

Development of Latent Fingerprints on Various Surfaces- A Review

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ABSTRACT

In recent times the fingerprints are obtained as key evidence from various crime scenes. This plays a vital role in solving the crime. Fingerprint development on various surfaces by powder method is very easy method for latent fingerprint visualization. Numerous techniques have been documented in the literature for revealing latent fingerprints on a variety of surfaces. In this present review paper, powders rather than standard powders are used for fingerprint development. Fingerprints have been developed on various surfaces using turmeric powder, soil, silica gel G powder, etc. Development of fingerprint on challenging surfaces is difficult. Powders used for fingerprint development is expensive so some easily available, inexpensive, eco-friendly powders are studied in this review.

Keywords : Evidence, Fingerprint Development, Standard Powders, Turmeric Powder, Soil, Silica Gel G Powder, Eco-Friendly.

I. INTRODUCTION

Dactyloscopy is used for the scientific study of fingerprints. Fingerprints evidence is commonly found at the majority of crime scenes. Finger ridges secrete sweat, and when they come into contact with any surface, they create impressions of fingerprints patterns on it. These impressions, created by fingertips, are not visible to the naked eye, so they are known as latent fingerprints. New methods are being developed for the visualization of fingerprints on various substrates. Latent Fingerprints are generally found on the different surfaces which are classified in three parts as porous, non-porous and semi-porous surfaces.

Fingerprints were firstly introduced by Sir. Francis Galton (Father of fingerprint). Sir Edward Richard Henry introduced the classification methods of fingerprints. Fingerprint powder is commonly used for developing latent fingerprints. There are four common methods of fingerprint powders i.e. ordinary fingerprint powder, luminous fingerprint powder, thermoplastic fingerprint powder and metallic fingerprint powder (Sri Adelila Sari, 2021).

Fingerprints on porous surfaces can be developed using black powder (Sara Moreno, 2021), durian seed powder (Nur Fatin Zulkifli, 2017), MMD (Eric stauffer, 2007), sandalwood powder (Niranjali Suresh

Suryawanshi, 2023). Fingerprints on non-porous surfaces can be developed using cyanoacrylate (Somaya madkour, 2017), Small Particle Reagent technique (SPR) (Richa Rohatgi, Development of latent fingerprints on wet non-porous surfaces with SPR based on basic fuchsin dye, 2015), powder method (Nur Fatin Zulkifli, 2017), (Niranjali Suresh Suryawanshi, 2023). Often at the crime scene poses various evidences. On this evidences we need to develop fingerprints. Sometimes latent fingerprints are not developed because of less contrast. In this present review, we take a closer look at the various available methods for the development of fingerprints on different substrates.



Fig. 1 Example of fingerprint on the mirror surface using durian seed powder (Nur Fatin Zulkifli, 2017)

II. METHODS AND MATERIAL

Development of fingerprints on various surfaces by using naturally available powders has gained a growing interest from the research community in recent years. Fingerprints are found on many crimes scenes. Fingerprints are considered as key evidence.

Development of fingerprint on various surfaces by using fruit seeds powder

Durian seeds contain main component starch, which adheres physically to both aqueous and oily components of latent fingerprint. This experiment was conducted on eleven different surfaces. The powder of durian seed is white in nature. However, a drawback of durian seed powder is that it does not visualize latent fingerprints on white surfaces (Nur Fatin Zulkifli, 2017).

