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Review Article

A review on recovery of latent fingerprints on different substrates immersed under muddy water

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ABSTRACT

Fingerprints are most affirmative evidence for personal identification found at crime scene. However, its quite tedious and crucial to develop and identify the latent fingerprints from destructive crime scene conditions. Although some may believe that evidence recovered underwater will have no forensic value, but forensic research shows that identifiable fingerprints may still be developed. In this paper, we have discussed that it is possible to develop latent fingerprints from non-porous and porous materials disposed of in muddy water by using different powders available in the home. All the samples were disposed of in containers containing muddy water and then different techniques were used for the recovery of latent fingerprints. In this paper, economical, simple, and easily available powders have been chosen to recover the latent prints on five frequently encountered different substrates i.e., plastic, glass, metal plates, aluminium foil, cardboard, glossy-painted wooden substrates. It is examined that it shows very good and clear results on most of the surfaces with clear ridge characteristics.

1. Introduction

Latent fingerprints are often considered as impressions that are left behind at the scene of crime and are not detectable to the naked eye.[1] Latent fingerprints can provide recognizable ridge characteristics which is helpful to identify the owner of those prints. These days, fingerprint evidence plays an important role in criminal lawsuits and investigations. The latent fingerprints could be developed by powder technique using the squirrel brush or camel hair brush. It involved the use of finely divided formulation to the fingerprint impression. In this technique mechanical adherence of powder to the sweat residue of the latent fingerprints was observed.[2,3] The powder could be easily blown off the forrows. The powders are colored, the ridges become visible and latent fingerprint are developed. In some cases offenders try to demolish the evidence by discarding the evidences such as firearms, knife, rods, glass, wood, etc into the water, so for forensic scientists, it's miles a tough task to get better fingerprints from that evidence.

But later the methodology used to develop latent print without using brush as preliminary examination and the main advantage of festival color to the print is quite simple and easy technique. Later a study in order to discover a new technique for the development of latent fingerprints on different surfaces using powder from turmeric: rhizomatous herbaceous plant.[4,5] The efficiency of Robin powder blue (due to its light-fastness and heat stability) for developing latent fingerprints on 24 different substrates which are easily obtained at the scene of crime.[6] The rangoli powders are used in latent fingerprint development in wet condition. Different colors of rangoli powders are used in five different substrates.commonly found and less expensive powders can be used in latent fingerprint development in wet condition which shows very good results.[5] Development of

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fingerprints on all the surfaces was successful, light colored surfaces gave best contrast and even dark colored surfaces gave fairly good results. Due to its high contrast it was very easy to photograph the prints and tape lifting of prints was also easily possible. Lennard et al.(2013) studied that latent fingerprints deposited are made up of natural secretions and contaminants present on the skin, when a smooth surface comes in contact with the bare hands. These prints or marks serve as signature of the culprit. The fine ridge pattern present in fingerprints can be used to identify the person to whom the print belongs. The chemical, physical, and optical methods are used to detect the fingermarks.[7] Omar et al. (2012) showed that the fastest and easiest method for fingerprint development is powder method. By using different fingerprints powders within six continuous week period, the differences in the physical characteristics of the fingerprint after development were examined. The number of physical identification of each minutae was compared after the use of black powder and black magnetic powder. Microscope slides were used in order to deposit the latent fingerprints from donor. The fingerprints are applied after thirty minutes interval. Slides were examined every week at similar interval for six weeks. It was made evident that for three weeks, the black powder could be used while the black magnetic powder could be used for up to fourth week.[8,9]The fingertip of a person is usually smeared by sebaceous secretion and sweat. Whenever an individual touches any material due to the presence of sweat in the fingertips he/she leaves the impression of fingers over that material. These fingermarks can be visualized, developed and lifted by fingerprint experts.[10] Nayak et al. (2010) conducted a study that showed that significance sex difference occurs in fingerprint ridge density. They found sex and race differences in finger ridge count, females have finer epidermal ridges than male.[1]

Jasuja et al. (2007) experimentally used the phase transfer catalyst (PTC) based reagent with Rose Bengal dye to recover latent fingerprint on sticky side of adhesive tapes.In this study shelf life of the reagent is also checked.With the use of simple and effective technique i.e. PTC latent fingerprints was detected. It also gives the best color contrast. Both fresh as well as old prints were developed using this reagent. The reagent can lasts about five months and give the best quality prints.[7] Sodhi et al. (2016) used physical developer technique to detect fingerprints on dry and wet, porous surfaces, including paper, clay-based products and adhesive tapes. The physical developer revealed the fingerprints as dark gray and black images due to absorption of metallic silver particles on sweat residues.[11] Bumbrah et al. (2016) carried out a test and studied the latent fingerprints have been evolved on moist non -porous substrates together with plastic,glass,metals, etc. With the aid of the usage of small particle reagent (SPR). On this technique, the first rate debris of treating answer adhered to oily and fatty components of latent fingerprint residues. By adding fluorescent dye within the solution, the effectiveness of the approach advanced. This fluorescent SPR come across the faint and prints and prints on multi- coloured surfaces additionally.[10]

