B59 Characterization and Comparison of Electrical Tape Backings by X-Ray Florescence (XRF)

Meghan Prusinowski, Morgantown, WV 26505; Andria H. Mehltretter, MSFS, FBI Laboratory, Quantico, VA 22135; Claudia Martinez, BSc, Florida International University, Miami, FL 33199; Jose R. Almirall, PhD, Florida International University, Miami, FL 33199; Tatiana Trejos, PhD, West Virginia University, Morgantown, WV 26506*

Learning Overview: After attending this presentation, attendees will understand: (1) the importance of elemental analysis in the comparison of electrical tape backings; (2) the advantages of utilizing XRF for characterization of the backing composition; (3) the considerations that must be made for sample preparation when using XRF; and (4) a method for quantitative assessment and comparison of the spectra.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the viability of XRF for the analysis of electrical tape backings. In addition, this presentation provides statistical analysis for the spectral data that aids in the classification and comparison of samples.

Elemental analysis is one of the most informative steps in the forensic examination of electrical tapes. The detection of inorganic elements provides input regarding the chemical composition of fillers, polymers and other additives of the backings. The analysis is typically conducted by Scanning Electron Microscopy-Energy Dispersive Spectroscopy (SEM-EDS), although Laser Ablation-Inductively Coupled Plasma–Mass Spectrometry (LA-ICP-MS) has recently shown to enhance the certainty of the determinations.[1] In this study, the utility of X-Ray Fluorescence (XRF) is compared to previously published SEM-EDS and LA-ICP-MS data. Three different XRF systems were used to evaluate a range of system configurations commonly available at crime laboratories. A set of 40 electrical tape backings known to originate from various sources was used to assess the inter-roll variability, discrimination and classification capabilities of the method. The improvement in discrimination ranged from 78.8% (SEM-EDS) to 81.5 to 91.0% (XRF) depending on the instrument configuration, to 84.6% (LA-ICP-MS). The characterization of elemental profiles and classification into different groups improved with superior sensitivity and selectivity of the methods. SEM-EDS detected up to 8 relevant elements, while XRF and LA-ICP-MS detected up to 14 and 29, respectively. As a result, classification capabilities and accuracy improved with the use of XRF and laser ablation methods. A set of 20 pieces of tape collected from the same roll were analyzed to evaluate the intra-roll variability. Duplicate control samples from the same tapes were used to assess inter-day and intra-day instrument variability. No false exclusions were observed in the data set, demonstrating the within sample variability and instrumental variability are relatively lower than the inter-sample variability. XRF showed to be a viable analytical tool for the forensic examination of electrical tapes, with advantages of speed of analysis, non-destruction of the tape, and high informing power.

Reference(s):

1. C Martinez–Lopez, T Trejos, AH Mehltretter and JR Almirall. “Elemental analysis and characterization of electrical tape backings by LA–ICP–MS.” *Forensic Chemistry*, 4. (2017):96-107.

Electrical Tape, X-Ray Fluorescence, Elemental Characterization

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