifying and reporting the cannabinoid acids will provide the customer additional information as to the composition of their items.

Technical Authorization	Yes - Authorized
Technical Authorizer	Galassie, Allison
Duration	1 year / next procedure revision
E: Quality Assurance Authorization	
Acceptable within general QA guidelines and good laboratory practice?	Yes
Significant negative impact to Crime Laboratory Quality System?	No
QA Authorization	Yes - Authorized
QA Authorizer	Schell, Kathleen
Effective Date:	1/27/2025

Version: 5.0
Created at 1/16/2025 10:15 AM by Galassie, Allison
Last modified at 1/17/2025 9:59 AM by Schell, Kathleen

Close

Technical Procedure for the Examination of Items Potentially Containing Cannabinoids

1.0 Purpose - This procedure specifies the required elements for the identification of suspected cannabis plant material and plant material extracts and products suspected to contain cannabinoids.

2.0 Scope - This procedure applies to all exhibits that potentially contain cannabinoids, to include plant material, plant material extracts, and products, that are analyzed in the Drug Chemistry Sections of the State Crime Laboratory.

3.0 Definitions

- **Hashish** - Common name for the extracted resin of marijuana.
- **Performance verification –** The initial confirmation of the reliability of a previously or externally validated method or instrument.
- **Quality control (QC) check –** Periodic confirmation of the reliability of equipment, instrumentation, and/or reagents.
- **Reference material** – Material sufficiently homogeneous and stable, with reference to specified properties, which has been established to be fit for its intended use in measurement or in examination of nominal properties.

4.0 Equipment, Materials and Reagents

4.1 Equipment

- Microscope(s) –stereo and/or polarizing
- Balance
- Gas Chromatograph/Mass Spectrometer (GC-MS)
- Fourier Transform Infrared Spectrophotometer (FTIR) with Universal Attenuated Total Reflectance (ATR) Sampling Accessory

4.2 Materials and Reagents

- Marijuana/Hemp or Hashish/THC/cannabinoid reference material
- Weigh vessel
- Modified Duquenois-Levine reagent (Drug Chemistry Section Technical Procedure for Preliminary Color Tests)
- Suspected plant material/plant material extract exhibit
- Chloroform, Methanol, or other suitable solvent (ACS grade or higher)
- Microscope slide
- Culture tube
- Pipette
- General lab utensils, such as tweezers or spatula
- GC-MS consumables (vials, caps, inserts)

5.0 Procedure

5.1 Standards and Controls - A primary or secondary reference material of marijuana/hemp and/or hashish shall be used for macro and microscopic comparison purposes.

5.2 Calibrations - N/A

5.3 Sampling - Plant material shall be sampled according to the Drug Chemistry Section Administrative Procedure for Sampling.

5.4 New Microscopes

5.4.1 New microscopes shall be installed according to the manufacturer's instructions. Refer to the user manual for each microscope model.

5.4.2 Stereomicroscopes shall be added to the FA Resource Manager, to include serial number and/or asset number.

5.4.3 See the Drug Chemistry Section Technical Procedure for Polarized Light Microscopy for new polarizing light microscopes.

5.5 Maintenance

5.5.1 Stereomicroscopes shall be serviced yearly by a certified vendor. Service records shall be maintained in the FA Resource Manager.

5.5.2 See the Drug Chemistry Section Technical Procedure for Polarized Light Microscopy for information regarding maintenance for polarizing light microscopes.

5.6 Application of Procedure on Evidence

5.6.1 Items shall be weighed according to the Drug Chemistry Section Technical Procedure for Balances and reported with applicable measurement assurance.

5.6.2 Plant material shall be viewed macroscopically and microscopically to verify the presence of visually recognizable morphological characteristics.

5.6.3 Macroscopic and microscopic characteristics of cannabis (marijuana/hemp) present in the exhibit shall be documented in the examination notes (i.e., checking the box next to the characteristic(s) present).

5.6.4 Macroscopic characteristics that may be observed include:

- Upright stalk attains a height of 3-16 feet, average 4-6 feet.
- Stalk varies in diameter up to two inches, averages less than one half inch.
- Plant has compound palmate leaves with 5-11 leaflets (usually seven), and odd in number.
- Leaf is similar in shape to a hand.
- Leaflets are pointed at both ends and vary up to about six inches length and to about 1.5 inches in width.
- Leaves are green, brown-spotted, or brown in color.
- Distinction between male and female plants is difficult except at maturity.

