



## Questioned Documents Section – 2008

### J26 The Analysis of Non Ballpoint Inks Using Gas Chromatography/Mass Spectrometry: Relevance to Ink Dating

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The goals of this presentation are to: (1) determine how often 2-phenoxyethanol and other common volatiles occur in non-ballpoint inks, (2) determine and compare the relative abundances of common volatiles to recognize patterns in solvent evaporation rates, and (3) identify discriminating characteristics among non-ballpoint ink formulae based on manufacturer, pen model, ink type, and year of production.

Limited resources currently exist pertaining to non-ballpoint ink analysis. A comprehensive study of these inks will impact the forensic

community by assisting forensic document examiners in cases involving comparisons, discriminations, or age determinations. From the extrication of an ink sample, it is possible to determine the mechanism of ink distribution, the ink cartridge material, and the relative age of the ink sample. With further research, a reproducible dynamic method for age determination may be achievable.

The objective of this presentation is to determine how often certain volatiles and semi-volatile organic compounds, particularly 2-phenoxyethanol, occur in non-ballpoint inks. Utilizing gas chromatography/mass spectrometry (GC/MS), the volatiles will be characterized by their abundance, ratio in respect to other volatiles, and intensity over time.

Dynamic approaches to ink dating involving solvent evaporation have been tested. Although this is not a novel method, little research has been conducted on non-ballpoint inks. The basic method involves extraction of the ink from an absorbent medium using an organic solvent followed by GC/MS analysis. Subsequent analyses are made after subjecting the ink to natural aging.

In this study, non ballpoint inks were analyzed using gas chromatography and mass spectrometry over a period of natural aging. The general term non ballpoint can be divided into 4 categories: fiber tip, gel, rollerball, and fountain. Black and blue ink samples from these 4 groups were placed onto Whatman™ filter paper No. 2 (scribble sheets), and the ink from 10-1mm hole punches was extracted with acetonitrile. A second extraction took place 28-31 days after the initial scribble sheet was prepared. Through GC/MS instrumentation, each extraction was analyzed to determine the concentration and identity of volatile components.

This research has been successful in providing information and data regarding the composition and characteristics of non ballpoint inks. The identification and rate of occurrence for each volatile has been established by the mass spectrometer and internal standards. Gas chromatography shows significant changes in the concentrations and ratios of major volatiles over a short period of time. The proprietary information and relative volatile abundances for each ink will be organized in a database to facilitate the act of recognizing patterns and establishing general assumptions regarding the entire population of non ballpoint inks.

#### **Non-Ballpoint Inks, Phenoxyethanol, Ink Dating**