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RESEARCH ARTICLE

Development of Latent Blood Stain Using Luminol from Four Different Surfaces after Subjecting to Different Agents over Periods of Time

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Abstract

The study is based on analysis of the latent blood stains left over a period of time (15 days), subjected to reagents like normal water, hot water, detergent, bleach, ethanol and developed using luminol solution on surfaces like cloth, paper, wooden plank, tile (porous and non-porous). The objective of the study is to understand whether the latent blood stains can be developed after cleaning agents are used to wash the blood stains on different surfaces (porous and non-porous) and to understand if they can be developed after fifteen days, post subjecting to cleaning agents. Luminol is a chemi-luminescent chemical. The luminol solution is prepared using standard procedure and is used to develop the latent blood stains, the analysis is done based on color, intensity, visibility of the reaction of luminol with latent blood stain. The reaction is positive, concluding that the latent blood stain can be developed over a period of time using luminol after treating the subjected surfaces with reagents mentioned.

Keywords: Chemi-luminescent, Luminol, Blood Spatter, Ethanol, Forensics, Crime Scene Investigation

Introduction

The word latent is used to describe something that is present but not visible to the naked eye. Latent blood stain is the blood stain which is not visible to the naked eye of the investigator usually at the crime scene in forensics investigation.

Luminol is a chemi-luminescent molecule. Chemi-luminescence is the emission of light during a chemical reaction. Luminol (5-amino-2, 3-dihydro-1, 4-phthalazine-dione) produces light when it reacts in the presence of hemoglobin. The molecule in the excited state emits light and then returns to a ground state. This is a fast reaction and because nitrogen (N₂) was expelled, it is not reversible. More Luminol must be added for further Chemi-luminescence to occur. The structure of luminol is based on aniline and the phthalates (Bevel et al, 2008).

When the presence of latent blood is suspected, or if the perpetrator has washed off the crime scene involving blood, Luminol can be used to develop

the latent blood stain regardless of the surface (porous and non-porous) (Adair, 2006).

The Luminol glow is very characteristic, but it does not last very long and requires a darkened environment to visualize properly. It produces a light-blue glow when it comes into contact with blood (Paonessa, 2008). Luminol is easy to mix and use. There are various commercial luminol products available. These include Hemaglow™ and Bluestar™ (Dilbeck, 2006).

The luminol reaction, in particular should be evaluated using three criteria: color, intensity, and duration. The color reaction should be a bluish-white to blue-green. White-blue and darker violets occur in any number of false positives. The intensity of the reaction should build over a very short period and it should remain evident for some period, although it will fade (Bevel et al, 2008).

When the blood stain is wiped off or washed off in the scene of crime, investigator finds it difficult to interpret the conclusion regarding the particular crime. The usage of luminol to develop the latent blood stain has got advantages over the other

developing techniques such as-it is extremely sensitive. On scene development of traces of blood if present can be done. It encompasses blood which has been diluted through clean-up attempts, bloodstains left out in the rain or for following fading shoeprint trails where each step leaves less blood than the one before. It gives the luminescence, emits dark blue light, when it reacts with blood. The light from luminol is chemiluminescent, luminol treated blood stain do not require excitation by external light source view the reaction. Importantly, luminol is well established for latent blood and has both general scientific and legal acceptance (Bevel et al, 2008).

However, the limitation of luminol, to develop the blood stain damages the DNA content in the blood due to presence of hydrogen peroxide in the luminol solution.

The surfaces, Cloth, Paper, Tile and Wooden plank, are subjected to blood stains as these are the type of surfaces on which blood stains are observed in the most of the crime scenes. Moreover, these surfaces used for the experiment falls under porous and non-porous which is the major category of types of surfaces.

The cleaning agents, Normal water, Hot water, Detergent, Bleach, Ethanol, are used to clean the blood stained surfaces, as the perpetrators of different blood shed crimes; use these agents in common to clean the blood stained surfaces.

Material and Methods

I hereby declare that this research project is a bona-fide research carried out at Department of Forensic Science, School of graduate studies, Jain University. No invasive method was used at any step.

The materials used were glassware such as beakers, test tubes and glass rod; chemicals used were Luminol (Bluestar™), Sodium hydroxide (NaOH) and Hydrogen peroxide (H₂O₂); Surfaces opted were wooden plank, paper, cloth (cotton) and tile; cleaning agents used were normal water, hot water, detergent, bleach and ethanol; Others materials used were human blood stains, cotton, lancets and gloves.

Total four surfaces wooden plank, paper, cotton cloth and tile with 40 human blood stains i.e., each surface contained 10 blood stains was included in this study. The blood stains were washed with various agents and left over a period of 15 days. The agent's normal water, hot water, detergent,

bleach and ethanol were used in two trials to wash the stains. The blood stains were developed using luminol solution and were observed to check the probability of development based on color, intensity and visibility.

Luminol solution was prepared as below:

- i. 2 mL 3% H₂O₂ was added to 50 ml distilled water.
- ii. 0.05 of luminol was mixed to 10 ml of 5% NaOH.
- iii. The solution was mixed with water.
- iv. Bring the final volume up to 100 ml with distilled water (Bevel et al, 2008).

The prepared luminol solution was applied directly on to the stain using cotton (dipped in the luminol solution). The human stains are made on tile in sequence as shown in figure. B and stains are made one above the other on paper, wood and cloth as shown in figure. A, C & D for two trials of development and the stains are left over a period of 15 days (30/02/2016 to 13/02/2016) and checked for the color, intensity and visibility of the developed stain with proper documentation of the developing process of blood stain.

