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ORIGINAL ARTICLE

Development of latent fingerprints on wet non-porous surfaces with SPR based on basic fuchsin dye

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Abstract: Small particle reagent (SPR) is a technique performed to detect latent fingerprints left on wet and moist surfaces based upon the reaction between fatty acid residuals present in the traces and hydrophobic tails of the specific reagent. Those tails are linked to a hydrophilic head of zinc carbonate based formulation to give coloured precipitate. In the present study, we have prepared a novel SPR formulation constituting of zinc carbonate based on basic fuchsin dye for the development of latent fingerprints on wet surfaces. It was shown to develop clear, sharp and detailed fingerprints on non-porous surfaces after these were immersed in water for up to 45 days. The ability of the present formulations to detect weak and chance prints not only enhances its utility, but also its potentiality in forensic casework investigations. The raw materials used to prepare the SPR are cost-effective and non-hazardous.

1. Introduction

Criminals usually tread carefully and try not to leave any traces at the scene of the crime. Investigators are frequently faced with the fingerprint detection and their subsequent development tasks. In some cases offenders try to destroy the traces by throwing items, e.g., bottles, firearms, plastics, foils, etc. in water or by exposing the scene and objects to extreme conditions like arson. Previously many researchers have developed and used fingerprint powder formulations, with each formula consisting of a colourant for contrast and a resinous material for good adhesion. Hundreds of fingerprint powder formulas have been developed over the years. In the past, powder dusting, ninhydrin dipping, iodine fuming and silver nitrate soaking, cyanoacrylate fuming were the most commonly used techniques for latent print development. These traditional techniques are quite effective for many surfaces.[1–5] 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[6–28] for the development of latent fingerprints on different surfaces is shown in Table 1.

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Table 1 Displays various chemical powders used by different workers for development of latent fingerprints.

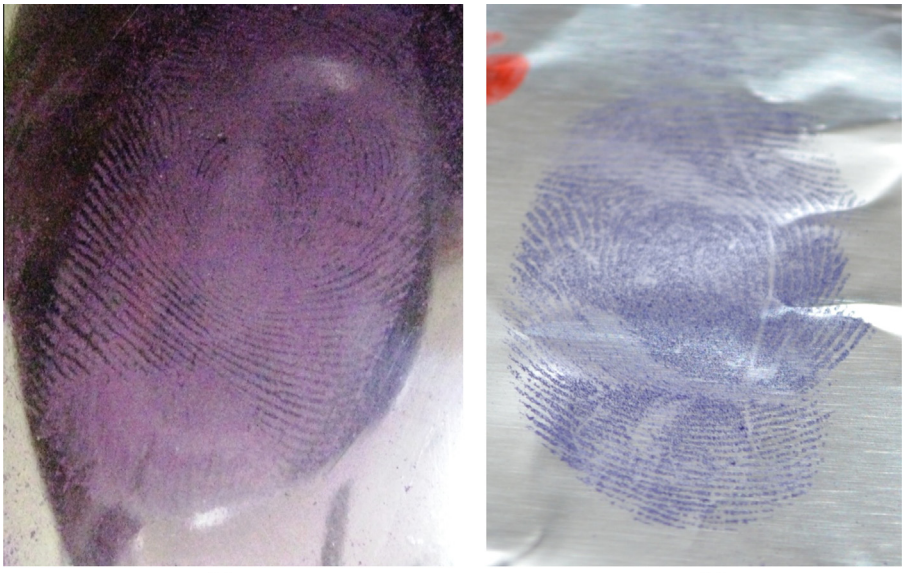
Sudan III	Bridges (1963)[6]
Lead powder	Graham (1969)[7]
Rhodamine 6G	Almog and Gabay (1980)[8]
Titanium oxide powder	Goode and Morris (1983)[9]
Rhodamine B dye	Kerr et al. (1983)[10] and Sodhi et al. (2003)[21]
Rhodamine 6G	Sears and Fitzgerald (2003)[11] and Exline et al. (2003)[22]
Fluorescein dye	Kerr et al. (1983)[12]
Basic fuchsin dye	Howard (1993)[13]and Sodhi et al. (2004)[25]
Eosin blue dye	Sodhi et al. (1997)[14] and Dhall et al. (2013)[27]
Eosin yellow dye	Sodhi and Kaur (1999)[15] and Dhall et al. (2013)[27]
Phloxine B dye	Sodhi and Kaur (2000)[16]
Guinea green dye	Sodhi and Kaur (2001)[17]
Aniline blue dye	Sodhi and Kaur (2002)[18]
Azure I dye	Sodhi et al. (2003)[19]
Azure II dye	Sodhi and Kaur (2004)[20]
Basic yellow 40	Exline et al. (2003)[22]
Basic red	Exline et al. (2003)[22]
Congo red dye	Sodhi et al. (2003)[23]
Cyano blue dye	Sodhi and Kaur (2004)[24]
Crystal violet dye	Sodhi and Kaur (2012)[26] and Rohatgi et al. (2014)[28]

SPR is a technique performed to detect latent fingerprints left on wet or moist surfaces based upon the reaction between the fatty-acid residuals present in the traces and hydrophobic tails of the specific reagents. Those tails are linked to a hydrophilic head, which reacts with metal salt to give coloured precipitate. In conventional small particle reagent, a suspension of molybdenum disulphide in a surfactant solution is used as a base material. Zinc carbonate, titanium dioxide and ferric oxide are some other materials used in SPR. However, as the base material is grey in colour, the fingerprints developed on dark coloured surfaces are not sufficiently clear due to lack of contrast.[29–31] Therefore, a formulation based on white coloured basic zinc carbonate, basic fuchsin and a commercial liquid detergent was prepared for developing latent fingerprints on crime scene evidence that were exposed to water for varied periods of time. The present study is done to investigate if novel SPR formulation prepared can recover latent fingerprints on glass and metal surfaces submerged in stagnant water at various time intervals. The subsequent results were compared with already in use SPR formulation based on crystal violet dye to conclude its efficacy.[28]

2. Materials and methods

2.1. Materials

Basic zinc carbonate was purchased from Glaxo Laboratories, while basic fuchsin and crystal violet were procured from Sigma–Aldrich[32] and Genteel^{R} liquid detergent was used as



(a) **(b)**

Picture 1 Latent prints developed on non-porous metallic surfaces after immersion in water (a) 5 days with formulation A; (b) 10 days with formulation B.