



Questioned Documents Section – 2010

J18 The Need for Research Into the Analysis of Pigmented Printing Inks

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The goals of this presentation are to contrast dye-based and pigment-based inks and toners, and describe why these two types of materials are most effectively analyzed by different methods. This presentation will further describe how the ICE Forensic Document Laboratory plans to address this need with the development of a new printing ink analysis program geared toward the analysis of pigmented printing inks and toners.

Ultimately, development of a printing ink analysis program will impact the forensic science community by making available a resource at the proposed scale which does not exist in the United States at the present time.

Analysis of inks has historically been centered on dye-based writing inks, primarily ballpoint pens. Thin-layer chromatography (TLC) has unquestionably been the method of choice, though research has been done in many other areas of analytical chemistry to compliment TLC. Additionally, TLC methods used for ballpoint pens have been adapted to the analysis of other materials containing dye colorants, including non-ballpoint writing instruments as well as inkjet inks. However, TLC requires extractability of the ink components from both the substrate and from the rest of the ink matrix as a prerequisite to effective separation, and does not perform well when used to analyze pigments that cannot dissolve in the extraction solvent due to their intrinsic chemical properties, or their encasement in binders within the ink vehicle. Printing materials such as impact printing process inks, toners, water- and light-fast pigmented inkjet inks, and even some specialty writing inks (such as gel pens) all fall into this category and are difficult to analyze by TLC. Accordingly, it is necessary to identify appropriate instrumental analysis methods that can be applied to pigmented ink samples, and validate them for court admissibility and casework. This is important for analysis of forensic samples such as counterfeit documents, including identity documents and packaging, which are produced using pigmented inks and (for example) traditional printing processes like offset lithography.

To accomplish this, the ICE Forensic Document Laboratory is in the process of developing a library consisting both of raw materials, including pigments, resins, oils and additives, and finished ink samples appropriate for a variety of printing processes, including offset, typographic, screen and intaglio. It is anticipated that collection of these samples, and construction of a database to document their properties, will be an ongoing process that will require several years and extensive cooperation with industry partners. Characteristics of these materials will be studied by a variety of instrumental analysis techniques, to include Fourier transform infrared spectroscopy (FT-IR), Raman spectroscopy, laser-ablation inductively-coupled plasma/mass spectrometry (LA-ICP/MS), pyrolysis gas chromatography/mass spectrometry (py-GC/MS), scanning electron microscopy (SEM), and other techniques as required. Of equal importance, various modes of sampling of the documents will be studied, not only because the pigmented materials in question are not easily solubilized, but also to minimize destruction to questioned documents for future court purposes. It is also expected that method selection, method development and validation of the chosen instrumental techniques will require several years to complete.

Printing Ink, Toner, Pigment