  Male: flowers are very prominent; mature ones shed pollen profusely.
  Female: flowers are inconspicuous and are found hidden among the small leaves at the ends of the stalk and branches.

- The plant branches at the nodes – a branch appearing immediately above each leaf. The branches occur at opposite points on the stalk with alternate pairs situated at right angles.
- Plant has a characteristic odor.
- Seeds (fruit) have a lacy, mottled appearance like a melon or turtle's back.
- Seeds (fruit) are ovoid in shape, mottled in color and are greenish-yellow to brown.
- Seeds (fruit) are enclosed in bulbs or pods (hulls).
- One main tap root up to eight inches long. Smaller branches from the main root.

5.6.5 Microscopic Characteristics that may be observed include:

5.6.5.1 Leaves or leaflets

- Green, brown-spotted, or brown in color.
- Characteristically serrated.
- Veins end at sharp point of each serration or notch, best seen from the underside.
- Cystolithic hairs on upper side.
- Glandular hairs on upper and/or lower side.
- Longer, sharper pointed hairs on underside.
- Effervescence with dilute hydrochloric acid.
- Sessile glands (i.e., trichomes without stalk) on lower epidermis.

5.6.5.2 Stems

- Fluted.
- Branches appear immediately above each leaf.
- Hairs – eglandular and/or glandular.

5.6.5.3 Seeds (Fruit)

- Greenish-yellow to brown in color.
- Lacy, mottled appearance like a melon or a turtle's back.
- Ovoid in shape.
- Ridge around the greatest circumference.
- Inside similar to coconut meat.

5.6.5.4 Hairs

5.6.5.4.1 Eglandular (non-glandular)

- "Cystolithic hairs" - Characteristic "warty" appearance; look like bear claws. They are found on the upper (adaxial) surface of the leaf. They may have a sphere of calcium carbonate at the base of the hair which effervesces in dilute hydrochloric acid. No plant which fails to show them can be cannabis (marijuana/hemp).

- Non-cystolithic long and slender hairs occur on the lower (abaxial) surface of the leaves, stems, and other plant parts, and lack the enlarged base. They are usually more profuse than cystolithic hairs. They can have a "wooly" or "fuzzy" appearance. These are sometimes referred to as "covering" hairs.

5.6.5.4.2 Glandular

- Capitate-stalked – Look like clubs with flattened, spherical heads and may be present in large numbers on the bracts of the female flowers and sometimes observed on leaves and the veins of leaves.
- Capitate-sessile – Large globular head without a stalk and are generally found on the lower (abaxial) surface, and sometimes also observed on the upper surface of the leaves, veins and stems.

5.6.5.5 Hulls (pods) - found on outside of seeds (fruit)

- Green, brown, or brown-spotted in color.
- Characteristically shaped.
- Cystolithic and/or glandular hairs on outer surface.

5.6.6 For plant material that exhibits the characteristic botanical features of cannabis (marijuana/hemp), the following examinations are considered the minimum acceptable criteria for positive identification:

5.6.6.1 Physical (macroscopic and microscopic) to include at least one of the following combinations of microscopic characteristics:

- Leaf/leaflets/leaf fragment(s) and hairs OR
- Stem(s) and hairs OR
- Seed(s) and hairs

NOTE: The indication of hairs, as noted in the combinations list above, implies the observation of cystolithic hairs; however other eglandular and/or glandular hairs may be present for that exhibit.

AND

5.6.6.2 A positive Modified Duquenois-Levine color test. If a positive Duquenois-Levine color test cannot be obtained, see **5.6.6.3.1** (See the Drug Chemistry Section Technical Procedure for Preliminary Color Tests.)

AND

5.6.6.3 GC-MS analysis identifying either: Tetrahydrocannabinol(s) and/or Cannabidiol.

5.6.6.3.1 Retention time match to Tetrahydrocannabinol(s) and/or Cannabidiol Reference Material shall be used if a Modified Duquenois-Levine color test was not possible due to sample size or sample matrix. (See the Drug Chemistry Technical Procedure for Gas Chromatograph/Mass Spectrometry (GC-MS)).

5.6.6.3.2 For GC-MS analysis of plant material, soak (approximately, no more than) thirty milligrams of material in approximately 3 milliliters of solvent. Filter the solvent into a GC-MS vial.

5.6.6.4 Material identified by the criteria in **5.6.6** shall be reported as "Plant material belonging to the genus *Cannabis* containing XXX. Concentration of cannabinoid(s) not determined."

5.6.6.4.1 XXX is the specific cannabinoid(s) identified, to include but not limited to: delta 9-tetrahydrocannabinol and/or its isomers, cannabidiol, and hexahydrocannabinol.