Development of fingerprint on various surfaces by using Pooja material

Baser et al., used non-conventional powder which generally used for the God's pooja. The fingerprint ridges have small pores which secretes sweat. Fingerprints are developed by using saffron, sandalwood, white abir, pink abir, ashtagandha powder, ash powder. Powder dusting or tapping method is used for fingerprint developed. Here dark colored powders are used for white surfaces and for dark surfaces light colored powders are used (Ayush Baser, Visualization of Latent fingerprints at crime scene using pooja materials, 2022). Similarly possible use of freshly grinded turmeric from rhizomes for developing the fingerprints on various surfaces was studied by Garg et al. Surfaces used for study such as normal paper, thermal paper, bond paper, transparent sheet, aluminum foil, wooden surface, plastic painted steel. They included comparison between standard black powder and turmeric powder and found good and clear results on substrates (Rakesh K. Garg, A new technique for visualization of latent fingerprints on various surfaces using powder from turmeric: A rhizomatous herbaceous plant(*Curcuma longa*), 2011). Similar impressive results using sandal wood powder are obtained. They tested this powder on various surfaces like metal surfaces, mobile surfaces, plywood surfaces, glass surfaces. The fingerprints are developed clear after lifting process (Niranjali Suresh Suryawanshi, 2023).

Visualization of latent (invisible) fingerprints on different surfaces by using vegetables

Skin has small pores which secrete sweat. Sweat is excreted from eccrine gland which contains more amounts of water, minerals, salt and urea. Different vegetables such as beetroot, turmeric and Broccoli powders were used for development of latent (invisible) prints. In this experiment turmeric, beetroot and broccoli was grinded and extracted the juice from it. The extracted juice was dried in air and dried extract was grinded again into fine talcum level powder. Broccoli powder was very fine so, it develops very clear results as compared to beetroot and turmeric powder (Jamal, 2019).

Spinach leaves powder potentially adheres to latent fingerprint because the pigment in spinach leaves can form a pattern when the leaves are blanched and dehydrated. Spinach powder has been found to be a useful material for developing fingerprints on the different surfaces in crime scene investigation. This could be a sustainable and eco-friendly option for forensic analysis (Sarika Yadav, 2020). Similar results and impressions of latent fingerprint are got by using Gambir powder. Here aluminum foil, glass slide, plastic cup, compact disc, transparent plastic was used for testing the selected powder (Sari sari, 2019).

Development of fingerprint on various surfaces by using commercially available powders

Latent fingerprint development by using the silica gel powder (which is usually used for making TLC plate) gives clear results on the majority of surfaces. The selected substrates includes glass, ordinary mirror, plastic and metallic surfaces, aluminum foil, cardboard, carbon paper, gloss-painted wooden surface, match box, writable surface and top of the CD and glazed colored magazine paper surface. The comparison of silica gel powder with standard white, light gray, black powder has been included in their study (Kulvir Singh, 2012). Badiye and Kapoor have investigated the possible use of Robin powder blue

(which is used as a post wash whitening agent) in developing the fingerprints on various surfaces. 24 different substrates are used for the study. The powder was blue in color so it gives good contrast on majority of substrates (Ashish Badiye, 2015).

Development of fingerprint on various surfaces by using soil

The adherence of soil particles to a latent fingerprint is primarily due to the presence of moisture or natural oils in the fingerprint residue. These substances create a slightly sticky surface, which can attract and hold onto fine soil particles through weak physical forces. Kamble et al. used soils of different colors to develop the latent fingerprints on substrates. It gives clear results on the contrast substrates (Dinesh Baban Kamble, 2018). Similar study was conducted by using Fuller's earth (multani mitti) on nine different surfaces. The comparison of fuller's earth with standard gray, black, white and magnum powder has also been included in their study (Pallavi Thakur, 2016).

Visualization of fingerprints on various surfaces by using Household food items

Eight different household food items such as cocoa powder, corn flour, baking powder, black salt, turmeric powder, custard powder, baking soda, edible food (orange color) are used for the latent fingerprint visualization on porous and non-porous surfaces. This gives better results on majority of surfaces. The drawback of this study is that it could not produce prints on rubber and cardboard (Richa Rohatgi, New visualizing agents for developing latent fingerprints on various porous and non porous surfaces using different household food items, 2014).

III.RESULTS AND DISCUSSION

In this review paper, various powders are used in development of latent fingerprints. The eco-friendly, easily available, less expensive powders are mainly

studies in this review. The powder method is an unrivaled technique in the field of forensic science for revealing latent fingerprints on a wide range of surfaces. It is crucial to acknowledge the persistence challenges and limitations in applying powder technique, particularly on challenging area.

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