The Use Of An IR Light Source To Screen Dark Fabrics For The Presence Of Blood: A Validation Study Of The Foster And Freeman Crime Lite 82S IR

Abstract

Bloodstains are easily missed on dark fabrics, yet detection by visualization is a necessary first step in their analysis. An infrared (IR) forensic light source which can project light between 700 and 1500 nm can deliver enhanced visual contrast over standard lighting conditions.

The Foster and Freeman Crime Lite 82S IR emits light between 800 and 900 nm, has an attached camera unit, and was validated for use in screening dark substrates under standard laboratory lighting conditions thus eliminating the need for the darkened room conditions needed in some latent blood detection methods. A variety of commonly encountered substrates and conditions were evaluated.

Introduction

IR light sources have become less complicated, more portable, and easier to use. They are an effective, nondestructive tool for the rapid screening of dark fabrics associated with crime scenes involving bloodshed. Although some substrates absorb IR light causing them to appear black under IR lighting, many dark fabrics reflect IR light causing them to appear light in color. This creates contrast between the fabric and the blood. The bloodstains appear as dark grey or black because the hemoglobin in the red blood cells absorbs the IR light.

Methods and Materials

Experiments were performed using the Foster and Freeman Crime Lite 82S IR light source to detect dried bloodstains. Freshly drawn blood was applied to 36 different absorbent surfaces (fabrics, carpeting and foam) and 9 non-absorbent surfaces. Other body fluids, food products and oils were evaluated on black fabric with the IR light source to see if they could possibly be misinterpreted as blood. Bloodstains were exposed to environmental conditions to ascertain the impact of extreme heat, sun, rain and soil on one's ability to detect bloodstains. Blood was also serially diluted to determine if dilute bloodstains could be detected over a period of three months. This serial dilution was studied to evaluate the impact of time on stain detection.

Results

Twenty-four of the thirty-six absorbent substrates examined with the IR light source exhibited sufficient contrast between the blood and the substrate to allow for the detection of the stains. The items that absorbed the IR light causing them to appear black - and therefore impossible to visualize the bloodstains - included automobile carpeting, black jeans, black fleece gloves, upholstery fabric, a black webbed strap and grey packing foam.

Non-absorbent black surfaces such as computers, painted metal, plastic electrical cords, plastic bags and plastic shoes absorb the IR light thus they interfere with the ability to detect blood.

Fine mist-like spatters, the tapering edge of blood smears on fabric and dilute bloodstains were virtually invisible on black fabrics in standard room light, but are easily visualized with the aid of the Crime Lite 82S.

Black coffee, ketchup, Coca Cola, barbeque sauce, urine, saliva, and semen were examined and found not to absorb the IR light. As such these substances were not visible with the IR light source and would not be confused with bloodstains under IR light.

Oily substances (Vaseline, motor oils, and cooking oils) were visible with the IR light source, but most appeared light grey in color. Some motor oils produced stains indistinguishable from bloodstains.

Both black and silver permanent markers were visible as black stains on black fabrics while the red permanent marker was not visible with the IR light source. Because of their color and IR characteristics, only the black marker could be confused as possibly being a bloodstain.

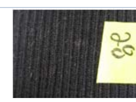
The treatment of dark fabrics with luminol did not decrease the ability to detect bloodstains with the IR light source.

The evaluation of serial dilutions over a period of three months did not exhibit a measurable decrease in the ability to detect stains.

Blood from a neck wound on a blue polo shirt. Standard room light.

Bloodstains on a black sweater. Standard room light.

Bloodstains on a black T-shirt with a close up photograph of the IR image of stains F and G.



Bloodstains on a black sock. Standard room light .

Blood from a neck wound on a blue polo shirt. IR light.

Bloodstains on a black sweater. IR light.

Bloodstains on a black sock. IR photograph.

Conclusions

The Foster and Freeman Crime Lite 82S IR light source with a built in camera can act as a fast, non-destructive tool for screening dark substrates, particularly fabrics, for the presence of blood. Because the IR light is reacting with the hemoglobin in the blood, the blood deposit has to be of sufficient quantity to be detected.

Factors such as the age of the stain and spraying stains with luminol do not affect the concentration of the hemoglobin in the stain and thus did not affect the ability to detect the stains.

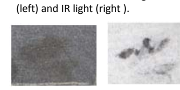
Minute stains such as gun-related back spatter on dark fabrics which would go undetected under standard room lighting conditions can easily be visualized with the IR light.

Environmental conditions which dilute the amount of hemoglobin present in a stain will decrease the ability to detect the stain with the IR light source. Bleaching and environmental exposure of fabric in wet conditions will decrease the ability to detect stains that are present because these conditions will decrease the amount of detectable hemoglobin in the stain.

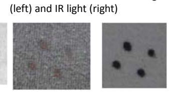
If a bloodstain is visible with the IR light source, it will be of sufficient concentration to give a positive result with the Kastle Meyer presumptive screening test.

Although some dark fabrics and non-absorbent surfaces will absorb the IR light making the bloodstains potentially indistinguishable from the substrate due to a lack of contrast, overall the IR light is an improvement over viewing dark fabrics under standard room light. The vast majority of clothing and textiles associated with crime scenes today will be aided by the contrast provided by the IR light source.

Motor oil viewed in room light (left) and IR light (right).



Black marker viewed in room light (left) and IR light (right)



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