5.6.7 For any material that does not exhibit the characteristic botanical features of cannabis (marijuana/hemp), the following shall be required:

5.6.7.1 A positive Modified Duquenois-Levine color test shall be obtained if sample size allows. If a positive Duquenois-Levine color test cannot be obtained, then **5.6.7.2.1** or a combination of **5.6.7.2** and **5.6.7.3** is required**.** (See the Drug Chemistry Section Technical Procedure for Preliminary Color Tests.)

AND

5.6.7.2 GC-MS analysis identifying either: Tetrahydrocannabinol(s) and/or Cannabidiol.

5.6.7.2.1 Retention time match to Tetrahydrocannabinol(s) and/or Cannabidiol Reference Material shall be used if neither a Modified Duquenois-Levine color test was possible nor an FTIR performed. (See the Drug Chemistry Technical Procedure for Gas Chromatograph/Mass Spectrometry (GC-MS)).

5.6.7.2.2 For GC-MS analysis of materials satisfying **5.6.7**, see the Extraction of Cannabinoid Containing Exhibits section and/or the Derivatization of Thermally Labile Compounds section of the Drug Chemistry Technical Procedure for Extractions and Separations.

5.6.7.2.3 If the material is a powder or is crystalline in nature and Tetrahydrocannabinol(s) and/or Cannabidiol(s) are indicated in the GC-MS, an FTIR shall be conducted as part of the analytical scheme for identification.

OR

5.6.7.3 FTIR analysis identifying either: Tetrahydrocannabinol(s) and/or Cannabidiol.

5.6.7.4 Material identified by the criteria in **5.6.7** shall be reported as "XXX. Concentration of cannabinoid(s) not determined."

5.6.7.4.1 XXX is the specific cannabinoid(s) identified, to include but not limited to: delta 9-tetrahydrocannabinol and/or its isomers, delta 9-tetrahydrocannabinolic acid and/or its isomers, cannabidiol, and hexahydrocannabinol.

5.7 Microscopic Examination of Cannabinoid Containing Exhibits Using Chloroform

5.7.1 Chloroform can be used to aid in the visualization of plant characteristics of cannabis (marijuana/hemp) or hashish.

5.7.1.1 Cannabis (marijuana/hemp) or hashish cystolithic hairs look like bear claws.

5.7.1.2 For frequently seen cystolithic hairs, the marijuana/hemp or hashish standard is not required to be run with each test sample.

5.7.2 Application of Procedure on Evidence

5.7.2.1 Add a drop of chloroform to the microscope slide. View under the polarizing light microscope to ensure no hairs are present.

5.7.2.1.1 If hairs are present, steps will be taken until no hairs are present. This includes, but is not limited to, obtaining a new microscope slide or new solvent.

5.7.2.2 Place a small sample of suspected hashish or cannabis (marijuana/hemp) onto the slide.

5.7.2.3 Observe, under a relatively low magnification, using the polarizing light microscope.

5.7.2.4 The results of the microscopic examination shall be documented in the casefile.

5.7.3 Material identified by the criteria in **5.6.7** and further identified by the criteria in **5.7** shall be reported in accordance with **5.6.7.4**.

NOTE: See the US Sentencing Commission Guidelines Manual for the Federal definitions of Hashish and Hashish Oil. Should the exhibit qualify under either of those definition, and there is indication the case will be prosecuted federally, the addition of "Hashish" or "Hashish Oil" shall be added to the end of the reporting statement in **5.7.3**. Furthermore, additional cannabinoids shall be identified, as applicable, to satisfy the definitions of these materials.

5.8 Additional Reporting

5.8.1 If the net weight of the item is less than five grams and consists of hand-rolled cigarettes or partial hand-rolled cigarettes, the paper will be included in the weight recorded/reported with applicable measurement assurance. The evidence can be cut open to expose the plant material for viewing and analysis.

5.8.1.1 For purposes of obtaining a sample for analysis, one unit shall be analyzed and reported with the weight of the paper. All other units in the population shall be left unanalyzed and no weight reported.

Example:
Description
Plastic bag containing multiple hand-rolled cigarettes.

Results
One hand-rolled cigarette was analyzed and found to contain X (see **5.6.6** or **5.6.7**).
Net weight of paper and plant material – X.XX (+/- 0.XX) gram.

Remaining material – No chemical analysis.

5.8.2 In cases where sampling does not apply and multiple pieces of material may be needed to conduct a complete analysis, a clear description of what was analyzed shall be required.

