B185   Optimum Case Detection Limit of the Forensic Luminol Test for Bloodstains

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After attending this presentation, attendees and especially crime scene investigators and DNA analysts will have a realistic description, based on systematic experimentation under controlled conditions, of the chemical behavior of luminol during reaction with low levels of blood.

This presentation will impact the forensic science community by providing information concerning the optimum-case Limit Of Detection (LOD) for bloodstains, which could impact interpretation of luminol tests conducted at crime scenes.

Luminol formulations are used by criminologists as a presumptive test for detecting latent bloodstains. The luminol test has been used by forensic investigators to aid in the discovery of bloodstains and to visualize blood spatter for more than 60 years. Many studies have been carried out which explore the luminol Limit Of Detection (LOD) for bloodstains; however, the luminol LOD is still elusive, having detection limits reported which range from100x to 5,000,000x dilute bloodstains. This range in reported luminol LODs stems from lack of experimental control: luminol applied to bloodstains is generally not accurately measured, the blood-luminol response is usually detected qualitatively using human observation, and bloodstain samples were produced without regard to the effect blood dilution has on spreadability. These factors do not allow for accurate determinations of LODs or effective comparisons of blood detection agents. Furthermore, published studies have not quantitatively defined the relationship between important variables involved in the blood-luminol reaction (such as bloodstain dilution, amount of luminol applied, age of luminol solution, etc.) and chemiluminescent response. Knowledge of how the blood-luminol response is affected will increase the utility of luminol, allowing investigators to make educated decisions both in luminol application technique and in luminol response analysis.

An experimental method was designed with heightened variable control, which renders an optimum-case luminol LOD and reveals a linear relationship between bloodstain dilution and chemiluminescent response. Blood solutions ranging from 10,000x to 40,000x were deposited on cotton T-shirt swatches using a patented stain barrier technique. The luminol formulation was applied to bloodstains in complete darkness and the response was measured using a digital Charge-Coupled Device (CCD) camera. Pixel intensity information was extracted from the resulting raw images and a linear relationship was discovered between bloodstain dilution and chemiluminescent response. An optimum-case LOD of approximately 100,000x was calculated.

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