IJournals: International Journal of Software & Hardware Research in Engineering
ISSN-2347-4890
Volume 3 Issue 9 September, 2015

DEVELOPMENT OF LATENT FINGERPRINTS FROM NON POROUS SURFACES

SUBMERGED IN WATER AT DIFFERENT INTERVAL OF TIME USING TWO SPR FORMULATIONS

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Abstract

Fingerprint evidence is one of the most reliable and accepted evidence in the court of law. When fingerprints are exposed to different atmospheric conditions for e.g. Rain, fire etc, a diverse range of physical and chemical methods are required for the development of fingerprints.SPR is a chemical technique which is used to detect latent fingerprints on nonporous wet surfaces where small black particles adhere to the fatty substance which was present in the fingerprint residue. The aim of my study is to recover fingerprints from the objects which are submerged in water for different interval of time which are subjected to the treatment of SPR white and SPR black and to determine which composition is best for recovering fingerprints.SPR white gave better results than the SPR black and also in 45 and 60 days the visualization of prints is decreasing in case of plastic and aluminium. SPR white gave better results in aluminium than the black SPR up to the time interval of 30 days. The materials used to prepare the SPR are cost-effective and not hazardous.

Keywords- SPR,Submerged Fingerprints ,SPR black and white .

1. INTRODUCTION

These days, fingerprint evidences plays a crucial and important role in criminal proceedings and investigations. Sometimes, Criminal lawbreaker throw the evidences (for e.g., glass, plastic bottles, containers, metals, firearms) into stagnant water, so for forensic scientists it is a difficult task to recover fingerprints from those evidences.Fingermarks can be found on porous (paper, cardboard wood and other forms of cellulose), non-porous (glass, metal, plastics, lacquered or painted wood and rubber) and semi porous surfaces (glossy cardboard and some finished wood). Latent fingerprints are the common type of fingerprints i.e. also called as hidden prints are found on the surfaces of evidences and can be found in wet environment. The surfaces of evidences can be wet due to the submersion of evidences in stagnant water. According to some researchers in past other methods like powder method, iodine fuming, cyanoacrylate fuming, ninhydrin and silver nitrate are also used to recover fingerprints from objects which are submerged in water for different interval of time.SPR is found to be effective among all other methods as it is cost- effective and non-hazardous. The ability of the present formulations to detect weak and chance prints not only enhances its utility, but also its potentiality in forensic work investigations. [4]

SPR is a technique which is used to develop latent fingerprints which is based upon the reaction between the fatty acids found in fingerprint residues and the hydrophobic tails. These tails are linked to a hydrophilic head, which reacts with metal salt to give a white or black precipitate.SPR White in which a suspension of molybdenum sulphide in detergent solution was prepared and SPR Black in which a fluorescent dye is used with Zinc Carbonate and detergent. Fluorescent SPR based zinc carbonate is a potential method for developing fingerprints from arson sites. [2] Zinc carbonate is an astringent and topical antiseptic .It does cause eye irritation when suspended in a non-volatile liquid like water, it is highly improbable that it would injure the eyes [5].Even under conditions as adverse as the ones reproduced, it is possible to develop finger-marks.

These reagents were slowly poured on the finger-mark area on the mobile surfaces, after few minutes it is washed out with tap water.The developed print can be seen clearly. The developed fingerprint were photographed immediately, for all the methods.

Formulations were made of SPR White and SPR Black. When the liquid detergent solution was prepared then the

reagents were applied over the objects that were exposed to water for different interval of time (for 15, 30, 45 and 60 days).The present study was done to investigate that which formulation of SPR was best to recover the fingerprints on glass, plastic and aluminium. In Conventional SPR is a suspension of molybdenum disulphide in a surfactant solution. The small black particles adhere to the fatty substances left in the fingerprint residue, so the base material in conventional SPR formulation is Molybdenum disulphide. The powder suspension can be sprayed, but small objects can also be submerged in it.The SPR method has the advantages that it can be used on wet or dirt or greasy surfaces. A number of SPR based on zinc carbonate have been developed in combination with various fluorescent dyes to develop latent fingerprints on a number of non-porous surfaces [3].

