CHAPTER I: INTRODUCTION

A fingerprint is an impression left by the friction ridges of a human finger. The recovery of partial fingerprints from a crime scene is an important method of forensic science. Human fingerprints are detailed, nearly unique, difficult to alter, and durable over the life of an individual, making them suitable as long-term markers of human identity. They may be employed by police or other authorities to identify individuals who wish to conceal their identity, or to identify people who are incapacitated or deceased and thus unable to identify themselves, as in the aftermath of a natural disaster.

Evidences usually recovered from under water crime scenes have always been a challenge for the forensic researchers, as water has a destructive effect on the prints and considerably affects the evidential values. Water bodies are considered to be the best place to dispose the evidences after commission of the crime. The evidences retrieved from these water bodies may contain latent fingerprints deposited on the weapons prior disposal in water bodies. Also these water may contain other chemicals. The enhancement of these prints becomes a real challenge for the examiner since this impression tends to become more malleable. This study was conducted to determine whether it is possible to develop latent fingerprints from surfaces disposed in water, NaCl and HCl. The study assumes that latent fingerprints can be developed from non-porous surfaces disposed in water by using suitable development technique. This study also assumes that the salinity and acidic nature of the water may have an adverse effect on the quality of print developed. The study mainly focused on development of latent finger prints on wet and nonporous surfaces.

Latent fingerprints are composed of several chemicals exuded through the pores in the fingertips and are left on virtually every object touched. The primary component of latent fingerprints is ordinary sweat. Sweat is mostly water, and will dry after a fairly short period of time. The other components of latent fingerprints are primarily solid, however, and can remain on a surface for a much longer period of time. These other components include organic compounds like amino acids, glucose, lactic acid, peptides, ammonia and riboflavin as well as inorganic chemicals like potassium, sodium, carbon trioxide, and chlorine.

The basic concept behind all of the chemical techniques is to apply something that will chemically react with one of the constituent chemicals of latent fingerprints to the area suspected of containing such a fingerprint. The resulting reaction will give all present latent fingerprints a new chemical composition. This new chemical composition will make the latent fingerprints easily rendered visible, and they can then be photographed.

Latent Fingerprints or chance prints are found at crime scene on various substrates and one among them is wet conditions. There is an urgent need for the development methods as well as studies related to their persistency on wet conditions. There are numerous techniques available for the development of fingerprints from various substrates under different conditions but hardly there are methods for development of fingerprints found in wet conditions. The present study deals with a powder method for the development of fingerprints found under wet chemical conditions.

CHAPTER II: LITERATURE REVIEW

`

1. Matthew J. West et al (2008) The spectroscopic detection of exogenous material in fingerprints after development with powders and recovery with adhesive lifters.

The powders adhere to the ridge pattern of the fingerprint only, thus allowing the image to be visualised. Fingerprints developed in situ at a crime scene routinely undergo lifting with specialist tapes to facilitate subsequent laboratory analysis. As with all recovered evidence these samples would be stored in evidence bags to allow secure transit from the scene to the laboratory and also to preserve the chain of evidence. In this paper, the application of Raman spectroscopy for the analysis of exogenous material in latent fingerprints is reported for contaminated fingerprints that had been treated with powders and also subsequently lifted with adhesive tapes. A selection of over the counter (OTC) analgesics were used as samples for the analysis and contaminated fingerprints were deposited on clean glass slides. The application of aluminium or iron based powders to contaminated fingerprints did not interfere with the Raman spectra obtained for the contaminants.

2. Michael J. Went et al (2009) The spectroscopic detection of drugs of abuse in fingerprints after development with powders and recovery with adhesive lifters

The application of powders to fingerprints has long been established as an effective and reliable method for developing latent fingerprints. Fingerprints developed in situ at a crime scene routinely undergo lifting with specialist tapes and are then stored in evidence bags to allow secure transit and also to preserve the chain of evidence. In a previous study we have shown that exogenous material within a fingerprint can be detected using Raman spectroscopy following development with powders and lifting with adhesive tapes. Other reports have detailed the use of Raman spectroscopy to the detection of drugs of abuse in latent fingerprints including cyanoacrylate-fumed fingerprints. This study involves the application of Raman spectroscopy for the analysis of drugs of abuse in latent fingerprints for fingerprints that had been treated with powders and also subsequently lifted with adhesive tapes.

3. B. J. Jones et al (2010) Nano-scale composition of commercial white powders for development of latent fingerprints on adhesives

Titanium dioxide based powders are regularly used in the development of latent fingerprints on dark surfaces. For analysis of prints on adhesive tapes, the titanium dioxide can be suspended in a surfactant and used in the form of a powder suspension. Commercially available products, whilst having nominally similar composition, show varying levels of effectiveness of print development, with some powders adhering to the background as well as the print.