Example:
Description
Plastic bag containing multiple pieces of hand-rolled cigarettes with minimal plant material present in each.

Results
Three pieces of hand-rolled cigarettes were analyzed and found to contain X (see **5.6.6** or **5.6.7**).
Net weight of paper and plant material – X.XX (+/- 0.XX) gram.

Remaining material – No chemical analysis.

5.9 Calculations - N/A

5.10 Uncertainty of Measurement - See the Drug Chemistry Technical Procedure for Balances and the Drug Chemistry Procedure for Measurement Assurance.

6.0 Limitations - Not every cannabis exhibit contains every plant characteristic. The Forensic Scientist shall identify and document those that are present. The current procedures at the North Carolina State Crime Laboratory do not allow for the differentiation of "marijuana" from "hemp", as defined in North Carolina General Statues. Additionally, several cannabinoids are also found in the "acid" form and will decarboxylate at high temperatures. Instrumental techniques utilized by the NCSCL may be unable to

differentiate these two forms [e.g., delta 9-tetrahydrocannabniol (delta 9-THC) and delta 9-tetrahydrocannabinolic acid (delta 9-THCA)].

7.0 Safety

7.1 Be aware of plant material that contains mold. Handle in a well-ventilated area and minimize movements that may cause aerosolization of the mold. Analysts may wear a dust mask for comfort.

7.2 Refer to Appendix 1 for chemical hygiene and safety precautions for extremely hazardous and particularly hazardous substances.

7.3 Submitted evidence consists of chemical unknowns; therefore, all cases should be treated with extreme caution.

8.0 References

Marihuana Its Identification. Washington, D.C.: U.S. Treasury Department Bureau of Narcotics, United States Printing Office, 1948.

North Carolina, *General Statutes.* Article 5 "North Carolina Controlled Substances Act."

United States Sentencing Commission, *Guidelines Manual*, §3E1.1 (Nov. 2018)

Recommended Methods for the Identification and Analysis of Cannabis and Cannabis Products. New York: United Nations, 2009.

Nakamura, George R. and Thornton, J. I. "The Identification of Marijuana" *Journal of Forensic Science Society*, (1972), 12, 461.

User manual for appropriate stereomicroscope model(s).

Recommended Methods for the Identification and Analysis of Cannabis and Cannabis Products (revised and updated by UNODC). Vienna: United Nations, 2022.

9.0 Records

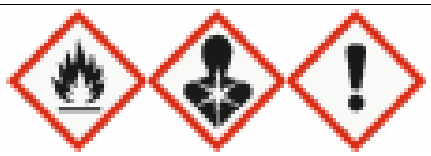
- FA Worksheets

10.0 Attachments

- Appendix 1 – Chemical Hygiene and Safety Precautions for Extremely Hazardous and Particularly Hazardous Substances

Revision History		
Effective Date	Version Number	Reason
10/28/2024	1	Procedure created from previous Technical Procedure for the Identification of Plant Material and Plant Material Extracts, v. 3

Appendix 1 – Chemical Hygiene and Safety Precautions for Extremely Hazardous and Particularly Hazardous Substances

Acetaldehyde **(component in Duquenois-Levine color test solution)** **DANGER: PARTICULARLY HAZARDOUS SUBSTANCE**	
	**HEALTH 2** **FLAMMABILITY 4** **REACTIVITY 2**
Detection of Release	Pungent odor; clear liquid
Signs/Symptoms of Exposure	Eye irritation; respiratory irritation
PEL	OSHA Table Z-1 TWA 200 ppm or 360 mg/m3
Associated Hazards	Extremely flammable liquid and vapor; Causes serious eye irritation; May cause respiratory irritation; Suspected of causing genetic defects; **May cause cancer**
Controls	Use under fume hood. Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. Use eye protection. Handle with gloves. Wear lab coat. Gloves: nitrile (break through time < 1 minute; CHANGE GLOVES OFTEN)
Safe handling, storage, disposal	Avoid contact with skin and eyes. Avoid inhalation of vapor or mist. Keep away from sources of ignition. Take measures to prevent the build-up of electrostatic charge. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Dispose in Hazardous Chemical Waste.
Emergency Procedures	**Eye Contact:** Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. **Inhalation Exposure:** If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician. **Ingestion:** Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician. **Skin Contact:** Wash off with soap and plenty of water. Consult a physician. **Spills:** Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas. Small spills: Contain spillage, and then soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container. Dispose in Hazardous Chemical Waste. Large spills: Evacuate area and call 911 (Haz Mat).