http://scidoc.org/IJFP.php

SciDoc Publishers
Infer, Interpret & Inspire Science

OPEN ACCESS

International Journal of Forensic Science & Pathology (IJFP)
ISSN 2332-287X

Visualization of Latent Fingermarks using Rhodamine B: A New Method

Case Report

Kapoor S[1*], Gurvinder S. Sodhi[2], Sanjiv K[3]

[1] University Science Instrumentation Center, University of Delhi, Delhi, India.
[2] Forensic Science Unit, S.G.T.B. Khalsa College, University of Delhi, Delhi, India.
[3] Department of Chemistry, Indira Gandhi National Open University, Maidan Garhi, Delhi, India.

Abstract

There are various methods available for the development of latent fingerprints on different substrates. This paper presents a new powder method for the development of latent fingerprints on different porous and non porous substrates. A fluorescent small particle reagent (SPR) based on zinc carbonate hydroxide monohydrate, also called basic zinc carbonate has been formulated. The other ingredients of the formulation are Rhodamine B dye and a commercial liquid detergent. The composition develops clear, sharp and detailed fingerprints on a large number of non-porous items, after these were immersed in water up to 96 hours. The raw materials used to prepare the SPR are cost-effective and non-hazardous. The novel formulation develops prints of a better quality as compared to the conventional, molybdenum (IV) sulfide-based composition. The fluorescent nature of the reagent helps enhance weak, fragmented and chance fingerprints that are often found at crime scenes.

Keywords: Latent Fingerprints; Development; Substrates; Small Particle Reagent; Conventional Powders; Rhodamine B.

***Corresponding Author**:
Smily Kapoor,
University Science Instrumentation Center, University of Delhi, Delhi-110007, India.
Tel: 9873115130
E-mail: smily248@gmail.com

Received: August 18, 2015
Accepted: November 06, 2015
Published: November 10, 2015

Citation: Kapoor S, Gurvinder S. Sodhi, Sanjiv K (2015) Visualization of Latent Fingermarks using Rhodamine B: A New Method. *Int J Forensic Sci Pathol.* 3(11), 199-201. **doi: http://dx.doi.org/10.19070/2332-287X-1500048**

Introduction

In forensic investigations, fingerprints are considered a very important type of physical evidence. Finger marks are frequently found at crime scenes. The latent fingerprints, deposited by the ridges of the finger or palm are a complex mixture of natural secretions and contaminants from the environment. The development and visualization of latent fingerprints on some rare substrates have remained a challenge to forensic scientists. Various methods are available to develop the latent fingerprints in the literature. However the traditional method for developing the fingerprints is the powdering method [1]. In this study a new material (powder) has been identified which can be used for the development of latent fingerprints present on both nonporous and porous substrate. Small particle reagent is considered to be a wet suspension method for development of latent fingerprints on broad spectrum crime scene evidence. It is sensitive to the lipid constituents of fingerprint sweat and is efficient for processing fingerprints on articles that have been accidently or intentionally wetted [2]. In regular small particle reagent, a suspension of molybdenum (IV) sulfide in a surfactant is used as a base material [3]. The crystal dimensions of molybdenum (IV) sulfide are significant for fingerprint development. The reason being that the quantum of attraction between molybdenum (IV) sulfide and the lipid deposition is influenced by the unit cell parameters of the former. However, as the base material is gray in color, the fingerprints developed on dark colored surfaces are not satisfactorily clear due to lack of contrast. A formulation based on white basic zinc carbonate, the unit cell dimensions of which are comparable to those of molybdenum (IV) sulfide, serves to overcome this problem by developing sharp fingerprints on dark colored articles [4]. Titanium dioxide may also be used for preparing a small particle reagent formulation. It develops white colored fingerprints on plastic, glass and metallic articles [5]. In this communication, we report the utility of a fluorescent fingerprint dusting composition based on Rhodamine B dye. It detects latent impressions on different porous and non-porous items. When suspended in water containing a few drops of a liquid surfactant, the composition acts as small particle reagent and lifts fingerprints on wet non-porous articles. In many countries, including India, the first responders are the police personnel, most of who are from non-science background. A single composition which can develop latent prints on both wet and dry surfaces is deemed to be of great support to them.

