Technical Note

A Photographic Comparison of Luminol, Fluorescein, and Bluestar

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Abstract: Three chemicals (luminol, fluorescein, and Bluestar) are photographically compared. The results demonstrate that Bluestar performs as well or better than luminol and fluorescein.

Introduction

Detecting and photographing latent bloodstains at a crime scene can be challenging. The ease through which a presumptive chemical test is prepared, administered, and viewed is the first obstacle. Photographically documenting the results is the next.

Luminol and fluorescein are frequently used by forensic specialists to detect latent blood. The simplicity of commercial luminol kits makes preparation and administration of luminol highly desirable, although its limited reaction time and the requirement of extreme darkness can be photographically challenging. Fluorescein does not require complete darkness, the reaction time is long-lasting, and although not tested in this trial, commercial kits are also available. However, a forensic light source is required to view the chemical reaction.

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The advertisements for a new chemical, Bluestar Forensic Latent Bloodstain Reagent, state that its advantages include "stronger luminescence, longer lasting reaction, higher sensitivity, total darkness not required, photos shot with ordinary camera, fully soluble, stable over time, easy to use, and non toxic". The purpose of this experiment was to compare the three chemicals.

Materials and Equipment

3 Canon Rebel G SLR 35 mm (film) camera with Tamron 28-80 mm f/3.5-5.6 lens

4 Canon Rebel XT 350D Digital SLR camera with Canon 18-55 mm f/3.5-5.6 lens

Shutter release cables

Tripods

Sunpak Auto 544 flash unit

Omnichrome 1000 forensic light source

Red indoor-outdoor carpet

Blood samples (human blood donated by the author)

Luminol kit (Evident product #3176-4)

Bluestar blood mini-test kit (product #BL-FOR-125)

Fluorescein (prepared as described by Monk and Maucieri [1])

Procedure and Experiment

The blood was transferred onto a shoe sole, golf club, and the author's hands with a sponge. Each surface was pressed or wiped against clean, white butcher paper until no visible transfer onto the paper existed. Then the surfaces were pressed onto four pieces of 12" x 18" carpet. The carpet pieces were stored for several days. One piece of the carpet was placed on butcher paper and set on the floor. A scale was placed next to the carpet sample with two copper pennies taped to each end of the scale as a control. Seven cameras were set up on tripods, surrounding the carpet. The camera settings and film were as follows:

Camera number	Film or digital	ISO rating	White balance setting	Shutter setting	Aperature
1	film	800		bulb	f/5.6
2	film	400		bulb	f/3.5
3	film	200		bulb	f/4.5
4	digital	800	auto	bulb	f/5.6
5	digital	1600	auto	bulb	f/5.6
6	digital	800	fluorescent	bulb	f/5.6
7	digital	1600	tungsten	bulb	f/5.6

Luminol

Luminol was mixed, the room was completely darkened, and after all participants' eyes adjusted to the dark, the author applied luminol to the carpet sample. At the first sign of a reaction, an instruction was given and the seven photographers opened the camera shutters (via the cable releases). The shutters remained open until the luminol reaction disappeared (3 1/2 minutes). The photographers then closed the shutters.

The process was repeated with a second application of luminol. Again, at the first sign of a reaction, the photographic exposures were initiated. The reaction was again timed to 3 1/2 minutes, at which time the author used the flash unit at manual, full power, and bounced the light off the ceiling. After the flash, the photographers released the shutter.

Bluestar

The carpet sample and butcher paper were replaced and the Bluestar reagent was mixed. The procedure was repeated using the same setup as with the luminol. However, at 3 1/2 minutes, the reaction was still very strong, but the exposure was ended for comparison with the luminol exposures.

