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Review Article

Recovery of latent fingerprints on different substrates submerged under fresh water: A review

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ABSTRACT

Fingerprint proof is the maximum dependable and popular evidence inside the legal court in the judicial system. Though fingerprints are identical to all kind of conditions of atmosphere like rain, fire etc., and a huge range with different types of physical and chemical methodologies are needed for the fingerprints development. Criminal offenders always have an essential intention is they plan not to leave any traces at the crime scene. Criminals may have thought that evidences which are recovered under water will have not a single value in the field of forensics, so they consequently try to spoil the strains by throwing items in water sources like ponds or lakes. These constitute a task for the forensic experts to investigate the fingerprints. Under water evidences which are recovered from the scenes where crime occurred, have usually been a venture for the forensic scientists, as water puts different environmental effect at the prints. There are various technical processes which available for the purpose of fingerprint development from various types of substrates like glass, metal, aluminum, plastic, wood etc. on different time intervals like two days, ten days etc. There are strategies for improvement of fingerprints discovered under fresh water. The present examine offers different techniques like SPR, PTC, Black Powder, Cyanoacrylate, zinc carbonate etc. for the development of fingerprints determined under fresh water.

1. Introduction

Fingerprint is mainly the replica style of the friction ridges at the distal phalanges of the finger and thumb. Mainly the fingerprints are the high quality way to prove which suspects are on the crime scene. Latent fingerprint improvement can be performed with a big range of optical, physical, and chemical strategies. Most of these advanced techniques were having at some point of the beyond century.[1] A Patent print is a type of fingerprint which can be seen with naked eyes. Patent fingerprints can also found in blood, paint, ink, mud, or dust in the crime scene.[2] A Latent print can't be detected until going through some physical or chemical technical processes to enhance the latent print. Many different strategies are used for detection of Latent fingerprints.[3] Porous substrates which are mainly the absorbents and which define materials like cardboard, wood, paper & different forms of cellulose. The deposited fingerprints into these media absorb the substrate and are mostly durable. Mostly the Amino acid process used for these techniques to stay stationary while absorption process is going on and do not migrate for a long time.[4] Nonporous surfaces are the type of surface which do not absorb for a longer time. These surfaces are seeming to be polished and can deal well with changing of weather. Examples are metals, timber, glass, plastics, rubber etc.[5] Mostly the latent fingerprints are found at the outer surface of the substrates so there is always a risk to develop Latent prints. Different methods like Cyanoacrylate fuming, Iodine fuming, different powders, Small Particle Reagent etc. are

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applied for developing the prints[4]. Semi porous surfaces are mainly that kind of surfaces which absorb water and which can be soluble in water completely. Those surfaces are mostly glossy finished material like glossy finished cardboard, cellophane etc. Textured substrates always may be porous or nonporous. Textured surfaces easily not respond to the powder methods or tap raising methods. These techniques make difficulties to visualize or to develop the fingerprints.

2. SPR

Small Particle Reagent (SPR) is a famous and a positive enhancement technique of recovering fingerprints on different surfaces. SPR is a cessation of a type of infusible powder in a melted aqueous solution of a surfactant. This suspension is applied with mainly spraying approach. SPR process also known as Wet Powdering method is an effective approach for surfaces which contain moisture.[2] The fluorescent dyes which are present in SPR composition detect dim fingermarks. It also detects the coloring surfaces of the fingerprints. So lastly they concluded that SPR method is so much easy, effective for detection of latent fingerprints and even a shallow hand can operate it without any requirement of specialized device.[6] SPR works to form gray deposit by adhesion of fatty acids. In market, SPR is available in a premixed liquid form. Some of the scientists concluded that the easiest methods to recover latent print on non-porous surfaces are SPR.[7]

Fig. 1: Recovering fingerprints using SPR Technique[1]

3. Black Powder

Black Powder is the easiest & common method which is used for recovering the fingerprint. Black Powder works on moisture, oil and different remainders[8]. Different scientists had done different experiments using this black powder method. They came to a conclusion that Black powder is one kind of the traditional and normal visualization methodologies for improvement of latent prints.[4] Coloring powders may be used to execute latent prints from much number of substrates under wet conditions and can give real effects like black and white powders which are used officially.[5] Some of the researchers concluded that Black powder gives a normal visualization effect to the fingerprints.[6] It is made of different carbon-based powders with a binder, which is added for the purpose of stability.[9]

Fig. 2: Recovering fingerprints using black powder technique[6]