Materials and Methods

Rhodamine B dye, titanium dioxide, lycopodium and gum rosin were procured from Sigma-Aldrich India, New Delhi and used without further purification. Basic zinc carbonate was purchased from Glaxo Laboratories, New Delhi. Genteel liquid detergent was used as the surfactant. To a suspension of basic zinc carbonate (3.0 g) in 10 mL distilled water, Rhodamine B dye (0.01g), titanium dioxide (2.0 g), lycopodium (0.1 g), and gum rosin (0.1 g) were added. The contents were thoroughly mixed, stirred and then allowed to dry under natural conditions. The solid mass was ground to a minute powder, the particle diameter being approximately 1 μm. The dye content in the composition was 1.5% by mass.

To a suspension of 5.0 g of the powder in 75 mL water, few drops of liquid detergent, Genteel R is added. The surfactant is a linear chain of alkylbenzene sulfonate. The contents were thoroughly mixed. The latent fingerprints were collected on different substrates which include porous as well as non-porous surfaces. The fingers were first lightly rubbed on the forehead and then pressed on the relevant surface. The entire study was conducted in winter season when the temperature was 18-20°C and relative humidity 60–75%.

The non-porous substrates used in this work are plastic sheet (of PET variety), glass slide, tacky side of transparent electrical tape, ceramic tile and stainless steel disc. The porous substrates used in this work are A4 size paper and glossy paper.

The composition was dusted on different surfaces containing the latent fingerprints with a camel hair brush. Subsequently, excess powder was blown off. The ridge pattern of the fingerprints was rendered discernible. The fluorescence of the prints was observed in cyan polylight (Rofin; Model PRY-002) of wavelength 505 nm with camera barrier filter of band pass IF565.

The non porous surfaces were earlier immersed in water from 0 to 96 hours. In other setup, the nonporous substrates kept in freezer (-50C) from 0 to 96 hours. After waiting for one minute, the items were washed under a mild stream of water for 30 s and then dried with a hair dryer for 30 seconds. Clear and sharp fingerprints were developed. The developed fingerprints were illuminated with radiation having 505nm wavelength. When observed through orange goggles, fingerprints showed fluorescence.

The test solution remained stable for 6 months. The developed prints were captured by digital camera (GE X5) in the auto mode. All the photographs were taken with full resolution (14 mega pixels) to capture better quality details. The images were stored in the jpeg format for record.

Results and Discussion

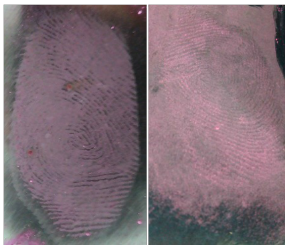
Small particle reagent technique has proved its worth in detecting finger marks on moist, smooth surfaces. The unique feature of the present formulation was its fluorescent nature. The fluorescence arose because of the incorporation of Rhodamine B stain in the composition. The other ingredients of the present 40. SPR were basic zinc carbonate, gum rosin and lycopodium proved to be good for adhesion.

A sample fingerprint developed on Glass, A4 size paper and plastic sheet (PET) film respectively using dry powder formulation is shown in Figure 1. The quality of developed prints is not compromised even after a lapse of 120 days.

Figure 1. Latent fingerprints developed on (A) Glass; (B) A4 size paper; (C) PET film using dry powder formulation.

