The Past, Present and Future of Bloodstain Reagents in Australia

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Introduction

Since the early 1990's Luminol has been the primary reagent for locating and interpreting blood stains at crime scenes throughout the world. The introduction to the market of Bluestar®, Hemascein® and Lumiscene now provide alternatives. This poster compares the performance, cost effectiveness and ease of use of all four blood reagents.

Lumiscene

Luminol

Methods

Each of the four reagents were tested in the following manner:

Comparison 1

Human and animal blood was deposited onto the walls of four huts in the form of castoff stains and handprints.

Each section of blood was cleaned:

1. Immediately with water only
2. Immediately with household orange power cleaner
3. After 15 hours with water only
4. After 15 hours with household orange power cleaner

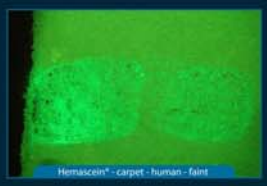
Comparison 2

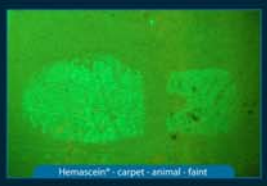
Footprints of animal and human blood were created on asphalt. The footprints covered 20m and the reagents were used within 2 hours.

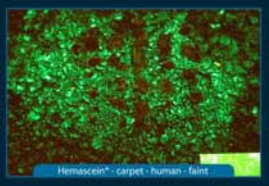
Comparison 3

Footprints of animal and human blood were created on a 10m length of carpet and left on for 4 weeks before the reagents were used.

Bluestar®







Hemascein®

Reagent	Cost per 500mL (May be approx 10% cheaper if bought in bulk)	Ease of Use	Fluorescent Capability on Porous Surface (carpet)	Fluorescent capability on semi-porous surface (cleaned - painted walls)	Fluorescent capability on non-porous surface (asphalt)	Could differentiate between animal and human blood	Could differentiate between old and new blood	Re-usability of Reagents after one week
Luminol	$39.91	Intermediate	✓	✗	✗	✗	✗	✗
Bluestar®	$93.50	Easy	✓	✗	✗	✗	✗	✗
Lumiscene	$80.00	Easy	✓	✓	✓	✗	✗	✓
Hemascein®	$106.40	Difficult	✓	✗	✓	✗	✗	✓

Conclusion

- There was no clear distinction between the human and animal blood.
- There was no difference in cleaning the walls with water or a cleaning product or the amount of time that the blood was left on the walls.
- All reagents performed well on porous surfaces (carpet), however Lumiscene provided the greatest fluorescence.
- Bluestar®, Luminol and Hemascein® performed poorly on semi and non-porous surfaces.
- Hemascein® was more difficult to apply due to the requirement of two bottles of reagents, however, once applied the results were comparable and it lasted for a much longer period of time.
- Fluorescent capability of Bluestar®, Luminol and Hemascein® were comparatively similar however Lumiscene again provided the greatest fluorescence.
- While Luminol is the most cost effective, the solution is single use and cannot be preserved for later use.
- Luminol and Bluestar® were comparatively similar although Bluestar® showed better fluorescence.

Based on the cost, performance and ease of use, Lumiscene has been found to outperform Hemascein®, Bluestar® and the well-tested Luminol.

The Past, Present and Future of Bloodstain Analysis

Louise Keningale, Greg Carnell, CIT

Camera Type: Nikon D70 SLR

Camera Settings:

Wall	ISO 1000, F8, Shutter Speed – 30 Seconds
Carpet	ISO 800, F8, Shutter Speed – 20 Seconds (Hemascein® - 10 seconds)
Asphalt	ISO 800, F8, Shutter Speed – 20 Seconds

Preparation of Reagents

Luminol – 500 mL	**Wall** Mix .1g of luminol with 5 grams of sodium carbonate in 100mL de-ionised water Just prior to use, add .7 grams of sodium perborate Mix well and apply with fine mist **Carpet and Asphalt** **Luminol Stock Solution** 50g Anhydrous Sodium Carbonate dissolved in 1L distilled water, then add 1g Luminol and stir until dissolved **Oxidant Stock Solution** 7g Sodium Perborate dissolved by stirring in 1L distilled water **Preparation of Luminol Working Solution** 200mL Luminol solution mixed thoroughly with 200mL Oxidant solution **Usage** 1. Finely spray on bloodstain
Bluestar® – 500mL	**Wall, Carpet and Asphalt** **Working Stock Preparation** 1. Add 4 x white tablets and 4 x beige tablets (close tubes immediately after removing the tablets) 2. Add the tablets to 500mL distilled water 3. Allow the tablets to dissolve completely by swirling the spray bottle (Do not shake the bottle). The instructions say it should only take 1-2 mins but it took at least 10 mins for the tablets to dissolve. **Usage** It was found that complete darkness was required, even though instructions state it is not required Finely spray on bloodstain
Hemascein® - 500mL	**Wall, Carpet and Asphalt** **Stock Solution Preparation** 1. Add 5mL of water to the Hemascein powder vial and mix it vigorously 2. Firmly recap the stock solution vial after each use **Working Solution Preparation** 1. Mix the stock solution just before use 2. Pour 5mL of stock solution into 500mL of distilled water into the supplied sprayers and mark it ABA spray **Hydrogen Peroxide Preparation** 1. Pour 1-3% Hydrogen Peroxide into the other sprayer supplied and mark it Hydrogen Peroxide **Usage** 1. Finely spray the ABA spray over the bloodstain then repeat with a fine spray of Hydrogen Peroxide 2. View the stain using an alternate light source (415-480 nm) such as a polilight or ultralight using an orange or yellow filter

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Preparation of Reagents

Lumiscene – 500mL	**Wall, Carpet and Asphalt** 1. Open the 500mL stock solution bottle 2. Add the two activation tablets and screw the top back on the bottle 3. Shake gently for 1 minute after 5, 10 and 15 minutes 4. The Lumiscene is now activated **Usage** Finely spray on bloodstain

Frequently Asked Questions

1. Do any of these reagents affect DNA analysis?

I did not conduct any DNA on the reagents. Although Hemascein®, Bluestar® and Lumiscene websites state that they do not affect DNA Analysis of the blood.

2. What kind of chemical reactions take place with each reagent?

Luminol	The iron from the hemoglobin in the blood serves as a catalyst for the chemiluminescence reaction that causes luminol to glow, so a blue glow is produced when the solution is sprayed where there is blood. Only a tiny amount of iron is required to catalyze the reaction.
Bluestar®	As per Luminol, chemiluminescence
Hemascein®	This is a fluoroscein based formula. The catalytic activity of the heme accelerates the oxidation by hydrogen peroxide of the fluoroscein that will then fluoresce when excited by a light source between 415 and 480nm.
Lumiscene	As per Luminol, chemiluminescence

3. What did you use to apply the reagents to the latent bloodstains and how much chemical did you use?

I used a spray bottle for each reagent with a fine spray. It has been suggested that an Airbrush is the best to use as it provides a much finer spray. I made up 500mL of each reagent and used approximately 200 – 300mL of each.

4. What surfaces did you use when testing the reagents?

Semi–porous - Walls – plasterboard walls were painted with standard satin household paint
Porous - Carpet- this was a standard household wool carpet
Non-Porous - Asphalt – footprints were made on standard asphalt, which is the tar from the crude oil mixed with sand or gravel

5. Where can I find out more information about the reagents?

Luminol	**There are numerous internet pages on Luminol**
Bluestar®	**www.bluestar-forensic.com**
Hemascein®	**www.abacusdiagnostics.com/hemascein.htm**
Lumiscene	**www.lumiscene.com**