A122 The Characterization and Discrimination of Pink and Red Nail Polish Lacquers – A Preliminary Study

Edward Sisco, BS, 4808 Cherokee Street, College Park, MD 20740; Michelle R. Robinson, BS, University of Texas at Austin, 1 University Station A5300, Austin, TX 78712; Madison Lands Palmer, BS, Kansas City Police Department, 6633 Troost Avenue, Kansas City, MO 64131; and Patrick Buzzini, PhD, West Virginia University, 304 Oglebay Hall, 1600 University Avenue, PO Box 6121, Morgantown, WV 26506-6121*

After attending this presentation, attendees will learn about the most discriminating analytical sequence for pink and red nail polish lacquers when they are recovered as physical evidence.

This presentation will impact the forensic science community by providing information about the chemical compositons of the studied nail polish lacquers as well as about their between-sample discriminations.

Suppose that a nail fragment is recovered from an upper garment seized from an individual suspected of having raped a woman. On the fragment a colored layer is observed and it is assumed to be nail polish lacquer. What is the best approach to examine this colored substance?

The goal of this study was to detect the different components for the characterization of nail polish samples, to evaluate the discriminating power of the available methods, and to identify an appropriate analytical sequence.

One hundred ten pink and red-colored nail polish lacquers of different common brands were collected. The samples were examined using visual and microscopical (unassisted eye observation followed by stereomicroscopy) observation, reflectance visible microspectrophotometry (MSP), Fourier transform infrared (FTIR) spectroscopy, Raman spectroscopy, and elemental analysis with scanning electron microscopy/energy dispersion spectroscopy (SEM-EDS).

The results indicate that color was the most discriminating feature. However, although most of the red and pink samples studied could be easily distinguished based on their shades, there were several instances when there was difficulty in determining whether a sample was red or pink. Microspectrophotometry proved to be the most discriminating technique. Out of 5,995 possible pairwise comparisons, 52 pairs could not be differentiated according to their MSP spectra. It was observed that some samples were difficult to distinguish by MSP but could be differentiated by visual examination and vice versa. Therefore, it was confirmed that visual examination and microspectrophotometry are complementary methods. The presence, distribution, and colors of sparkling (or glitter) particles played an important role as discriminating features.

On the other hand, infrared spectroscopy provided confirmation that all the samples of our dataset were nitrocellulose-based substances. Though the presence of additional absorption bands allowed for observing further discriminations, infrared analyses discriminated 43 pairs of the 52 indistinguishable with MSP. Raman spectroscopy (using a near-infrared laser source at 785nm) allowed for the detection of the main pigments contained in the analyzed samples. For red colored samples, C.I. Pigment Red 57:1 (C.I. 15850:1) was the most commonly encountered, while for pink samples the most frequently detected pigment was C.I. Pigment White 6:1 (C.I. 77891). The latter was the anatase form of titanium dioxide. The 785nm laser line, which was the only wavelength used, was not successful in detecting the mixtures of pigments as they were described on the sample bottles. Therefore, low discriminations were observed with the Raman technique. In some cases, it was possible to discriminate pairs that could not be distinguished using MSP and FTIR. Such discriminations were possible by means of the consideration of the presence (or absence) of additional Raman bands along with those of the main pigment. Elemental analysis with SEM-EDS allowed for obtaining a commonly observed profile based on silicon, sulfur, titanium, magnesium, aluminum, and phosphorous. Some differentiations of X-ray spectra were possible on the basis of a higher intensity of the sulfur signal as well as the occasional presence of other elements (such as bromine or tantalum).

To conclude, this preliminary study indicated that the following analytical sequence was the most appropriate one for the characterization and discrimination of pink and red nail polish lacquers: stereomicroscopy, MSP, FTIR spectroscopy, and Raman spectroscopy. This sequence allowed for the observation or detection of the following properties: color observation and sparkling particles, color measurement, binder, plasticizers and additives, and organic pigments.

Nail Polish Lacquers, Trace Evidence, Microscopy

 ** Presenting Author*