

Conducting Duct Tape Sourcing Searches in the National Forensic Tape File (NFTF) Using Spectral Library Identification and Classification Explorer (SLICE)

1 Introduction

The National Forensic Tape File (NFTF) is a collection of various tapes collected by FBI Laboratory personnel from tape manufacturers or retail outlets. Acquisition information, physical characteristics, and analytical data about each tape sample are compiled in a searchable database known as Spectral Library Identification and Classification Explorer (SLICE). This collection can be utilized in duct tape sourcing investigations to develop manufacturer and product information about duct tape evidence. The NFTF can also be used in conjunction with information available from industry contacts.

2 Scope

This general procedure applies to Chemistry Unit caseworking personnel who utilize the NFTF reference samples and SLICE database for duct tape sourcing.

3 Equipment/Materials/Reagents

- a. NFTF
- b. PC capable of running the SLICE software program
- c. SLICE software (xk, Inc., EDAX)

4 Standards and Controls

Not applicable.

5 Sampling or Sample Selection

Not applicable.

6 Procedure

1. Utilizing guidance provided in *General Approach for Tape Casework*, evaluate the physical characteristics and chemical composition of a tape specimen. Not every technique need be conducted before searches commence.

2. Conduct a search(es) through SLICE using the physical characteristics and/or chemical composition of the tape specimen. It is recommended that the search criteria be limited to duct tapes.
 - a. A best fit search can be conducted using the spectrum of the tapes' adhesive or backing. The candidate list will be provided in order of best to least fit.
 - b. Drop down menus for certain physical characteristics (e.g., weave, backing color) can be selected and searched. If a best fit search has not been indicated, any reference tape that meets the criteria selected will be included in the candidate list. If a best fit search has been selected, the candidate list will be in order of best to least fit and will only include references tapes that meet all selected criteria.
 - c. A range for the scrim count can be searched. Results will be displayed as in 2.b.
 - d. A text based search (e.g., organic composition) can be selected to further narrow the search results. Results will be displayed as in 2b.
3. One possible search procedure is as follows:
 - a. Perform a best fit search of the tape's adhesive. Compare the spectrum of each successive candidate until the spectra no longer compare favorably with the questioned sample spectrum. If the list of candidates is still too numerous to manage, repeat the search with additional physical characteristics included. Determine if any possible candidates can be eliminated by comparing the remaining information available for the samples in the candidate list.
 - b. Perform a best fit search of the tape's backing. Compare the spectrum of each successive candidate until the spectra no longer compare favorably with the questioned sample spectrum. If the list of candidates is still too numerous to manage, repeat the search with additional physical characteristics included. Determine if any possible candidates can be eliminated by comparing the remaining information available for the samples in the candidate list.
 - c. Cross-reference the candidates remaining from the search described in 3a to the candidates remaining from the search described in 3b. Any candidates found in common can be directly compared to the questioned tape specimen.
4. Compare the color, appearance, thickness, and the acquired Fourier transform infrared spectroscopy (FTIR) and X-ray diffraction data of the evidentiary tape specimen to the selected tape standards.
5. If a particular manufacturer or product cannot be eliminated as a candidate, contact the manufacturer to see if the information can be corroborated.

7 Decision Criteria

If a duct tape reference standard compares is consistent favorably in physical characteristics and chemical composition to the evidentiary duct tape specimen, record as a candidate.

8 Calculations

Not applicable.

9 Measurement Uncertainty

Not applicable.

10 Limitations

- a. Not every duct tape product is represented in NFTF.
- b. Sample condition can preclude conducting certain examinations, such as color assessment and overall thickness.

11 Precautionary Statements

- a. Some data entry errors may exist in the database. Verify search results using orthogonal resources when practicable.
- b. Adhesive and backing color differences can occur between questioned and reference samples, which may not eliminate the reference tape as a potential candidate.
- c. Since width and thickness are known to vary along the length of a roll of tape, and between different rolls of the same product, observed differences in these parameters between questioned and reference tapes may not be indicative of different products or manufacturers.

12 Safety

Not applicable.

13 References

FTIR Analysis of Paints, Tapes, and Polymers, FBI Laboratory, Chemistry Unit - Paints and Polymers SOP

General Approach for Tape Casework, FBI Laboratory, Chemistry Unit - Paints and Polymers SOP

Mehltretter, A.H., Bradley, M.J. Forensic analysis and discrimination of duct tapes, *Journal of the American Society of Trace Evidence Examiners*, 2012, 3(1): 2-20.

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Mehltretter, A.H., Wright, D.M., and Smith, M.A. Variation in duct tape products over time: Physical measurements and adhesive compositional analysis by Fourier transform infrared spectroscopy, *Forensic Chemistry*, June 2017, 4: 1-8. *Physical Examinations of Tape Evidence*, FBI Laboratory, Chemistry Unit - Paints and Polymers SOP

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Wright, D.M. and Mehltretter, A.H. Forensic duct tape sourcing examinations: Developing investigative leads using multiple resources, *Journal of the American Society of Trace Evidence Examiners*, 2013, 4(1): 13-28.

X-Ray Diffraction Analysis of Tapes, FBI Laboratory, Chemistry Unit - Paints and Polymers SOP

| Rev. # | Issue Date | History |
|--------|------------|---|
| 0 | 12/18/09 | New document. |
| 1 | 12/23/13 | Minor editorial changes in sections 3 and 12. In section 4a, provided description for NFTF. References to <i>Macroscopic and Microscopic Examinations of Tape Evidence</i> changed to reflect current title of document as <i>Physical Examinations of Tape Evidence</i> . Section 13 expanded. Updated references to include article by Wright and Mehlretter. |
| 2 | 09/18/18 | Modified scope, streamlined procedure for clarity, minor grammatical edits throughout, and updated references. |

Redacted - Signatures on File

Approval

Paints and Polymers
Technical Leader:

Date: 09/17/2018

Chemistry Unit Chief:

Date: 09/17/2018

QA Approval

Quality Manager:

Date: 09/17/2018