

A Comparative Analysis of Commercially Available Protein and Peroxidase Reagents for Blood Detection and Enhancement on Laundered Clothing

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Blood on a suspect or victim's clothing is not uncommon in criminal cases involving violent incidents, and often these stains will be washed away in hopes to destroy the evidence. This study aims to produce a comprehensive analysis of three protein based reagents and three peroxidase based reagents commonly used and commercially available for the detection of trace amounts of blood on laundered clothing. Enhancement reagents Hungarian Red, Coomassie Blue, Amido Black, luminol, Bluestar® Forensic Magnum, and aqueous Leuco Crystal Violet (LCV) were used to detect 100 µl human blood stains on varying fabric types and colors (white cotton, black cotton, blue denim, white polyester, and black polyester) at a range of blood dilutions (neat, 1:10, 1:100, 1:1000, 1:10000, 1:100000, 1:1 million) after laundering to determine the usability and sensitivity of the reagents. This study revealed that the peroxidase based reagents produced the greatest sensitivity on the natural fabrics, reacting positively down to a blood dilution of 1:1000. The protein reagents produced greater sensitivity on the synthetic fabrics, reacting positively down to a blood dilution of 1:10. Peroxidase stains relying on chemiluminescent properties rather than colorimetric results produced better results on the dark colored fabrics.

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Discussion

The results of the post-laundering enhancement of the neat blood and dilutions on the varying fabric types revealed the peroxidase based reagents (luminol, LCV and Bluestar® Forensic Magnum) to have the greatest sensitivities on the natural fabric types (white cotton, black cotton and denim) as they all reacted positively on these fabrics down to 1:1,000. However, when the protein reagents were tested, they revealed the greatest sensitivities (1:10) on the white polyester when compared to the peroxidase reagents, which only produced positive reactions on the laundered neat blood. As the protein based reagents are color reactions and are not based on chemiluminescence, their use on dark fabrics revealed indeterminate results.

Conclusion

The results of this study provide a valuable comparative analysis of commercially available blood enhancement reagents for use in the forensic investigations. The results suggest peroxidase based reagents to be the superior method for use on natural fabrics and chemiluminescent peroxidase reagents to be superior on all dark fabrics. Protein based reagents were best suited for use on synthetic fabrics. This information will serve as a valuable resource for forensic professionals in the future.

References

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Objectives

The objectives of this research was to:

1. Provide a comprehensive analysis of the optimal reagent to detect bloodstains on fabrics of varying colors and compositions
2. Determine the sensitivities of each reagent on laundered bloodstains