



J18 Inks Examination Using a Combination of Video Spectral Comparator (VSC) Spectra and Color Deconvolution

Yi Hui Ngor, Health Sciences Authority, 11 Outram Road, Singapore 169078, SINGAPORE; and Nellie Cheng, BS, Health Sciences Authority, 11 Outram Road, Singapore 169078, SINGAPORE*

The goal of this presentation is to conduct ink examinations using a combination of VSC spectra and color deconvolution.

This presentation will impact the forensic science community by providing Forensic Document Examiners (FDEs) a quantifiable means to examine inks and to better discriminate different inks.

Ink examination is usually performed either by: (1) using non-destructive methods such as visual and microscope examination and VSC examination; (2) destructive methods such as Thin-Layer Chromatography (TLC), Raman spectroscopy; or, (3) a combination of both non-destructive and destructive methods. If possible, FDEs would prefer non-destructive over destructive methods in their examinations. Often, the infrared reflectance and luminescence examinations using VSC are sufficient to differentiate the inks; however, issues arise when the difference observed in VSC results is subtle and requires examiners to interpret and determine if these subtle differences (e.g., a small difference in intensity of luminescence of the inks) are sufficient to determine if the inks are different or insufficient not to exclude them. It is this type of interpretation that differs from examiner to examiner that, in the end, could result in different conclusions between examiners. Yet, without using destructive methods such as TLC or Raman spectroscopy, which could provide a more conclusive finding, it is difficult for examiners to make any effective conclusion solely based on observations of when the inks exhibit subtle differences in luminescence at the various VSC settings.

With the goal of resolving the ambiguity that may arise due to the subtle differences observed for inks, a combination of two non-destructive methods of VSC spectra and color deconvolution is proposed. These two methods utilize different working principles and, hence, are complementary to each other in the examination of inks.

VSC spectra: The inks are subjected to various settings of the VSC under both the reflectance and luminescence modes and the results are then tabulated in the format of spectra. The spectra provide examiners a more objective interpretation of the results based on the profiles of the spectra and do not require examiners to agree or disagree if the extent of luminescence is sufficient or not to determine if they are different.

Color deconvolution: The inks are scanned, then processed using the image processing tool, which helps to separate the color of the different inks. The image processing tool utilizes mathematical algorithms that can define each image pixel as a vector of red, green, and blue components, then uses these vectors to help make subtle color differences obvious.

By using the combination of the spectra obtained by VSC and color deconvolution, examiners would have a more quantifiable means in the interpretation of results.

Inks Examination, VSC, Color Deconvolution