4. PTC

Phase Transfer Catalyst, which accommodates an interphase, a hydrophilic phase, a hydrophobic phase. The ion transfers to the natural segment from the aqueous segment. It forms a metal carnation on the middle area. This methodology is useful for both types of porous and non-porous surfaces.[2] PTC is mainly a dye material for the development of latent fingerprints which can solve the insolubility problems. Different chemical dyes like eosin blue and erythrosine B have been used with phase transfer catalyst (tetra butyl ammonium iodide) for proceeding latent fingerprints on various surfaces.[8,9] PTC dye formulations are very much different from other dye formulations. Some of the researchers concluded the effectiveness of PTC method by recovering fingerprints on the sticky side of a huge variety of adhesive tapes.[10] Some have been reporting that the use of PTC based chemicals on variety of surfaces under various conditions for recovery of the latent fingerprints. PTC is not been tried and validated for wet

surfaces.[11]

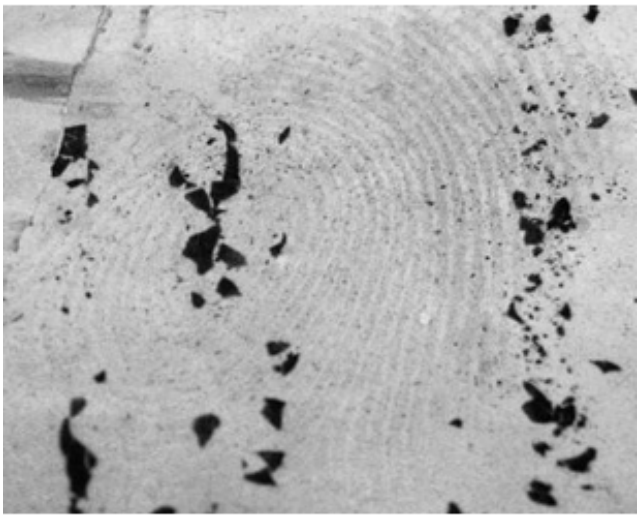

Fig. 3: Recovering of fingerprints using PTC technique[11]

5. Cyanoacrylate Fuming

Cyanoacrylate fuming is the best satisfactory approach used for development of latent fingerprints submerged under fresh or sea water, though sea water has the more destructive power towards recovering the fingerprints.[9] Some researchers conducted in their study that it is efficient to get the best latent prints submerged under water on different kinds of non-porous dried surfaces with high-quality visualization methodology Cyanoacrylate Fuming but during the longer time duration of submersion under water, the condition of the prints will be the worst.[12]

Cyanoacrylate vapor is attracted to the fingerprint residues selectively. It started polymerization to form a hard, white polymer known as poly- ethyl cyanoacrylate (PECA) in the fingerprint ridges. Some study also clarified that humidity and its effect on cyanoacrylate enhancement is taking a primary initiative for the polymerization.[13] Cyanoacrylate Fuming recovered fingerprints are white three-dimensional matrix and visible to the naked eye. An enclosed space is needed to enclose the fumes because oxygen is considered as a terminating agent for the polymerization process.[14,15]

6. Iodine Fuming Technique

The fumes of iodine easily get adsorbed on the fingermark residues because of sebaceous material to give yellowish brown latent prints. The technique is very simple, fast, efficient as well as pocket friendly and also applied to a high range of porous and nonporous surfaces like paper, plastic, glass, wood etc. The iodine fuming mechanism reaction was initially thought to process the reversible addition of iodine

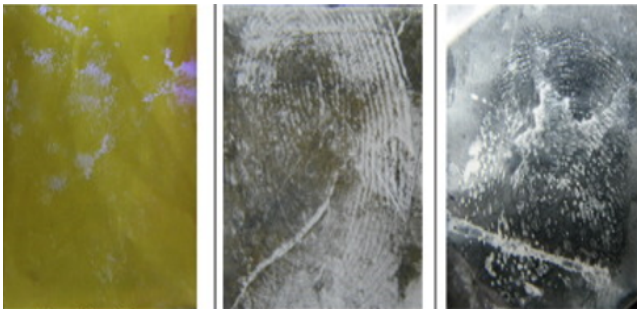

Fig. 4: Recovering Fingerprints using cyano acrylate fuming[7]

to the double bonds of the unsaturated fatty acids in latent fingerprint residue by the process of halogenation.[12] That time when a fingure is being pressed down onto a paper, oils from the skin are transferred to the paper. Then these biological oils react with the following iodine vapor and produce a brown color which traces the fingerprint.[11]

