E81 Is Latent Print Viability Affected by Heat (Accumulated Degree Hours) From 60-Watt Incandescent Light Bulbs?

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After attending this presentation, attendees will understand how time and temperature, as a combined variable, impact the viability of latent fingerprints deposited on 60-watt incandescent glass light bulbs.

This presentation will impact the forensic science community by directly addressing the lack of research regarding the effect of varying environmental factors on pattern and impression evidence, as discussed in the 2009 National Academy of Sciences (NAS) Report.[1] A statistical regression model (using Accumulated Degree Hours (ADH) as the independent variable) will be used to predict latent print viability and provide a time frame for when a print was deposited.

In the fall of 2016, the Henrico County Police Department in Richmond, VA, recovered a print from a light bulb in a burglary case, speculating that it had been removed to prevent suspect identification; however, the defendant asserted that he had touched this light bulb months prior to the crime, and there was no published research from which to assess the validity of this claim.[2] Current research has addressed the detection limits of certain components of fingerprint residue, such as serine, which has been detected by Gas Chromatography/Mass Spectrometry (GC/MS) after exposure to temperatures of up to 150°C.[3] Although this information is valuable, it does not address the practicality of crime scene investigators visualizing and preserving prints, nor does it use time and temperature to estimate the time since a fingerprint is deposited.

This project addresses issues not covered in this study by: (1) recovering latent prints with conventional methods; (2) evaluating fingerprint quality based on a previously established scale; and, (3) relating the combined variables of time and temperature in a regression model that can be used to estimate the elapsed time since a fingerprint was deposited.[4] Through the use of the regression model and popular fingerprint recovery methods, this study will demonstrate the persistence of latent fingerprints and provide law enforcement with additional information that could bring perpetrators of crime to justice.

Ten light sockets were mounted on five strips of shipping wood and wired in parallel to provide equal amounts of electricity to each bulb. Each light bulb was secured into each light socket with gloves. Once secured, nine fingerprints were deposited on each bulb with medium pressure. A 12-hour baseline test was performed to determine the best length of time to leave the bulbs on for subsequent testing. After the baseline test, each unit was turned on for 18 hours, 72 hours, 120 hours, and 168 hours, respectively. A thermal imaging camera monitored the units to record the generation of heat from the bulbs. After each allotted time period, the prints were enhanced with black powder and lifted with tape onto a lifting card to be examined for quality using an 11-point scale.

Latent prints were recovered through the baseline test (1,488 Accumulated Degree Hours (ADH)), so the units were left on longer. Still, latent prints were recovered through 18-hour heat exposure (2,231 ADH). Of the 81 prints recovered, 54 ranked within the top half of the 11-point scale and were identifiable. Results were similar after 48 hours (5,991 ADH) and 72 hours (8,968 ADH). During these tests, 89 and 83 latent prints were recovered, with 58 and 61 being deemed identifiable, respectively. Additionally, latent prints were persistent and proven recoverable after five days (14,875 ADH) and seven days (20,948 ADH). Prints insufficient for identification were often adversely affected by moisture in the print and movement when the print was deposited, which occurred independently of heat.

In conclusion, the analyses of latent prints exposed to heat over time could provide valuable information to law enforcement and is an important addition to the body of work in the field of pattern and impression evidence.

Reference(s):

1. Committee on Identifying the Needs of the Forensic Sciences Community, National Research Council. (2009). *Strengthening Forensic Science in the United States: A Path Forward.* United States Department of Justice (online). 136-145.

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3. Birnbaum S.L. 2011. *Chemical Analysis of Latent Fingerprint Components Subjected to Arson Conditions.* MSc Dissertation. Environmental and Life Sciences Graduate Program, Trent University.

4. Dhall J.K., Sodhi G.S., and Kapoor A.K. 2013. A novel method for the development of latent fingerprints recovered from arson simulation. *Egyptian Journal of Forensic Sciences.* 3(4), 99-103.

Latent Fingerprints, Accumulated Degree Hours, XX Scale

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