E39 Textile Biodeterioration: Postmortem Interval (PMI) Estimation With Image Analysis Software in Burial, Surface, and Freshwater Environments

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Learning Overview: After attending this presentation, attendees will have a new perspective on the use of textiles at forensic scenes, an understanding of textile biodeterioration rates for common clothing items in specific habitats, and knowledge of proper protocols for documenting forensic textiles and analyzing the images in the software ImageJ.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a novel, quantitative method for measuring textile biodeterioration with the potential to estimate PMI with clothing found at crime scenes. This presentation also includes vital inter-observer error rates and demonstrates textile biodeterioration rates in the previously unstudied temperate deciduous forest biome.

Estimating the PMI can be challenging, especially in outdoor settings where numerous environmental variables complicate analyses and trends. As time passes, crucial data and context are lost, and the accuracy and precision of physiological changes and entomological indicators are reduced. Because clothing is often deposited at the scene near the time of death, either on the human remains or nearby, the textiles are exposed to the same environmental factors over the same time period. While a few studies have tested textile biodeterioration rates for application to PMI estimation, there is an overall lack of consistency across the types of textiles utilized, the environments tested, and the scoring method employed. Furthermore, the majority of existing literature rely on qualitative observations to estimate the amount of textile degradation with vague, often only descriptive categories. These problems obfuscate any trends that may exist and prevent comparisons between datasets.

The current study aims to address the lack of quantitative data through a novel application of open-source image analysis software to measure the amount of textile biodeterioration over time. It is hypothesized that: (1) the textiles will follow a predictable (linear) pattern of biodeterioration over time; and (2) the biodeterioration rates will be significantly different between settings and between textile types. Five common clothing textiles (100% cotton, denim, linen, 50-50 cotton-polyester blend, and merino wool) were utilized. The five textiles were cut into 10cm by 10cm swatches. These swatches, along with whole garments composed of the same five textiles, were weighed and photographed prior to placement. The samples were placed at The University of Akron's Field Station in Bath, OH. The field station is located on the Bath Nature Preserve, which contains a variety of habitats in the temperate deciduous forest biome. Swatches and one complete garment of each textile type were placed in three different locations: on the ground surface (forested area), buried at a depth of 5cm (forested area), and suspended in a freshwater pond. Three swatches of each textile type were collected from each location every two weeks. The whole garments were collected at the end of the study period. The study spanned the spring, summer, and fall seasons and the samples were exposed to the environment up to 238 days. Upon collection, each sample was dried on a flat surface for 48 hours and then gently cleaned with a soft brush, weighed, and photographed. Swatches were placed in a magnetic Plexiglas® picture frame to ensure all aspects of the samples remained flat during photography. The total surface area of each sample was measured via photos with the software ImageJ before and after placement in the field.[1] The measurements were used to determine the percentage of each textile sample remaining after each sampling interval.

Significant trends were identified using a simple linear regression that modeled the degree of deterioration in relation to the time elapsed. Analysis of each image was conducted by multiple individuals and inter-observer error was calculated. The rate of degradation was fastest in the burial environment and slowest in the freshwater environment. Cotton samples degraded at the greatest rate overall, followed by linen, denim, and wool, with the cotton-polyester blend degrading at the slowest rate. This study offers a novel, simple, and cost-effective method to quantitatively measure textile biodeterioration and estimate PMI with clothing. This data is especially useful, as it provides replicable methods, measures textile biodeterioration rates in a previously unstudied biome, and provides inter-observer error rates.

Reference(s):

1. Schneider, Caroline A., Wayne S. Rasband, and Kevin W. Eliceiri. NIH Image to Image: 25 years of Image Analysis. *Nature Methods* 9, no. 7 (2012): 671-675, PMID 22930834.

Postmortem Interval, Textiles, Image Analysis

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