B6 A Comparative Analysis of Commercially Available Protein and Peroxidase Reagents for Blood Detection and Enhancement on Laundered Clothing of Varying Fabric Types

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After attending this presentation, attendees will better understand the use of a variety of protein and peroxidase reagents that are commercially available to forensic professionals. Attendees will also gain insight into the advantages and disadvantages of these reagents, particularly when used with a variety of colored fabrics and following laundering.

This presentation will impact the forensic science community by providing a comprehensive comparative analysis of various blood detection reagents, their sensitivities on laundered fabrics, and their best use with particular fabric types, thereby providing a useful resource for forensic professionals.

Human blood is commonly encountered in forensic investigations, particularly on clothing following a violent incident. In certain circumstances, clothing may have been laundered prior to seizing to eliminate any traces of human blood. A number of methods and commercially available products have been introduced in recent years for the detection and enhancement of dilute bloodstains, including both protein- and peroxidase-based reagents. While each product has been researched individually in the literature, to date, these products have not yet been simultaneously and comparatively analyzed on a variety of laundered fabric types. The aim of this study was to investigate six commonly used protein and peroxidase reagents, which are commercially available from crime scene supply companies, and determine their sensitivities and most appropriate utilization on varying colored fabric types post-laundering.

Following informed consent from volunteers, venous blood was collected in sterile vacutainer EDTA vials. Five fabric types were selected: white cotton, black cotton, white polyester, black polyester, and blue denim. Three protein-based reagents and three peroxidase-based reagents were selected and purchased from Sirchie®: Hungarian red, Coomassie blue, amido black, luminol, Leuco Crustal Violet (LCV), and Bluestar® Forensic Magnum. One hundred microliters (µL) of human blood was deposited onto each fabric type in a range of seven dilutions from neat to 1:1 million. Each sample was performed in triplicate and photographed prior to laundering and enhancement. Following laundering, each sample was photographed and subsequently enhanced following the manufacturer's instructions provided with each of the six reagents. The results of each reagent, dilution, and fabric type were compared, using a scale from 0-4 (0 = no reaction; 4 = strong positive reaction).

The results of the post-laundering enhancement of neat blood and blood 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 on the dilutions and varying fabric types, 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. The results of this study suggest peroxidase-based reagents to be the superior method for use on natural fabrics and all

dark fabrics. Protein-based reagents have previously been shown to have merit for the enhancement of blood detail on non-absorbent surfaces, while in this study, their use, albeit inferior in most cases to peroxidase-based reagents, was shown on absorbent fabrics.

This study highlights the variety of commercially available blood detection and enhancement reagents offered and reveals their advantages and disadvantages in certain settings and on difficult types of evidence. The results of this research provide a much-needed comparative analysis of these reagents and could be used in the decision-making process for forensic investigators evaluating fabric evidence.

Blood Enhancement, Laundered, Fabric