4. Ashish Badiye et al (2015) Efficacy of Robin powder blue for latent fingerprint development on various surfaces

Latent fingerprints are subject to easy damage and destruction owing to their fragile nature. Powder dusting is the easiest and fastest of the methods used for latent fingerprint development (LFPD). In the present study, Robin® powder blue, a common household product (used as a post-wash whitening agent and popularly known in India as 'neel') which is user friendly, less expensive, non toxic, non hazardous, environment friendly, simple and easily available substitute to the commercially available and costlier powders, has been used for LFPD. The powder was tested on twenty-four strategically chosen surfaces, keeping in mind the high frequency at which they are commonly encountered on various crime scenes. It was shown that this powder gives very good results, even on most of the intricate and multi-colored surfaces tested.

5. Wei Zeng Low et al (2015) Application of acid-modified Imperata cylindrica powder for latent fingerprint development

Experiments were carried out to determine the suitability, adherence quality and sensitivity of the acid-modified IC powder. Fingermarks of different constituents on different types of surfaces were used. Acid-modified IC powder was also used to develop fingermarks of different ages as well as aged fingermarks recovered from the water. A statistical comparison was made against the Sirchie® Hi-Fi black powder in terms of the powders' sensitivity and quality of the developed natural fingermarks. The image quality was analyzed using MITRE's Image Quality of Fingerprint (IQF) software. From the experiments, acid-modified IC powder has the potential as a fingermark development powder, although natural fingermarks developed by Sirchie® black powder showed better quality and sensitivity based on the results of the statistical comparison.

6. Chuanjun Yuan et al (2018) Cationic dye-diatomite composites: Novel dusting powders for developing latent fingerprints

Powder method, the most widely used procedure for developing latent fingerprints, is based on the visual contrast between background surface and powder-covered fingerprint region, thus dusting powders with excellent performance are urgently needed. Four cationic dye-diatomite composite powders with different colors have been prepared relying on the adsorption between cationic dye molecule and diatomite. Compared with synthetic silica matrix, the employment of natural diatomite greatly reduces the amount of dye usage, which is simple, green and low-cost. This work shows that the cationic dye-diatomite composite powders have high sensitivity, high selectivity and good contrast and are promising for practical use in forensic science.

7. Hélio L. Barros et al (2019) Micro-structured fluorescent powders for detecting latent fingerprints on different types of surfaces

Benzazole dyes have shown great potential for application in different fields of science due to their intense and stable photoluminescence properties, associated with high sensitivity. In this study, we developed and evaluated micro-structured fluorescent powders based on benzazole dyes for fingerprint detection on different types (porous and non-porous) and colors (dark, white, and multi-colored) of surfaces. The new micro-structured powders were obtained by embedding a small amount of benzazole dye into a silica matrix (1:100 and 1:300 mass ratio) using an aqueous solution or ethanol under ambient conditions.The developed micro-structured powders showed intense fluorescence emission in the blue-green region, and a sharp contrast with the fingerprint residues when exposed to long wavelengths of UV light (365 nm) was observed, producing distinct ridge details on all examined surfaces.

CHAPTER III: AIM AND OBJECTIVES

AIM

To determine the development of latent fingerprints on nonporous surfaces

OBJECTIVE

- To develop the latent fingerprints on non-porous surfaces dipped in various solutions and examine the fingerprints after developed with power method
- To develop the latent fingerprints dipped in various solutions with time variation of 1hr, 2hr and 3hr

CHAPTER IV: MATERIALS AND METHODOLOGY

Materials Required:

1. Glass Slides
2. Beakers
3. Petri-dish
4. Fingerprint development Brushes
5. Black powder
6. White powder

Reagents

1. Dilute Hydrochloric acid
2. Sodium chloride
3. Distilled water

Methods

Step 1:

The non-porous surfaces such as slide, beaker and petri-dishes are taken first. The subject is taken to leave an impression of fingerprint onto the 10 slides, 1 beakers and 1 petri-dishes.

Step 2:

After leaving an impression, the four slides, one beaker and one petri-dish is taken and placed in 100ml water. The slides are taken out from the water with time variations of 1hour, 2hour and 3hours respectively and then the latent fingerprint is developed by using black powder and white powder.

Step 3:

Then another three slides are taken and placed in dilute HCl solution. The slides are taken out from the water with time variations of 1hour, 2hour and 3hours respectively and then the latent fingerprint is developed by using black powder.

Step 4:

Then another three slides are taken and placed in dilute NaCl solution. The slides are taken out from the water with time variations of 1hr, 2hr and 3hr and then the latent fingerprint is developed by using white powder.

Step 6:

The beaker which is having fingerprint impression is to be placed in water and removed with time variations of 1 hour, 2 hour and 3 hours respectively and then latent fingerprint is developed by using black powder.

Step 7:

The petri dish which is having fingerprint impression is to be placed in water and removed with time variations of 1 hour, 2 hour and 3 hours respectively and then latent fingerprint is developed by using white powder.

.

