B22 The Effects of Exposure to Various Environmental Conditions on the Analytical Data of Manufactured Fibers

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Learning Overview: After attending this presentation, attendees will understand how different environmental conditions affect the ability to analyze manufactured fibers.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing analytical data of manufactured fibers during a time trial where the fabrics (nylon, acrylic, rayon, and polyester) were placed in different environmental conditions. The results of which inform forensic scientists of how various environments can affect the analysis of manufactured fibers.

The forensic analysis of fiber evidence involves the ability to link a questioned fiber back to its known source. Before the collection and analysis of fiber evidence, fibers are potentially exposed to various environmental conditions for an extended period of time. There has been significant research done on how natural fibers are affected by environmental conditions showing how natural fibers degrade overtime. However, there has been little research on the impact of environmental conditions on manufactured fibers. To avoid the potential of erroneous exclusions of fiber evidence, it is necessary to determine if the analytical data from manufactured fibers is measurably altered when the fabrics are exposed to environmental conditions for an extended period of time.

Colorless manufactured fabrics of nylon, polyester, acrylic, and rayon were exposed to multiple environmental conditions for a nine-month period. These conditions ranged from solid media including soil, sand, cow manure, chicken manure, mixtures of soil and manure, to liquid media including calcium chloride road pretreatment, calcium chloride road pretreatment and water, salt road pretreatment and oil. Squares of each fabric type were placed in glass containers, each stored while exposed to a different controlled environmental condition. Fibers from each fabric square were removed from the environments every two weeks and analyzed microscopically and instrumentally.

Microscopic examination of the fiber followed the standard operating procedures established by SWGMAT. The instruments used to examine the fibers after exposure were a Raman spectrometer, Fourier Transform Infrared Spectrometer (FTIR) and Ultraviolet/Visible Microspectrophotometer (UV/Vis MSP) in fluorescence mode. Comparisons of the exposed fibers were made back to the control fibers to determine if the fibers were measurably altered over time to a point where they are inconsistent with their known source. Throughout the first eight weeks of exposure, rayon completely broke down leaving no remnants behind. This provided an opportunity to compare the decomposition rate of rayon to cotton by adding cotton to the containers since rayon is a semisynthetic fiber composed of cellulose.

Microscopic analysis was used to determine if there are any significant differences in the fibers' physical appearance over time. Within the first two months of microscopic analysis there was no significant change in the microscopic properties of the manufactured fibers. Instrumental data was analyzed using statistics to determine if there were significant differences between the instrumental results over the course of the time study. With the exception of rayon, the increased strength and resilience of manufactured fibers over natural and semisynthetics should allow for there to be no significant observed changes to the analytical data from the manufactured fibers despite the exposure to various environmental conditions.

Manufactured Fibers, Environmental Conditions, Analytical Data