J19 Comparison of a Standard Set of Black Ballpoint Inks Using a Direct Analysis in Real Time Mass Spectrometer (DART™-MS)

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After attending this presentation, attendees will understand DART™ and its application to forensic ink examination on questioned documents.

This presentation will impact the forensic science community by providing a potential alternative to current ink analysis techniques.

Examination of writing inks has revolved around the use of chromatography for decades. Chemists frequently use chromatography to separate components of a mixture to avoid potential interferences or overlaps in the obtained spectra. Often, this process requires some sample preparation or pre-treatment prior to analysis and results in destruction to small parts of the document. However, overlaps and interferences can be minimized, or even eliminated, if an instrument is used that is sensitive enough to distinguish between two components that are unresolved by other analytical techniques.

The Direct Analysis in Real Time Mass Spectrometer (DART™- MS) utilizes an ion source to generate a beam of electrically excited helium that is used in the analysis of complex mixtures. Instead of separating the components using some chromatographic medium, DART uses an AccuTOF™ mass spectrometer to separate the constituent ions. The time of flight spectrometer provides exact masses at accuracies up to a few millimass units. Such sensitivity, coupled with a reference collection of precisely known molecular masses, such as the National Institute of Standards and Technology (NIST) mass spectral library, allows for identification of numerous dyes, pigments, and vehicles (solvents) simultaneously without the use of chromatography. Sample preparation for DART™ is minimal and signal collection takes only a few seconds. This increased sensitivity and potential for nondestructive sample analysis make DART™ a viable option to consider as an alternative for the examination of writing inks. Previous research in academia has also been published to validate the application of DART™-MS to ink analysis.

Previous studies have been conducted in which a set of forty-four (44) black ballpoint pen inks were analyzed using a variety of techniques, including Video Spectral Analysis (VSA), Gas Chromatograph / Mass Spectrometry (GC/MS), Thin Layer Chromatography (TLC), scanning densitometry, and Hyperspectral Imaging. This black ballpoint set was recently analyzed using the DART™-MS and the results compared with those generated using these other analytical techniques. The discriminating power of the inks was calculated based on inter-sample comparison. This research could impact the questioned document field by providing a potential alternative to current ink analysis techniques.

Questioned Documents, Ballpoint Pen Ink, DART™

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