B43 Investigating the Impact of Protein and Peroxidase Blood Enhancement Reagents on DNA Recovery From Laundered Clothing

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After attending this presentation, attendees will better understand the use of protein and peroxidase reagents for blood detection and their potential effect on DNA recovered from laundered clothing. Additionally, attendees will gain insight into the potential transfer of DNA evidence from one article of clothing to another during the laundering process.

This presentation will impact the forensic science community by providing a comprehensive analysis of the effects of six blood enhancement reagents on DNA recovery from laundered clothing, allowing forensic examiners to make more informed decisions when analyzing this difficult type of evidence. This research will serve as an advantageous resource for forensic science professionals to use when deciding the type of enhancement reagent to use given various fabric compositions.

Blood is a commonly encountered biological fluid in criminal investigations concerning a violent incident, and visual traces of the fluid on a suspect's clothing can be diminished through laundering. Despite the potential to arouse suspicion and help reconstruct a crime, the mere presence of blood on laundered clothing is not often sufficient enough to make conclusive inferences about the nature and circumstances of a specific person's involvement in a crime. Because of this, it is essential that a method exists that both enhances a forensic examiner's ability to visualize a dilute bloodstain on a piece of laundered fabric while maintaining and preserving the quality of the DNA evidence that may be present. This study proposes to analyze the effects of laundering and the application of commercially available blood enhancement reagents commonly used to improve visualization of dilute bloodstains on DNA recovery.

Following Institutional Review Board (IRB) approval and informed consent from volunteers, venous blood was collected in sterile vacutainer EDTA vials. Six commonly used and commercially available enhancement reagents were chosen: Hungarian Red, Coomassie Blue, Amido Black, luminol, Bluestar® Forensic Magnum, and aqueous Leuco Crystal Violet (LCV). Then 100µL of human blood was deposited onto cotton, polyester, denim, and wool in triplicate, and these samples were laundered under standard washing conditions with blank controls. Following laundering, a selection of samples from each fabric type was enhanced with each of the six reagents. DNA was extracted from these samples using a QIAamp® DNA Investigator Mini Kit and quantified using a NanoDrop™ OneC Ultraviolet/Visible (UV/Vis) spectrophotometer.

Following laundering and enhancement, quantifiable amounts of DNA originating from bloodstains were obtained from all fabric types. Although washed blood samples often had a lower DNA recovery than unwashed blood samples, all untreated washed samples had a suitable DNA recovery, ranging from 0.9ng/mL to 38.2ng/mL. Similarly, samples treated with all enhancement reagents except Amido Black had DNA yields higher than the washed blank samples that ranged from 1.1ng/mL to 23.0 ng/mL. Despite this, measurements indicated that the application of some blood enhancement reagents, particularly Amido Black, may affect DNA recovery. Across all fabric types, samples treated with Amido Black had a low DNA recovery comparable to blank samples, returning yields as low as 0.7ng/mL on cotton samples. Across the board, washed blank fabric samples had a higher amount of recovered DNA than the unwashed blank samples; however, these samples were treated exactly the same with the exception of laundering. While unwashed blank samples had an average DNA yield of 3.57ng/mL, washed blank samples had an average DNA yield of 8.59ng/mL. Because of this, it is suggested that cross transfer of DNA between samples during the laundering process is possible.

Despite these results, the NanoDrop™ OneC UV/Vis spectrophotometer does not provide differentiation between human-specific DNA and DNA from other sources. Although unlikely that other DNA sources are largely contributing to the quantities of DNA present within the sample, it remains a possibility that not all of the quantified DNA yield is representative of human-specific DNA that would be probative during a criminal investigation.

This study highlights the importance and value in choosing enhancement reagents that enhance bloodstains while maintaining the integrity of critical DNA evidence on laundered clothing. The results provide a crucial resource for forensic investigators and future researchers to aid in the utilization of laundered fabric evidence.

DNA, Laundered, Enhancement Reagents