Results and Discussion

The subjected surfaces, paper, cloth, wooden plank, and tile, on treated with luminol solution after cleaning with agents, normal water, hot water, detergent, bleach and ethanol, for two trials over a period of 15 days' time, development of blood stains were observed on the subjected surfaces, bluish-white to dark blue color was observed based on surface it is developed.

According to table 1, on paper the luminol reaction is observed to be bluish-white for normal water and hot water, dark bluish for detergent and light bluish for bleach and ethanol.

According to table 2, on cloth the reaction is observed to be light bluish for normal water, hot water and ethanol, dark bluish for detergent and bleach.

According to table 3, on wooden plank the luminol reaction is observed to be dark bluish for normal water, hot water and ethanol, dark bluish for detergent and bleach.

According to table 4, on tile the reaction is observed to be dark bluish for normal water, dark bluish for hot water, detergent and bleach, thick dark for ethanol. In all the surfaces the reaction lasted for few seconds.

Table 1: Color Observations on Paper

	Normal water	Hot water	Detergent	Bleach	Ethanol
Tri. I	Bluish-white	Bluish-white	Dark bluish	Light bluish	Light bluish
Tri. II	Bluish-white	Bluish-white	Dark bluish	Light bluish	Light bluish

Table 2: Color Observations on Cloth

	Normal water	Hot water	Detergent	Bleach	Ethanol
Tri. I	Light bluish	Light bluish	Dark bluish	Dark bluish	Light bluish
Tri. II	Light bluish	Light bluish	Dark bluish	Dark bluish	Light bluish

Table 3: Color Observations on Wooden Plank

	Normal water	Hot water	Detergent	Bleach	Ethanol
Tri. I	Dark bluish	Dark bluish	Light bluish	Light bluish	Dark bluish
Tri. II	Dark bluish	Dark bluish	Light bluish	Light bluish	Dark bluish

Table 4: Color Observations on Tile

Tile	Normal water	Hot water	Detergent	Bleach	Ethanol
Tri. I	Light bluish	Dark bluish	Dark bluish	Dark bluish	Thick bluish
Tri. II	Light bluish	Dark bluish	Dark bluish	Dark bluish	Thick bluish

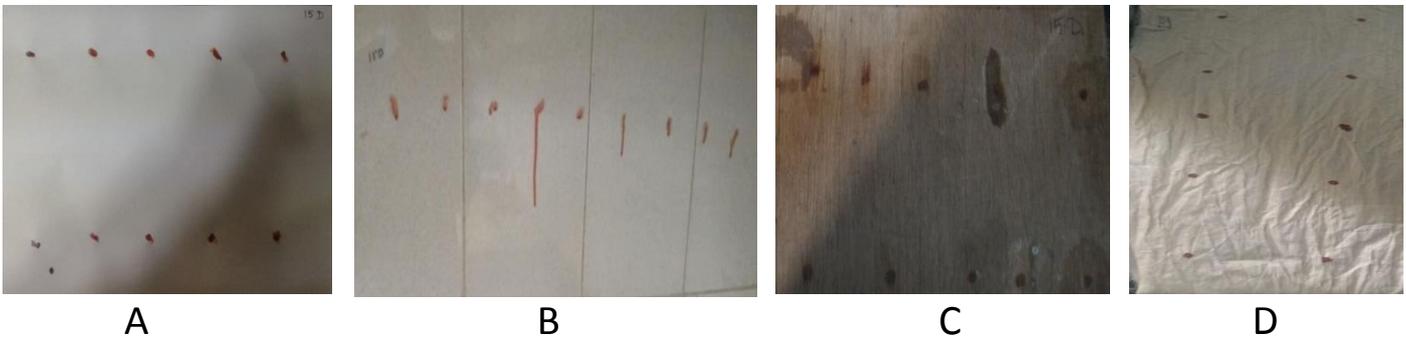


Figure 1: Showing Blood stains on (A) Paper, (B) Tiles (C) Wooden Plank (D) Cloth

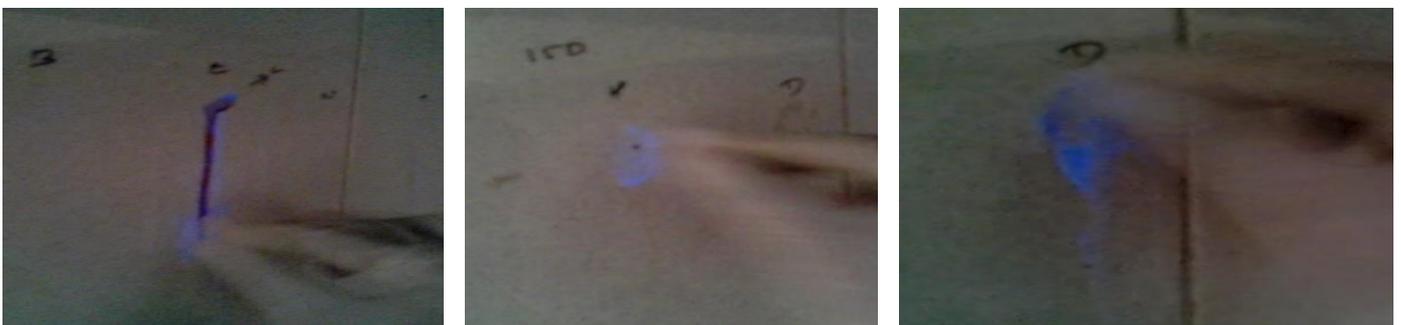


Figure 2: Showing Bluish coloration of the latent stains on the tile while treating with luminol solution



Figure 3: Showing Bluish coloration of the latent blood stains on wooden plank after treating with

Conclusion

The result proved positive stating that the hypothesis, latent blood stains can be developed using luminol on different surfaces over a period of time even after the blood stain was subjected to above mentioned agents.

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