2. MATERIALS AND METHODS

2.1 Materials

This proposed work has carried out in the Department of Forensic Science, Allahabad applying said methods SPR (white and black).Here we used 120 each glass, aluminium and plastic sheets. Finger-marks were obtained from volunteers of department of Forensic Science. Fingerprints are taken on the surfaces of samples of plastic, glass and aluminium. Preferably, plain prints are taken over the surface of different objects as chance prints are always plain prints. The samples were also labelled with the help of markers as G1, G2, G3, and G4….. (For glass), P1, P2, P3, P4……. (For plastic) and A1,A2,A3,A4 ……(For aluminium) as shown in Fig.1, then all the samples were placed in the stagnant water for 15, 30, 45 and 60 days. It was then placed to rest for different time intervals. After different time intervals, the methods were applied to recover fingerprints after submersion of evidences in stagnant water. Light source or poly light was used to visualize the latent fingerprints on the surface of glass, aluminium and plastic prior to fingerprint deposition. Finger mark depositions were carried out and detection of fingerprints were done in a laboratory with room temperature of 24 degree Celsius Then the, different methods were applied with the questioned sample for development of fingerprint. Each sample was examined individually for examination of extent of development of fingerprint on the given surface at different interval of time. Photography of each sample is carried out using a measuring scale and number cards. Each photographs were then preserved for further examination. Photographs of finger marks are taken using a still camera of high resolution.

2.2 Methods

2.2.1 Visual examination

First, the prints were visually examined in the light source or poly light prior to any chemical and fuming method.

2.2.2 Then the solutions for both SPR White and SPR Black was prepared. Two compositions of SPR are used here,

1. 7.5g of molybdenum disulphide+2-3 drops detergent and dissolves in 75ml of distilled water. - SPR (Black)

2. Eosin B which is a fluorescent dye (15mg) +Zinc carbonate (5g) +2-3 drops of detergent in 75ml of distilled water.-SPR (White)

In SPR method, fingerprint were taken on the samples .A suspension of fine particles of molybdenum disulphide (MoS2), a laboratory detergent and water were made. These reagents were slowly poured on the finger-mark area on the mobile surfaces, after few minutes, washed out with tap water.The developed print can be seen clearly. The developed fingerprint were photographed immediately, for all the methods. For determining the shelf life of SPR reagents the solution was kept for 60 days covered with aluminium foil. The solution remained stable for 60 days.

3. RESULTS AND DISCUSSION

SPR has proved its importance in detecting latent fingerprints on wet surfaces. The feature of this reagent is its fluorescence. The fluorescence in SPR white comes from the Eosin B dye that is used in the composition with zinc carbonate and detergent. According to some previous literatures, the composition of SPR develops clear, sharp and detailed fingerprints on a large number of non-porous items, after these were immersed in water for up to 36h[6].Finger-marks on transparent foil can be developed even after having been exposed to water for one week[7]. In the present study the best results were given by glass surfaces followed by plastic and aluminium because in aluminium the deposition of salts stops the development of print, but in aluminium the SPR white gave results in comparison to SPR black.SPR white gave best results for glass and only 66.66 % are found to be suitable for identification.SPR black gave results in glass also, in plastic approx.. 58% gave results .In aluminium 30% results were given by SPR black and 41% by SPR white. This shows that SPR white is better than SPR black in aluminium strip cases. The table shows the overview of the development of fingerprint and to how much % it is developed.

Fig1. objects submerged for 1 month of glass and plastic subjected to SPR white


Fig2. objects submerged for 1 month and 45 days of glass and plastic subjected to SPR black

Finger-marks were divided into three groups:

A -finger mark good for identification.

B- Finger-marks suitable for further examinations.

C-mark of no use and no observed mark.

Then the part % which is the % development of each no. of marks A, B, C are calculated.


Fig3. objects submerged for 45 days of aluminium samples subjected to SPR white

Finger-marks were divided into three groups:

Table 1 An overview of results of development on glass surfaces exposed to the effects of stagnant water in four (15, 30, 45 and 60 days) time intervals.

