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J11 Characteristics of Gel Pen Inks by Microscopy and VOCs Using HS-SPME GC/MS

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After attending this presentation attendees will learn about two common analytical methods that were used to attempt to differentiate 16 gel pen ink specimens.

This presentation will impact the forensic science community by presenting the results of this study, which indicate that distinct characteristics about manufacture and brand could be a useful tool for discriminating between gel pen inks.

Recently, gel pens have become a popular type of writing instrument due to their smooth writing characteristics, vivid color, and environmentally friendly properties. However, up to now, ink analysis for forensic purposes has mainly focused on ball-point pen inks. As the composition of gel pen inks are largely different from that of ball-point pen inks, it is difficult to identify gel pen ink using the methods for ball-point pen analysis. In this study, 16 different brands of gel pen were analyzed by Scanning Electron Microscopy (SEM) as a relatively non-destructive method of analysis for confirming the surface morphology of their dyes and pigments.

In addition, black gel pen inks were analyzed for their volatile organic compounds (VOCs), which served as an important classifying characteristic, using Headspace Solid Phase Microextraction (HS-SPME). Twenty different VOCs were detected among the pens analyzed (namely, isopropyl alcohol; 2-methyl-2-propanol; 2-butanone; hydrazinecarbothioamide; benzeneacetic acid (ethyl ester); benzeneacetic acid; dimethoxymethyl-silane; 2,2-dimethoxybutane; tetrahydro-2-methyl-furan; 1,2-ethanediol; silicic acid (tetramethyl ester); 1,2-propanediol; propylene glycol; 3-ethyl-3-hexanol; 1,1-dipropoxy-propane; 2-butoxy-ethanol; 2,2'-oxybisethanol; 1-butyl-benzene; 2-pyrrolidinone; and 2-(2-butoxyethoxy)-ethanol). The three most prevalent were 2,2-dimethoxybutane (3.02~47 % ratio); tetrahydro-2-methyl-furan (1.19~52.19 % ratio); and 1,2-ethanediol (52.83~95.84 % ratio).

It was also possible to discriminate between inks made in Japan and Korea through detecting the presence of two VOCs (Japanese inks contained 1,2-ethanediol, 52.83~95.84 %, while Korean inks contained 1,2-propanediol, 76.17~93.51 %).

Gel Pen Inks, HS-SPME, SEM