1.1. Fingerprints at the crime scene

Fingerprints encountered at a scene of crime are classified as follows:

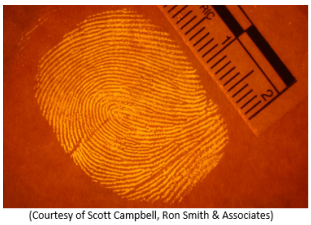
1. Patent print
2. Latent print
3. Plastic print

(a) Patent print: the prints which are visible to the naked eye are called visible prints. These are smeared with blood, paint, oil, grease, etc left at the scene of crime.

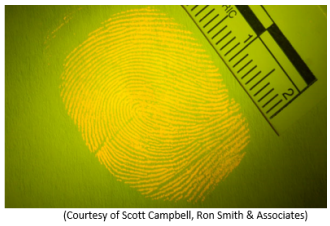
(b) Latent prints: the prints which are invisible at the scene of crime and need to be developed with the help of reagents are called latent prints. These prints are found at the surface due to sebaceous and sweat gland secretions. If the prints are formed by chance, then it is said to be chance prints.

(c) Plastic prints: the prints which are leftover soft surface or articles such as wax, soap, clay, cheese, etc are said to be plastic prints.

The use of various alternative light source may help in enhancement of latent finger prints.[12]



(Courtesy of Scott Campbell, Ron Smith & Associates)



(Courtesy of Scott Campbell, Ron Smith & Associates)

In this paper, we have chosen the powder method to develop latent prints on various substrates in moist conditions. Powders are considered as an excellent medium to recover latent prints on small surfaces, in competent hands. Latent prints visualization with powder, and dusting involves the allocation of finely divided particles that physically adhere to the aqueous and oily constituent in latent print residue on different surfaces. This method is considered as one of the oldest and most common technique of latent print detection. Fingerprint powders are available in different variety of compositions and colors. These powders are used to develop latent prints on different surfaces such as on non-porous surfaces and porous surfaces. The

powder selected should be finely grained, amorphous, and of a color that gives contrast with the background.[13] It should be somewhat sticky. These powders are applied on different surfaces with the help of a fiberglass brush, camel's hairbrush and squirrel brush.

1. Black powder: The black powder is formulated from a variety of carbon-based powders with a binder or earth powder which is added for stability. The basic ingredients of black powder are lampblack, graphite and charcoal. black powder is used against a light background.
2. White/Grey Powder: The white powder consists of mercury and chalk. The white powder consists of zinc oxide, titanium oxide, and gum acacia. It performs best on glass, plastic, and rubber. These powders are used for all dark colored surfaces.
3. Red powder: It consists of finely powdered red resins from the fruit of a palm which is used in the formulation of zinc engravings. It is found beneficial on paper where the prints are fresh.
4. Fluorescent powder: These powders are useful where a print is difficult to distinguish from its surface, used to recover fingerprints on multi-colored surfaces. The recovered prints are then exposed to ultraviolet light. Anthracene and Rhodamine B are examples of fluorescent powders.

In the previous work, researchers have experimented with latent fingerprint enhancement using different techniques which involve the use of chemicals, commonly available powders, pigments, and dyes. Most of the conventional methods make use of chemicals that possess potential health problems to the examiner during the development so to overcome this limitation some examiner have also worked on the development of latent fingermarks using powders of herbal origin like Banana peel activated carbon, Turmeric powder, Genipin and Imperata cylendrica.[5] Trapecar et al. (2012) studied that latent fingerprints on glass and metal surfaces submerged in water can be recovered by using varied development methods. Fingerprints intentionally imprinted on glass and metal surfaces from different donors were examined and recovered with silver powder,small particle reagent and cyanoacrylate at different time intervals. This study showed that the duration of exposure to stagnant water and method chosen for detection had effect on the quality of detected fingerprints.[14] Madkour et al. (2017) demonstrated the best method for recovering latent fingerprints on dry non-porous substrates (glass, metal and plastic) submerged in aquatic environments at different time interval. Study shows that it is possible to recover latent prints that are submerged in water on various dry non-porous surfaces with the best visualization method using cyanoacrylate either in fresh or sea water. In addition, this study has concluded that the exposure to high salinity i.e sea water has more damaging effect on the quality of detected prints.[15]

The present study aims to develop fingerprints on different substrates from wet conditions using powders used for cooking which is also naturally originated. In the present work, powders that are used in cooking and others have been used as fingerprint powder to develop latent fingerprints and compared with other powders. All the powders which are used for cooking purposes are used i.e. corn flour, besan, coriander powder, baking soda, coffee powder, turmeric powder other powders such as rangoli colors (red and green), talcum powder, and black powder. Black powder is one of the most common and oldest methods of latent print detection. Finely divided particles physically adhere to water and oily residues of fingerprints. It is manufactured from a variety of carbon-based powders with a binder or earth powder added for stability. The basic ingredients of black powder are lampblack, graphite and charcoal.