Method	Time	No. of deposited marks	A (No. of marks)	Part (%)	B(no. of marks)	Part (%)	C(no. of marks)	Part (%)
SPR(white)	15 days	3	3	100	3	100	0	0
	30 days	3	3	100	3	100	0	0
	45 days	3	2	66.67	1	33.33	0	0
	60 days	3	3	100	3	100	0	0
	Total	12	11		10		0	
	Part (%)	100	91.6		83.33		0	
SPR(black)	15 days	3	3	100	3	100	0	0
	30 days	3	2	66.66	2	66.66	0	0
	45 days	3	2	66.66	2	66.66	0	0
	60 days	3	1	33.33	1	33.33	0	0
	Total	12	8		8		0	
	Part (%)	100	66.66		66.66		0	

Table 2.An overview of results of development on plastic surfaces exposed to the effects of stagnant water in four (15, 30, 45 and 60 days) time intervals.

SPR(white)	15 days	3	3	100	3	100	0	0
	30 days	3	3	100	3	100	0	0
	45 days	3	2	66.66	2	66.66	0	0
	60 days	3	0	0	0	0	3	100
	Total	12	8		8		3	
	Part (%)	100	66.66		66.66		25	

SPR (black)	15 days	3	3	100	3	100	0	0
	30 days	3	2	66.66	2	66.66	0	0
	45 days	3	1	33.33	1	33.33	1	33.3
	60 days	3	1	33.33	1	33.33	1	33.3
	Total	12	7		7		2	
	Part (%)	100	58.33		58.33		16.66	

Table 3.An overview of results of development on aluminium surfaces exposed to the effects of stagnant water in four (15, 30, 45 and 60 days) time intervals.

SPR (white)	15 days	3	3	100	2	66.66	0	0
	30 days	3	2	66.66	1	33.33	0	0
	45 days	3	0	0	0	0	3	0
	60 days	3	0	0	0	0	3	0
	Total	12	5		3		6	
	Part %	100	41.66		25.0		50	
SPR(black)	15 days	3	0	0	0	0	3	100
	30 days	3	0	0	0	0	3	100
	45 days	3	1	33.33	1	33.33	2	66.66
	60 days	3	2	66.66	2	66.66	1	33.33
	Total	12	3		3		9	
	Part %	100	30.0		30.0		75.0	

In my present study, I concluded that as the time interval for submersion of objects is increasing the clarity of ridges or the development of prints is decreaing.The most suitable surfaces which showed reasonable quality of ridge-details and identifiable characteristics was glass. The aluminium surfaces gave good results up to 45 days but after 45 days the prints were not that much clear due to the deposition of salts that is present in water. In cases of glass the SPR white and SPR black both reagents gave good results as the molybdenum disulphide particles adhere to the fingerprint residues. It was observed from the study that the clarity of fingerprints decreases with an increase of submersion time intervals. Thus it is concluded that the best results were obtained on glass surfaces followed by plastic and aluminium surfaces. The prints on plastic and aluminium were not clear because of the salts and some inorganic materials present on stagnant water that would have interfered with the composition of sweat.

5. ACKNOWLEDGEMENT

Our thanks to all the people who helped us in completing this research.

4. CONCLUSION

The aim of this work is to recover the latent fingerprints present on three different surfaces (plastic, aluminium and glass) at different time intervals (15, 30, 45 and 60 days) through two SPR formulations. The study concluded that the prints were clear on the glass surfaces with both SPR white and SPR black. The poor results gave by aluminium surfaces but on aluminium SPR white gave 40% results that the SPR black.

The work was carried out with an objective to find out the best method of fingerprint development on different objects submerged in water at different interval of time. One should be aware that in real cases it will be difficult to find out whether the fingerprint on a submerged object were deposited before or during submersion.Consequently,it will be necessary to find out which reagent and procedures is the most effective in three cases. It is suggested that black powder and SPR were the most appropriate. The effectiveness of the reagents confirms the need for a sequential treatment of the samples, with the less damaging ones.

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