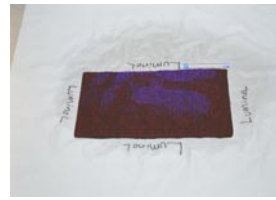
Fluorescein

The fluorescein test was conducted at the San Diego County Sheriff's Crime Laboratory. The author set one of the blood-stained carpet samples on the butcher paper. Because of space limitations, only four tripods were set up with cameras 3, 4, 5, and 6 surrounding the carpet sample. The camera settings remained the same. The ambient room light was similar to the luminol and Bluestar conditions.

A criminalist used an Omnichrome forensic light source at 450 nm to illuminate the fluorescein-treated sample. Each photographer wore orange goggles and held an orange shield in front of each camera. The criminalist applied the fluorescein to the carpet sample and the reaction was immediate. The photographers opened the camera shutters (via the cable releases). Because of the brightness of the forensic light source, the exposure was ended at 1 minute. A second exposure was obtained without retreatment with the fluorescein, but this exposure was ended at 30 seconds. Cameras 1, 2, and 7 were then used to repeat the experiment with another sample of carpet. The procedure was repeated. Two exposures were obtained: the first at 1 minute and the second at 30 seconds.

Photographic Results

Camera 1 – Luminol, no flash.

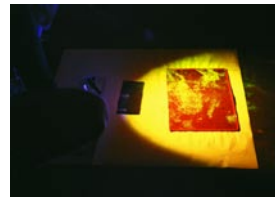


Camera 1 – Luminol, with flash.

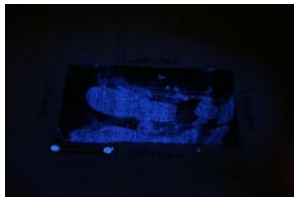
Camera 1 – Bluestar, no flash.

Camera 1 – Bluestar, with flash.

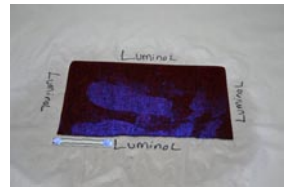
Camera 1 – Fluorescein, 1 minute.



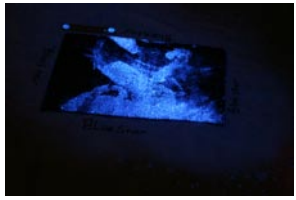
Camera 1 – Fluorescein, 30 seconds.



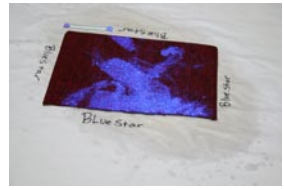
Camera 4 – Luminol, no flash.



Camera 4 – Luminol, with flash.



Camera 4 – Bluestar, no flash.



Camera 4 – Bluestar, with flash.

Camera 4 – Fluorescein, 1 minute.

Camera 4 – Fluorescein, 30 seconds.

Discussion

Luminol produced a faint reaction when it was first applied, but the reaction became brighter as more chemical was applied. The reaction remained steady but then slowly began to fade and disappear at 3 1/2 minutes.

Bluestar produced an immediate bright reaction when it was first applied. After the first few seconds, the brightness was reduced. However, an even, steady reaction remained and was strong at 3 1/2 minutes with little, if any, fading.

Fluorescein produced an immediate bright reaction when it was first applied, but also caused the butcher paper to glow.

The chemical continued to strongly react at 1 minute, but the exposure was ended to avoid an overexposed photograph.

Conclusions

Bluestar performed as well as luminol and fluorescein and in some cases, Bluestar performed better. The flash photograph with the Bluestar chemical at ISO 800 film and digital at ISO 800 set at auto white balance (cameras 1 and 4) was favored because of the ability to see the background as well as the chemical reaction.

Providing additional camera settings or white balance settings, experimenting with different blood dilutions, and using digital imaging to enhance photographs might be explored in the future.

Acknowledgments

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Reference

Monk, J. W.; Maucieri, L. A. Enhancement of Faint and Dilute Bloodstains with Fluorescence Reagents. *CAC News*, Summer 1992, pp 13-20.