2. Discussion

Latent fingerprints are said to be fragile in nature. Powder method is the easiest and fastest method used for developing latent fingerprints.In the present study, the common and easily available household products are used for detection of latent prints.The household products which are selected are non- hazardous,eco -friendly and non- toxic in nature. Also the sustrates chosen are commonly encountered in the scene of crime. Both substrates and powder are selected with different and vibrant color contrast.

3. Conclusion

It is concluded from the present study that these commonly and easily available as well as less expensive agents (colors-food and festival colors) could work as a useful substitute for the decipherment of latent fingerprints deposited on different substrates. The latent fingerprints submerged under water are successfully developed in almost every substrate (glass, plastic, metal plates, sun mica coated wood, and aluminium foil) with the best visualization method using powder method in muddy water. Also, the duration of submersion affects the quality of fingerprints developed; the longer the duration, the worse the quality is. There are lots of factors that affect the quality of the fingerprint-like weather conditions, the surface itself, how the fingerprint got deposited,its force applied and how long.

In this study, fingerprints obtained in less time interval have developed more clear ridges with identifiable characteristics which are due to the reason that longer submersion ridges with sweat content to dissolve and thus latent prints were hard to visualize and extremely difficult to identify. This study shows that fingerprints are considered as the most common and easily available forensic evidence at most crime scenes. Moreover, it requires easily available,

non-hazardous, and less expensive techniques therefore it could be the most useful mode for the decipherment of latent fingerprints deposited on different surfaces and found in the aquatic condition.

4. Conflict of Interest

The authors declare that there is no conflict of interest.

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None.

References

1. Nayak VC, Rastogi P, Kanchan T, Lobo SW, Yoganarasimha K, Nayak S, et al. Sex differences from fingerprint ridge density in the Indian population. *Journal of Forensic and Legal Medicine*. 2010;17(2):84–6.
2. Sodhi GS, Kaur J. Powder method for detecting latent fingerprints: a review. *Forensic Sci Int*. 2001;120(3):172–6.
3. Jasuja OP, Singh GD, Sodhi GS. Development of latent fingerprints on the sticky side of adhesive tapes: phase transfer catalyst-based formulation. *Can Soc Forensic Sci J*. 2007;40(1):1–13.
4. Kumari H, Kaur R, Garg RK. New visualizing agents for latent fingerprints: synthetic food and festival colors. *Egypt J Forensic Sci*. 2011;1(3-4):133–9.
5. Garg RK, Kumari H, Kaur R. A new technique for visualization of latent fingerprints on various surfaces using powder from turmeric: a rhizomatous herbaceous plant (Curcuma longa). *Egypt J Forensic Sci*. 2011;1(1):53–7.
6. Badiye A, Kapoor N. Efficacy of Robin® powder blue for latent fingerprint development on various surfaces. *Egypt J Forensic Sci*. 2015;5(4):166–73.
7. Lennard C. Fingerprint identification: how far have we come. *Aust J Forensic Sci*. 2013;45(4):356–67.
8. Omar MY, Ellsworth L. Possibility of using fingerprint powders for development of old fingerprints. *Sains Malaysiana*. 2012;41(4):499–504.
9. Thakur P, Garg RK. New developing reagent for latent fingermark visualization: Fuller's earth (Multani Mitti). *Egypt J Forensic Sci*. 2016;6(4):449–58.
10. Bumbrah GS. Small particle reagent (SPR) method for detection of latent fingermarks: A review. *Egypt J Forensic Sci*. 2016;6(4):328–32.
11. Sodhi GS, Kaur J. Physical developer method for detection of latent fingerprints: A review. *Egypt J Forensic Sci*. 2016;6(2):44–7.
12. http://www.forensicsciencesimplified.org/prints/how.html (last accesed on 5th may 2021).
13. Pandey A, Jain N. Development of Latent Fingerprints on Various Substrates under Wet Conditions by Powder Method (Rangoli Powders). *Int J Cri For Sci*. 2018;2(1):50–4.
14. Trapecar M. Fingermarks on glass and metal surfaces recovered from stagnant water. *Egypt J Forensic Sci*. 2012;2(2):48–53.
15. Madkour S, Dine FBE, Elwakeel Y, Abdallah N. Development of latent fingerprints on non-porous surfaces recovered from fresh and sea water. *Egypt J Forensic Sci*. 2017;7(1):1–12.

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