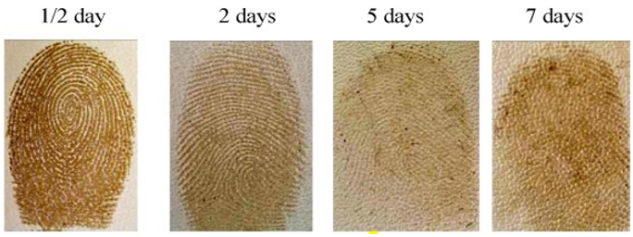

Fig. 5: Recovering fingerprints using Iodine fuming technique[13]

7. Overview of Other Techniques

Ninhydrin is a chemical which is powdery in nature. It is mostly soluble in ethanol or acetone at normal room temperature. When ninhydrin solution applies to the fingerprints by using the spray bottle, it reacts with the amino acids that are present in the fingerprints. Ninhydrin is not so efficient method for recovering the fingerprints submerged under water.[6]

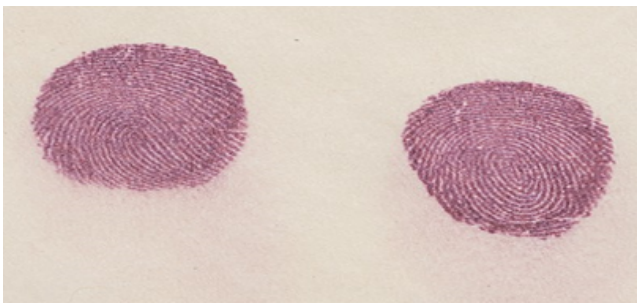

Fig. 6: Recovering fingerprint using ninhydrin technique[11]

Coloring Powders may be used to develop latent prints from various numbers of substrates under wet conditions

and can give real effects like black and white powders which are used officially. Coloring Powders can also be used for development of latent prints deposited different surfaces in moist situations and this method are less luxurious.[9]

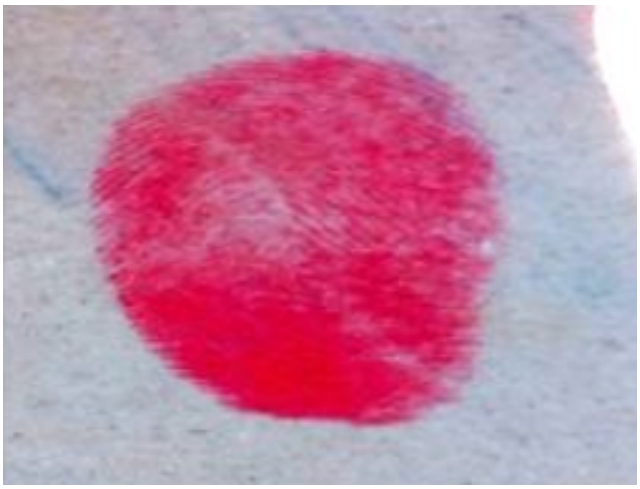

Fig. 7: Fingerprints comes after using colouring powder[13]

Latent fingerprints are the most effective evidence found in a crime scene. In these present study discussed methods are the most common and suitable methods used to determine the fingerprints which are submerged under fresh water. The chemicals which are selected are easily available methods to detect the evidence. All the basic ingredients like substrates and materials are very much different.

8. Conclusion

It is concluded from the present study that chemical techniques are common and effective methods as compared to powdering method which are being used for collecting the fingerprint evidence. The fluorescent dyes of SPR can detects faded fingerprints whereas powder methods are the eco-friendly and non-hazardous methods among all and it can be done from the household products even. Phase transfer catalyst method mainly solve the insolubility problems. By Cyanoacrylate fuming the recovered latent fingerprints are white three dimensional and clearly visible by the naked eyes. The Iodine fumes reacts with the biological oils and make clear brown colored trace. The commonly used Iodine fuming and ninhydrin methods are also effective methods for porous surfaces. Coloured and fluorescent powders are effective on coloured surfaces.

This study shows that it is probable to regain latent prints submerged under fresh water through various surfaces with several chemical methods. Cyanoacrylate Fuming and SPR are the best chemical method for recovering the latent fingerprints. The time interval hampers the recovering process of fingerprints because longer time duration under water makes the worst condition of the fingerprints. So at the earliest convenience the recovering process should be done for better quality of the prints under the aquatic condition.

9. Conflict of Interest

The authors declare that there is no conflict of interest.

10. Source of Funding

None.

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