A75 Improved Discrimination of Duct Tapes Using Carbon and Hydrogen Isotope Ratio Variations in Duct Tape Polyester Web Fibers

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After attending this presentation, attendees will understand the forensic isotopic information contained in duct tape web materials.

This presentation will impact the forensic science community by providing additional isotopic tools for in-depth duct tape investigations.

At the Netherlands Forensic Institute (NFI), Isotope Ratio Mass Spectrometry (IRMS) is used in combination with other techniques (visual, FTIR, LA-ICP-MS, etc.) to investigate potential relations between different materials in forensic investigations. A prominent example material is (gray) duct tape as it is now commonly used in Dutch households and often found at crime scenes. If a visually similar tape is retrieved during, e.g., a search at a suspects home, a request is almost always made to compare the tape materials. If tapes are not discriminated using visual comparison (color, thickness, width) and FT-IR, other techniques such as LA-ICP-MS and IRMS are used to investigate chemical and isotope characteristics.

Duct tape mainly consists of three different layers: (1) a polyethylene backing film; (2) a network of cotton or polyester fibers (web); and, (3) an adhesive layer (glue, often isoprene based). The web is a network of cotton or polyester fibers usually woven with length and crosswise threads commonly referred to as warps and wefts, respectively.

Previous work has shown that isotope ratios (d13C and d2H) of the backing film isolated from the adhesive layer can be of value in making discriminations. The value of the forensic evidence is increased by considering isotope ratios (d13C and d2H) of the backing film in isolation from the adhesive layer. The background variation of carbon and hydrogen isotope ratios from the backing was evaluated using 44 duct tape rolls of major brands randomly purchased in the Netherlands (van Breukelen *et al*., 2010).[1]

To date, the NFI gray duct tape collection comprises 120 tape rolls. Results will be presented on the discrimination of these rolls based on the backing d13C and d2H ratios.

Secondly, the added forensic value of d13C and d2H ratios for the cotton/polyester layer in duct tapes will be demonstrated. Because the isotope discrimination between different batches produced during a short production period was weak using the backing material only, an analytical procedure was developed and validated to determine d13C and d2H from the isolated web material. The warp and weft threads are found to have, in general, different d13C and d2H values; differing e.g., up to 2.5% in d13C values. This difference may be explained by the manufacturing process where presumably raw materials from different sources or batches are used for warp and weft threads, providing an additional level of discrimination. The d13C and d2H isotope variation of warp and weft bundles, as well as within individual warp and weft threads, is shown to be insignificant.

Nineteen gray duct tapes were investigated using this web method. Using the additional isotope information of the warp and weft threads, 17 of these tapes could be discriminated.

Results will also be presented from the application of this web method to representative samples from seven production rolls provided by the Dutch producer “Supertape.” The samples from these rolls of 12m length (produced between March 21, 2007 and April 12, 2007 to manufacture small tape rolls) were indistinguishable based on their backing d13C and d2H isotope ratios. It will be evaluated how much discrimination improves if the d13C and d2H isotope ratios of the polyester web are included.

Reference:

1. Discrimination of duct tapes using Isotope Ratio Mass Spectrometry, M.R. van Breukelen, F. Vogelpoel, M. Schrader, W. Wiarda, A.J.J. van Es and G.J.Q. van der Peijl, Fourth FIRMS Conference, Washington, April 12-14, 2010, book of Abstracts, p 33 (to be accessed through http://www.forensic- isotopes.org/assets/2010-Abstracts.pdf)

Duct Tape, Web, IRMS

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