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Original Research Article

Identification of blood stains under different environmental conditions

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Abstract

Blood stain analysis is an important area in crime investigation; which might get affected due to many conditions. In present study, the blood stains were prepared over different fabrics and then placed in different environmental conditions (different temperatures and pH) and were analyzed by chemical reagent (phenolphthalein). We found that the adverse temperature conditions, interferes in identification of blood stains and it should be taken into consideration while analysis.

Keywords: Chemical analysis, blood stains, fabrics.

1. Introduction

Analysis of blood stain recovered from crime scene is an extremely specialized area, which can often prove to be the most valuable source of information, when searching for clues and details of the event. The blood stain is important part of forensic examination as this evidence can be used to determine the origin of species, type of blood groups or run the sample for DNA analysis. It is corroborative evidence which is found at crime scene and is a connecting link between suspect, accused and a crime scene. [1] At a crime scene, the blood stain can be found at two different condition either dried or in liquid condition. The dried blood stain sample could be found over the clothes or small and large objects [2].

Blood is a common body fluid which can be present at the crime scene. The contamination of biological evidence can destroy the evidence. This contamination is caused by microorganisms, temperature, heat, moisture and other living and non-living factors. The concentration of acid and alkalie, will also affect the blood stain. The presence of bloodstains are identified by some of presumptive tests - Kastle Mayer (km) which gives bright pink color in presence of blood and Benzidine test which gives dark blue color in presence of blood. [3]

The fabric of clothes also effects the penetration of blood stain, into the fabrics. The degree of distortion of blood stain observed on the fabrics and the ability of the fabric to absorb the blood, depends on the texture of the fabrics. [4]

Uncontrolled conditions of crime scenes affect the quality of biological evidence, including bloodstains.

Degradation of biological trace evidence can be caused by heat, moisture, microorganisms, etc. Moreover, biological evidence can also be deteriorated by chemical insult. Thus the study was undertaken to identify blood stains under different environmental conditions

2. Materials and method

This study was carried out in the Analytical toxicology laboratory, situated in the Department of Forensic Medicine and Toxicology Sri Aurobindo Medical College & PG institute, Indore. In this study, blood stain were prepared over different fabrics like cotton, silk, chiffon, jeans, tericot, etc. by the known blood sample taken from the blood bank. These fabrics with the stains were exposed to different conditions like (temperature, PH).

Then the blood stains were analyzed using Phenolphthalein reagent solution.

The stained fabrics were placed in three different condition, i.e. normal room temperature (20-28^{o}C), freezer (4 ^{o}C), deep freezer (-20 ^{o}C) and at high temperature (150 ^{o}C) under different acidic and alkaline pH condition.

2.1 The material which is required for the experiment is as follows

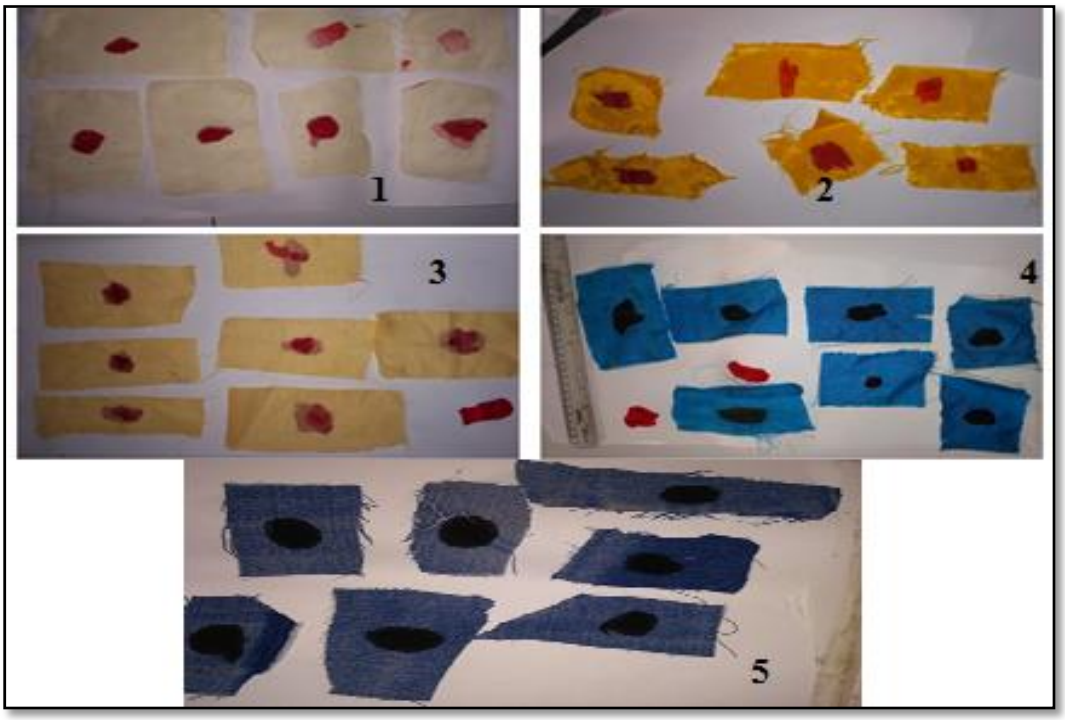
Various fabrics (cotton, tericot, chiffon, silk, jeans), Oven (for heating), Freezer, Deep freezer (-20^{o}C), pH meter, Hydrochloric acid (HCl), Sodium hydro oxide (NaOH), Phenolphthalein reagent solution, Micropipette, Slide.