CHAPTER V: OBSERVATION

Figure 1: Glass slide dipped in water for 1 hour and then developed with black powder

Figure 2: Glass slide dipped in water for 2 hour and then developed with black powder

Figure 3: Beaker dipped in water for 3 hour and then developed with black powder

Figure 4: Petri-dish dipped in water for 1 hour and then developed with white powder

Figure 5: Glass slide dipped in water for 2 hour and then developed with white powder

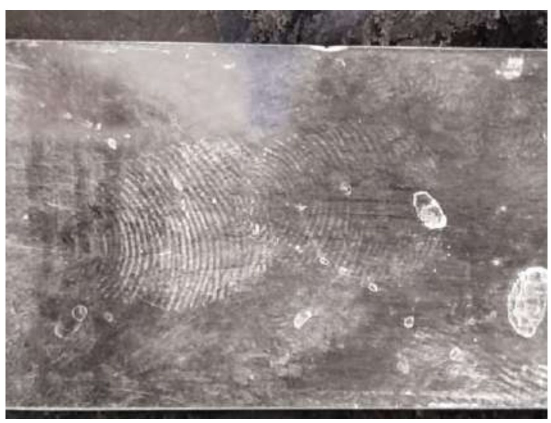

Figure 6: Glass slide dipped in water for 3 hour and then developed with white powder

Figure 7: Glass slide dipped in dilute NaCl for 1 hour and then developed with white powder

Figure 8: Glass slide dipped in dilute NaCl for 2 hour and then developed with white powder

Figure 9: Glass slide dipped in dilute NaCl for 3 hour and then developed with white powder

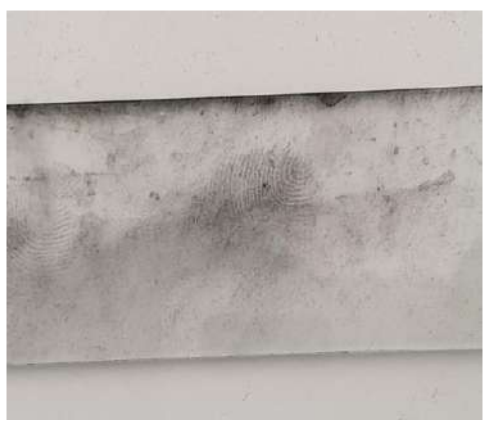

Figure 10: Glass slide dipped in dilute HCl for 1 hour and then developed with black powder

Figure 11: Glass slide dipped in dilute HCl for 2 hour and then developed with black powder

Figure 12: Glass slide dipped in dilute HCl for 3 hour and then developed with black powder

CHAPTER VI: RESULT AND CONCLUSION

Result

Latent fingerprints were developed on various surfaces using black powder and white powder which were placed in water, NaCl and HCl. Compared to the other development techniques used for the enhancement of latent fingerprints, the powders are easily available and it will give good result. Black and white powders will give clear prints in water but it not clear in NaCl as well as in HCl.

The Comparative analysis of non-porous surfaces with this powder will give good result on contrast surfaces. Non-porous surfaces will give partial fingerprints on HCl and NaCl but in water it will get good result with clear ridge. The investigators can use this powders for the samples placed in water medium & develop the latent fingerprint from the crime scene.

Conclusion:

From the present study, it is been concluded that with respect to time, development of fingerprint becomes difficult with increase of time.

Further studies can be done on the decipherment of fingerprint in different mediums under various concentration and different powders which are easily available.

REFERENCES

1. Matthew J. West et al (2008) The spectroscopic detection of exogenous material in fingerprints after development with powders and recovery with adhesive lifters. Department of Forensic Science. 16:39-44
2. Michael J. Went et al (2009) The spectroscopic detection of drugs of abuse in fingerprints after development with powders and recovery with adhesive lifters. Fingerprint world. 35.90:100
3. B. J. Jones et al (2010) Nano-scale composition of commercial white powders for development of latent fingerprints on adhesives. Fingerprint world. 6:328-332
4. Ashish Badiye et al (2015) Efficacy of Robin powder blue for latent fingerprint development on various surfaces. Egyptian J Forensic Sci 5(4),166-173
5. Wei Zeng Low et al (2015) Application of acid-modified Imperata cylindrica powder for latent fingerprint development. Forensic Science International41(1-2), 73-82.
6. Chuanjun Yuan et al (2018) Cationic dye-diatomite composites: Novel dusting powders for developing latent fingerprints. Selective and Scientific Book Publishers; 77-85.
7. Hélio L. Barros et al (2019) Micro-structured fluorescent powders for detecting latent fingerprints on different types of surfaces. Advances in Fingerprint technology 2 (105-176), 10.
8. Fingerprint identification: advances since the 2009 National Research Council report.
9. F.M Kerr, I.W. Barron, F. Haque, Organic based powder for latent fingerprint detection on smooth surfaces. Part I. Can. Soc. Forensic Sci. J. 16:39-44.