## J18 The Use of Filtered Lighting and Infrared Luminescence for the Evaluation of Writing Inks Analyzed Using Thin Layer Chromatography

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The goal of this presentation is to provide additional knowledge regarding the evaluation of writing inks that are analyzed using thin layer chromatography, as well as, to provide information regarding the use of a digital capture station equipped with various filters.

This presentation will impact the forensic science community by demonstrating pre-existing techniques that can be used to enhance the evaluation and demonstration aspects of thin layer chromatography examinations.

Thin layer chromatography (TLC) is one of the most widely used and generally accepted scientific methodologies employed to compare and help characterize ink formulations. Since TLC is an effective and efficient method for separating and identifying colorants and nearly all ink formulations are proprietary, forensic examinations that employ TLC analysis are invaluable. For instance, two or more questioned inks can be compared to determine if they are the same, or questioned inks can be associated to a known standard. However, it must be emphasized that TLC is only one portion of an analytical scheme, and the "profile" of an ink is only achieved using the results from a series of physical, optical, and chemical examinations.

As part of the examination process, it is sufficient to compare and evaluate the components on a TLC plate using standard light and an ultraviolet source (254 and 366 nanometers). Some writing ink formulations, produced by different manufacturers, are sometimes indistinguishable after conducting optical examinations and TLC examinations. In addition, there may be batch variations in writing inks produced by the same manufacturer that are not detectable at this level of examination. Further analysis using additional analytical techniques such as gas chromatography/mass spectrometry (GC/MS) and Fourier transform-infrared spectroscopy (FT-IR) may be warranted, but are sometimes not helpful for further discrimination. Inks that are not distinguishable or their differences may not be detectable using the prescribed analytical techniques can be classified as being in the same "family" or having the same root formulation. Indeed, one must consider that indistinguishable inks found in different brands of writing instruments may have originated from the same source (e.g., ink wholesaler) and are chemically the same.

A variety of ballpoint and non-ballpoint inks from the same families and ink formulations from different batches that were indistinguishable following TLC analysis were further evaluated using filtered light and infrared luminescence (IRL). The images were evaluated using a Video Spectral Comparator (VSC), a digital camera equipped with special filters, and an alternate light source. Differences were detected within some of the families and between batches. Analysis using GC/MS was utilized in an attempt to identify the chemical compounds responsible for the differences. Furthermore, the filtered light and IRL examinations of inks that could not be further differentiated on TLC plates proved to be an excellent corroborating step during the evaluation process. This was especially evident in cases where resolution of bands was minimal since the various filters provided detailed contrast. The digital images of chromatographic profiles were captured and determined to be beneficial to demonstrate similarities and differences to jurors if necessary.

**Writing Inks, Thin Layer Chromatography, Filtered Lighting**

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