



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 Issue: X Month of publication: October 2017

DOI: <http://doi.org/10.22214/ijraset.2017.10131>

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Recent Advancement in Development of Latent Fingerprints by Various Physical Methods: A Review

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Abstract: Fingerprints play a very important role in forensic science and criminal investigations. When human fingers touches any porous or non porous surface, the sweat secreted from the fingertips can left and formed latent print. This can be visualize by UV lights and developed by different physical and chemical methods. After development it can recorded by either photograph or lifted by adhesive tapes for future reference of examination. There are, basically, three types of fingerprint evidence that may be found at a crime scene: latent or invisible prints, patent or visible prints and plastic or 3-D prints. This article is mainly concerned with latent prints, which, as the name suggests, are ordinarily invisible or less visible and thus require some means of development or enhancement for their visualization. After the observation of many studies, we have find out a number of physical method of development are available which was done by commonly used products like Robin© Blue, white cement, fuchsin dye etc.

Keywords: Latent Fingerprints, Physical methods, powder, evidence, crime scene, dye etc.

I. INTRODUCTION

Fingerprints are stable compounds and unless they are exposed to extremes of heat or humidity and/or friction, they may persist indefinitely. Latent print requires additional processing to be rendered visible and suitable for comparison. Latent prints are the most impotent example of Locard's Exchange principle : 'When two objects come into contact with each other, there is always some transfer of material from one to the other'; hence, the great importance of visualizing them onto useful evidence.¹ Most methods for the development of latent prints were developed on the basis of knowledge about the latent print residue composition. Over time, many investigators have explored new and improved techniques for the development and recovery of latent prints. In more recent years, new dimensions have been opened in latent print processing techniques, revolutionizing the field of fingerprint identification. New techniques have been developed not only for latent fingerprint detection, but also for fingerprint identification. These developments have significantly improved the efficiency of criminal investigation and personal identification.²

II. THE POWDER

The simplest and most commonly used procedure for latent fingerprint development is powder dusting. Powder dusting is a "physical" method of enhancement that relies on the mechanical adherence of fingerprint powder particles to the moisture and oily components of skin ridge deposits. Application of powder to latent prints by brushing is a simple technique and yields instantly apparent prints, but it also has disadvantages. Contact of the brush with the fingerprint ridges has an inevitably destructive effect. The use of fingerprint powders dates back to the early nineteenth century. In general, there are four classes of fingerprint powders: regular, luminescent, metallic, and thermoplastic. Regular fingerprint powders consist of both a resinous polymer for adhesion and a colorant for contrast. Hundreds of fingerprint powder formulas have been developed over the years.²

However, these traditional methods for latent print detection are not always effective and scientists have attempted to improve the existing methods for the visualization of latent prints. The list of different powders which have been used by various workers for the development of latent fingerprints on different surfaces is shown in Table 1.

Table 1 showing different powders used by various workers

Lead powder	Graham (1969) ³
Rhoda mine B dye	Kerr et al. (1983) ⁴
Robin© blue (2015) ⁵	Neeti Kapoor et al.
Basic fuchsin dye	R. Rohatgi et al. (2016) ⁶
Eosin blue dye	Sodhi et al. (1997) ⁷
Turmeric	Garg et al(2011) ⁸
Crystal violet dye	Sodhi and Kaur(2012) ⁹
Basic yellow 40	Exline et al(2003) ¹⁰
Cyano blue dye	Sodhi and Kaur(2004) ¹¹
White cement	Garg et al(2014) ¹²

III. METHODOLOGY

The methodology of the development of latent fingerprint by powder is very simple. When the latent fingerprint is revealed, a fine fingerprinting brush (usually camel hair brush) is applied along with the powder. If the surface is coloured then the powder is selected from opposite colour like if the surface is white then black, blue, or red colour powder are preferred. The brush is applied one direction first and then other direction second, and the flow towards the ridge start appearing. When sufficient powder adheres to the prints, the excess amount of the powder is carefully brushed with light touch. The developed print is then photographed. A variety of fingerprint powder with different compositions and colours are available in the market (mentioned in the table 1). The various workers was used this powders for develop the latent prints on various surfaces. Some powders are as follows-

A. Black powder

- 1) Ferric oxide powde
- 2) Manganese dioxide powder
- 3) Lampblack powde
- 4) Photocopy toner etc.

B. White powder

- 1) Titanium dioxide powde
- 2) Chalk-titanium oxide powde
- 3) White cement etc.

C. Grey powder

- 1) Chemist grey
- 2) Lead carbonate etc.

IV. DISCUSSION AND EVALUATION

It was observed that the adherence of physical powder to the print is depends on the size of the particle used for development. If the particle size is higher, then the print becomes smudgy and not very clear. The various workers used very fine powder particle such

as white cement. The white cement is used for fixing floor tiles and the particle is very fine.¹² Another method used to develop latent print by turmeric powder, generally found in the form of plant *Curcuma longa* of ginger family. Before applying the powder on the surface, ensure that the particle size is fine. Because that formation of good print is depends on the fineness of the particle.⁸ The use of Robin© powder blue was also suggested to develop the latent print. This is a post wash whitening agent of cloths and popularly known as 'neel'. It gives blue to violet blue colored prints on various non porous surfaces like door knob, computer mouse, credit cards etc. The print was also clear. But sometimes it was found to be adulterated. Means that the particle size can be vary so the developed print may be unclear or smudged. The Robin© powder blue color is always blue so if the print is located on the blue colored surface the identification of print may be difficult.⁵ Conventional powder methods is less effective in developing latent prints on multicolored surfaces due to poor contrast. Its effectiveness further resolve with Basic yellow 40 and Rhodamine 6G were recommended. The Robin© powder blue was also suggested for this.^{4,5} A cyno blue dye based latent fingerprint development was also recommended.¹¹

V. CONCLUSION

Regular fingerprint powder consists of both a resinous polymer for adhesion and colorant for contrast. More than hundreds of fingerprint powders have been developed. There are many different types' colors or metallic fingerprint powder are commercially available. Some of the chemical substance used as fingerprint powder are eco-friendly, non-toxic and easily available but some are toxic or hazardous including antimony trisulphide, cobalt oxide, copper powder, tin powder, lead sulphide, titanium dioxide. Safety procedures and caution should be followed when preparing or using the powders. In recent years, researchers have been developed and improved the powder dusting techniques. But there are more advancement needed. More research is required to improve the sensitivity and quality of the development of latent fingerprint by powder method on different colored surfaces.

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