B16 Comparison of Blue Gel Ink Pens Through Chemical and Optical Methods

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After attending this presentation, attendees will understand the use of chemical and optical methods in the identification of blue gel inks. The presentation will provide a systematic way for document examiners and forensic chemists to identify blue gel inks.

The results of these methods were used to create a flow chart that can be used in the identification of gel inks. The creation of the flow chart will impact the forensic community and/or humanity by creating a procedure for identifying gel inks from questioned documents and to elaborate on traditional methods of identifying gel inks.

The increased popularity of the gel ink pen has created a need for professionals involved in the identification of inks to be able to classify and differentiate them from other pen types. The historical method of identifying inks has been thin layer chromatography (TLC), but as many gel inks are pigment based this technique is of only nominal use. To differentiate twenty-one blue gel inks, this study used optical and chemical techniques. Of the twenty-one blue gel inks, seven where dye- based and fourteen were pigment-based. The optical techniques used were stereomicroscopy, light microscopy, phase contrast microscopy, and fluorescence microscopy. Attempts at chemical differentiation of the blue gel-based inks included differential solubility, thin-layer chromatography, and Fourier Transform Infrared (FT-IR) spectroscopy using the IlluminatIR®.

Solubility tests using various solvents indicated that dye-based inks showed varying degrees of solubility and that the resulting color with certain solvents could differentiate some of the dye-based inks. The pigment-based inks showed only partial solubility with 5% NaOH and no solubility with the other solvents. As a result of lack of solvent solubility in the pigment-based inks, only the dye-based inks could be distinguished using thin-layer chromatography. Samples were distinguished using a mobile phase of ethyl acetate: ethanol: water (75:35:30) on a variety of plate types. Plates with aluminum, glass, and plastic backing yielded no difference in sensitivity. Additionally, two of the pigment-based inks could be distinguished from the others based on fluorescence of separation products under both shortwave and longwave UV light.

The FT-IR analyses of the inks produced similar spectra for all the gel inks, so it did not assist in the differentiating the gel inks. The peaks observed on the spectra were more indicative of the material used to create the gelatin nature of the inks such as xanthan gum.

Using fluorescence microscopy, the dye-based inks showed little to no fluorescence whereas the fluorescence of pigment based-inks was abundant. In addition, there was variation in fluorescence for the pigment-based pens in both color and intensity thereby allowing for the identification of each of the fourteen pigment-based inks used in the study. Conversely, phase contrast microscopy showed more success in differentiating between the dye-based inks than in the pigment-based inks. Stereomicroscopy and light microscopy showed little ability to distinguish either the gel-based or pigment-based inks.

Gel-based Inks, Microscopy, Chemical Analysis

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