J17 The Use of Liquid Chromatography - Mass Spectrometry for the Analysis of Writing Inks

Yvette Thomas, MFS*, and Gerry LaPorte, MSFS, United States Secret Service, Forensic Services Division, 950 H Street NW, Washington, DC 20223

After attending this presentation, attendees will learn the discrimi- nation potential of High Pressure Liquid Chromatography – Mass Spectrometry (LC-MS) for the analysis of ballpoint and non-ballpoint ink samples. The advantages of LC-MS in the comparison of questioned and known inks will be demonstrated. This presentation will describe the utility and efficiency of LC-MS in comparison to thin layer chromatography (TLC) for different groups of ballpoint and non-ballpoint (e.g., roller ball, felt tip, and gel) writing inks. This presentation will demonstrate results from this research which will allow forensic examiners to assess the overall utility of LC-MS for the characterization and discrimination of writing inks. The authors will also evaluate the feasibility of developing and maintaining an ink database of LC-MS spectra.

TLC is the most widely used method in ink analysis due to its effectiveness and efficiency. However, although very different inks can be easily distinguished, it is also possible that different inks with similar formulations may produce colorant profiles on a TLC plate that can some- times be indistinguishable. It may be difficult to determine differences in component ratios. TLC is not feasible for the detection of volatile and semi-volatile organic compounds and other components such as resins.

Mass Spectrometry can differentiate dyes and other components with differing molecular structures. This level of discrimination is not possible by chromatographic means alone, which relies on the properties of each dye to result in separation. Therefore, ESI-MS is capable of providing additional analytical information on the relative abundances of ions pro- duced from components in a given ink, thus allowing otherwise identical formulates to be distinguished. In addition, ESI-MS may be able to detect resins and other additives not visible with TLC.

The discrimination potentials of ESI-MS and TLC were compared for several classes of inks. For each class examined, the inks were sorted into groups based on the TLCs available in a database. Each group consists of several unique inks, including some that were considered indistinguishable by TLC analysis alone. Each ink was analyzed using ESI-MS. To assist in the identification of individual components within the spectra, several standard dyes of known composition were also analyzed by ESI-MS.

The results from this research will allow forensic examiners to assess the overall utility of LC-MS for the characterization and discrimination of writing inks. As well, the authors will evaluate the feasibility of developing and maintaining an ink database of ESI-MS spectra.

Questioned Documents, LC-MS, Ink Analysis