A27 A Comparison of Chemical Enhancements for the Detection of Latent Blood

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After attending this presentation, attendees will have reviewed the components of blood, the basic principles and biochemical reactions behind the major serological tests for latent bloodstains, and understand the effects that dilution and substrate play in observed sensitivity of the tests. Limitations of the tests will be discussed. Participants will also be able to better interpret future research in serological blood testing as it can be applied to forensic casework, as impacted by the type of blood or artificial blood used in testing.

This presentation will impact the forensic science community by presenting a careful and balanced evaluation of the modern detection methods for latent bloodstains, by exploring differences in observed sensitivities, and making appropriate conclusions for applying the research to forensic casework, as dependent upon the type of blood or blood substitute used in the research.

In forensic investigations, the presence of latent bloodstains can be critical information to the case. Often, the blood is not detectable for a variety of reasons, to include time, weather, and attempts by the perpetrator to clean the crime scene. In these types of cases, the use of forensic chemical enhancements for the detection of blood is important for location of the latent stains, so that subsequent confirmation, followed by forensic DNA analysis, can be performed at the laboratory.

Luminol and Fluorescein are chemicals commonly used in the detection of latent bloodstains. Both classes of reagents, including commercial preparations, share a common chemical pathway in that they

result in a visible chemical reaction based on the peroxidase-like activity of blood, specifically the Heme group of the Hemoglobin protein in red blood cells. Both tests present the Heme group with a substrate to act upon, releasing free oxygen radicals. These free radicals act upon the chemical indicators to yield a visible response. In the case of luminol, 3- aminophthalhydrazide is oxidized to 3-Aminophthalate, releasing energy in the form of visible light. In regards to the fluorescein reaction, fluorescin is oxidized to fluorescein, which fluoresces when under a 450nm alternate light source. Both methods require relative darkness for visualization. While the fluorescein method requires an additional light source and filter to visualize, it is nontoxic. In contrast, the luminol reaction requires no additional equipment, but dries to leave a residue that is slightly toxic.

This study compared and contrasted the relative sensitivities and specificities of laboratory and commercial preparations of the luminol and fluorescein detection tests. This comprehensive study also examined the relative sensitivity of each reagent in regards to differing substrates, ranging from smooth fabrics to carpet, tile and hardwood, porous and nonporous surfaces, and the effect of colors and dyes on the substrate in altering observed sensitivity of the tests. As a further exploration, each preparation was tested against fresh human blood with no additives, as well as synthetic, pig blood and human blood collected in EDTA-vacuum tubes, all commonly used in blood detection forensic research. Results indicated that observed sensitivity varies depending on commercially prepared versus homemade preparations, and, as seen in other studies, that sensitivity is drastically impacted by the substrate that the latent bloodstain is present upon.

Blood Detection, Latent Blood, Enhancement

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