B159 Photobleaching in Cotton Fibers Dyed Using Red, Yellow, and Blue Direct Dyes During Examination With Microspectrophotometry (MSP)

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After attending this presentation, attendees will understand the susceptibility of cotton fibers to loss of color, or photobleaching, when being analyzed using MSP. Attendees will also understand how spectra obtained by performing Ultraviolet/Visible (UV/Vis) spectroscopy measurements on dye solutions compare to the spectra obtained from MSP of fibers dyed with the same dye.

This presentation will impact the forensic science community by increasing forensic examiners' awareness of the tendency of dyed cotton samples to undergo photobleaching while performing MSP analysis, which may affect procedures for examining dyed cotton fibers, and will also demonstrate the usefulness of MSP on fibers by comparing spectra of the dye solutions with the dyed fibers.

MSP is a promising technique for the analysis of trace evidence such as fibers and paint. Color can be a powerful tool for comparison of many types of trace evidence, but previously large samples or elaborate procedures were required for analysis of color in paint or fiber. This rapid, non-destructive technique combining microscopy and UV/Vis spectroscopy can eliminate the need for time-consuming extraction and analysis of dyes from textile fibers when performing analysis of colored fibers and can directly analyze color from multiple layers of paint, all while performing microscopic analysis of these materials.

This study will present an experiment in which bleached cotton fabric was dyed with direct dyes in blue, yellow, and red colors at different concentrations. The dyed cotton fibers were then examined using MSP. Photobleaching was investigated by measuring a specific spot on the fiber periodically over the course of one-half hour, which was considered the longest time a forensic examiner might ever leave a sample in the MSP. Visible color loss and a reduction in absorbance was observed for all three colors, but was most pronounced for the fibers dyed with red dye. Since forensic examiners expect MSP to be a non-destructive method, it is important to be aware of situations in which their selected analysis might unexpectedly be destructive. While some MSP vendors are educating examiners during training about the possibility of photobleaching of dyed cotton fibers, an informal poll of forensic trace evidence examiners indicated that this was not common knowledge among the trace evidence community. It is recommended that fiber trace evidence examiners become aware of the possibility of photobleaching when analyzing cotton fibers using MSP and that they understand how spectra collected using MSP from a fiber compare with UV/Vis analysis of dye solutions in the liquid state. After attending this presentation, attendees should better understand both concepts.

Microspectrophotometry, Fiber, Photobleaching