2.2 Preparation of Phenolphthalein reagent

The 20 gram of zinc powder mixed with phenolphthalein 2gm then add sodium hydroxide 20gm and distilled water 100 ml. The blood stain is extracted in saline solution, add 2-3 drops of hydrogen per oxide and then add 2 drops of phenolphthalein reagent. The presence of blood stain gives pink. [5]

3. Result

Figure 1: Different Fabrics of Blood Stain



1- Cotton, 2-Silk, 3-Tericot, 4- Synthetic and 5-Jeans

Figure 2: Phenolphthalein test for detection of blood

Sample was kept on the slide and added a drop of hydrogen per oxide on it, added 2-3 drop of phenolphthalein reagent.

Figure 3: Slides stained with phenolphthalein

Pink color indicates the presence of blood.

Table 1: Showing reaction of blood stains with phenolphthalein reagent

Condition	Fabrics	Phenolphthalein test	Color concentration	Time taken for giving pink color
Control sample	Cotton	Positive	Pink	Immediately
	Jeans	Positive	Pink	Immediately
	Silk	Positive	Pink	Immediately
	Chiffon	Positive	Pink	Immediately
	Tericot	Positive	Pink	Immediately
Sunlight	Cotton	Positive	Pink (light)	2 seconds
	Jeans	Negative	-	-
	Silk	Negative	-	-
	Chiffon	Negative	-	-
	Tericot	Negative	-	-
Heat oven air (Temperature (150°C)	Cotton	Negative	-	-
	Jeans	Positive	Light pink –	2 seconds
	Silk	Negative	-	-
	Chiffon	Negative	-	-
	Tericot	Negative	-	-
Deep freeze (Temperature (-20°C)	Cotton	Positive	Light pink	2 seconds
	Jeans	Positive	Light pink	3 seconds
	Silk	Positive	Light pink	2 seconds
	Chiffon	Positive	Light pink	2 seconds
	Tericot	Positive	Light pink	2 seconds
Freeze (Temperature) (4°C)	Cotton	Positive	Light pink	2 seconds
	Jeans	Positive	Light pink	2 seconds
	Silk	Positive	Light pink	4 seconds
	Chiffon	Positive	Light pink	2 seconds
	Tericot	Positive	Color interpretation Green and pink	3 seconds
pH Acidic HCl	Cotton	Positive	Light pink	Immediately
	Jeans	Positive	Light pink	Immediately
	Silk	Positive	Light pink	Immediately
	Chiffon	Positive	Light pink	Immediately
	Tericot	Positive	Light pink	Immediately
pH Alkali NaOH	Cotton	Positive	Pink	Immediately
	Jeans	Positive	Pink	Immediately
	Silk	Positive	Pink	Immediately
	Chiffon	Positive	Pink	Immediately
	Tericot	Positive	Pink	Immediately

- In control samples all shows immediate pink coloration.
- In samples kept in sunlight only cotton shows light pink coloration after 2 seconds, others sample shows negative result
- In samples kept in hot air oven only jeans shows light pink coloration after 2 seconds, others sample shows negative result
- In samples kept in deep freeze all cloths shows light pink coloration after 2 seconds.
- In samples kept in freeze all cloths shows light pink coloration after 2 seconds.
- In samples kept in freeze all cloths shows light pink coloration after 2 seconds.
- In samples kept in acidic and alkaline condition all cloths shows light pink coloration after 2 seconds.

4. Discussion

The presences of blood stain in the clothes give us a clue about pattern and time of crime committed. A Biologist working in forensic science is confronted with many problems on grouping of dry blood stains. These problems are due to many factors and environmental changes which may mislead the analysis. [6]

In our study we found difference in absorption time, pattern of blood over different fabrics. Similar results were noted by Karger *et al*.[7] Bloodstains over various fabrics, differ in stain sizes, shapes, and its characteristics. It is due to the difference in texture of fabric, such as Cotton fibers are flattened twisted tubes. They consist of long tubular cells, with thickened edges and blunt – pointed ends. Silk fibers consist of long clear thread, without any cell. They are smooth and finely striated, etc.

The biologist in forensic work confronts many problems. These problems are due to environmental factor and their changes. The temperature is a physical property of matter that quantitatively expresses the common notion of

hot and cold. Bloodstains kept at low temperatures could be easily distinguished by the naked eyes as compared to high temperatures as the fabric surface becomes charred, thus it difficult to distinguish the stain from the surface by the naked eyes.

Treated blood stains were presumptively tested with Kastle Mayer (KM) reagents. All blood stains left at low temperature showed positive results giving a pink color change to the KM reagents. However, from fabrics which ever kept at higher temperature, only cotton and jeans shows color change, this might be due to fabric composition. High temperature causes oxidation of $Fe^{2+}$to Fe^{3+}. Therefore, no color change would be observed in the absence of Fe^{2+}.

The results suggested that at different pH conditions like acidic and alkaline, it did not affect the chemical presumptive testing on bloodstains. Similar was found by Kannika Suthapodjanarux *et al* [3].

5. Conclusion

Different environmental conditions mainly high temperature and different textures of fabrics affects the blood stain identification and should be taken into consideration while analysis.

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