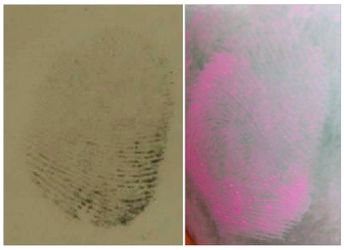
The novel composition developed sufficiently clear and identifiable fingerprints on metallic as well as on glass surfaces which had remained in water for up to 96 hours. Good quality prints have been lifted from substrates kept in freezer also. Each print was developed after a gap of 12 hours. A sample fingerprint developed respectively on metallic surface and plastic tape after 36 hours of immersion in water was shown in Figure 2.

Figure 2. Fingerprints developed on (A) metallic surface; (B) plastic tape; after 36 hours of immersion in water by using SPR suspension.



The quality of developed fingerprints, both by the powder composition and by SPR formulation, was gauged on the basis of friction ridge clarity and degree of fluorescence, on a scale ranging from zero to 10, according to the criteria laid down by SWGFAST [6].

Figure 3. A latent impression developed by (A) molybdenum (IV) sulfide formulation and (B) novel SPR formulation on paper after 120 days.



The fingerprints developed within a period of 30 days by powder formulations, and by SPR formulation after 48 hours of immersion in water may be accorded a scale of 8-10. The conventional black powder was used for comparative study. A comparison between the quality of fingerprints developed by using the novel formulation and the conventional, molybdenum (IV) sulfide formulation was carried out on paper. The result was shown in Figure 3(A) and 3(B). Latent fingerprint developed on glass substrate with SPR formulation after kept in freezer for 48 and 96 hours represented in figure 4(A) and 4(B).

Figure 4. Latent fingerprint developed on glass substrate with SPR formulation after kept in freezer (A) for 48 hours, (B) for 96 hours.

The shelf life of the reagent developed is found to be acceptable for case work purposes. Reduction in fluorescence in prints immersed for 96 hours was noticed which obviously may due to a dilution of the residue material in latent fingermarks as a consequence of immersion for a long period. As a part of SPR formulation this was deemed unnecessary since a suspension of basic zinc carbonate in water would not injure the eyes. In comparison, molybdenum (IV) sulfide, which is used in conventional SPR formulation, is a skin irritant [7]. Zinc carbonate is an astringent and topical antiseptic. It does cause eye irritation [8].

Conclusion

Latent fingermarks may be present on objects with multicolored surfaces. If these objects are immersed in water for a period of time and suspected to have latent fingerprints, SPR may prove very useful in the recovery of the marks. It offered a convenient and economical methodology to detect latent fingerprints on a broad spectrum of items. It may be used both as a powder as well as a small particle reagent. Its capability to detect weak and faint fingerprints by virtue of its fluorescent characteristics not only enhances its utility, but also its potentiality in casework investigations.

Acknowledgement

Financial assistance from University Grants Commission, New Delhi is gratefully acknowledged.

References

[1]. Sodhi GS, Kaur J (2001) Powder method for detecting latent fingerprints: a review. Forensic Sci Int 120(3): 172-176.
[2]. Ramotowski R (2013) Lee and Gaensslen's Advances in Fingerprint Technology. (3rd edtn), CRC Press, Boca Raton, USA.
[3]. Mock JP (1984) Recent development on the use of small particle reagent. Identification News 34(2).
[4]. Frank A, Almog J (1993) Modified SPR for latent fingerprint development on wet and dark objects. J Forensic Identification 43(3): 240-244.
[5]. Polimeni G, Feudale FB, Saravo L, De Fulvio G (2004) A novel approach to identify the presence of fingerprints on wet surfaces. Forensic Sci Int 146: S45-46.
[6]. SWGFAST, Standard for the Documentation of Analysis, Comparison, Evaluation, and Verification (ACE-V) (Latent), 2/12/10, version 1.0. www.swgfast.org
[7]. Material Safety Data Sheet: BEMOLTM Molybdenum Disulfide Powder, www.rosemill.com, Bemol_MoS2_MSDS.pdf
[8]. Safety Data Sheet: Zinc carbonate, www.greenagro.net, http://www.greenagro.net/ftp/greenmot_zinc_carbonate/