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Advancement in fingerprint identification over the last decade

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ABSTRACT
Fingerprints play a significant part in criminal identification. The development of latent fingerprints is a crucial phase in the whole process of fingerprint recognition. For many years, many chemical and metal powders have been utilized in the field of Forensic Science. However, there are novel methodologies emerging from the realm of green chemistry. This article examines advancements in fingerprint creation and recognition.

Keywords: Fingerprints, Green chemistry, Powder methods, Identification

INTRODUCTION

Fingerprints are a distinctive distinguishing characteristic of humans. Owing to their distinctive and enduring attributes, they are employed in civil and criminal investigations[1], [2]They are among the earliest and generally recognized physical evidence that aids in the individualization of a person. The fingermarks may be readily retrieved from the murder scene, establishing a clear connection to the culprit[1], [2]Fingerprints consist of perspiration residues and fatty acids excreted from the pores of the friction ridge skin on fingers. The imprints discovered at the crime scene are typically imperceptible to the unaided eye and are hence referred to as latent fingerprints. Eccrine, apocrine, and sebaceous glands facilitate natural secretions from the fingertips. The palms of the hands have many eccrine glands. These glands produce transparent perspiration. It consists of roughly 99% water, 0.5% organic matter, and 0.5% inorganic matter. Eccrine sweat comprises amino acids, choline, creatinine, lactic acid, proteins, carbohydrates, urea, and uric acid, whereas sebaceous sweat contains fatty acids, glycerides, squalene, sterol esters, and wax esters[3], [4]Experts have employed several fingerprint identifying methods for many years. The most effective and dependable technique for identifying fingerprints is the powder method.Fingerprint powders have been utilized since the last decade of the 19th century. Sir Edward Richard Henry (1850-1931), the architect of the fingerprint classification system, advocated for the utilization of mercury-based and graphite-based powders.Traditional powder techniques include chemical powders.

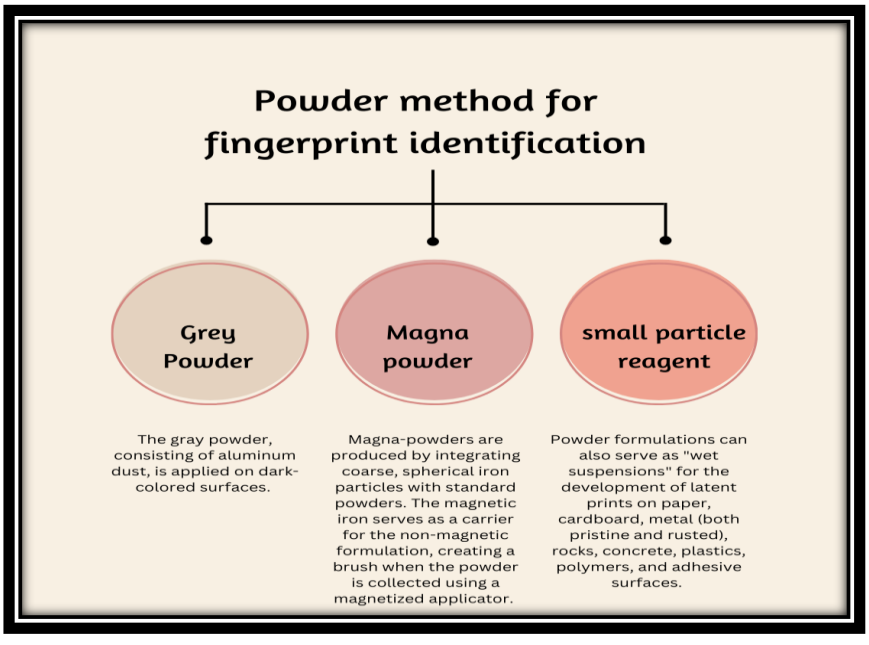

Figure 1 Different Powders for Fingerprint development

Old Chemical Powder methods

Prior to the application of the powder formulation, the surface must be visually inspected for fingerprint impressions. The print must initially be captured with a suitable filter. The pertinent powder must be applied using a gentle brushing technique. Precautions must be made to prevent the smearing of the impression. The surplus powder should thereafter be eliminated by lightly striking the surface. The completed print should be photographed once again. Ultimately, it must be elevated with tape and archived for documentation. The Gray powder, consisting of aluminium dust, is utilized on dark-coloured surfaces. This is also applicable to mirrors and polished metallic surfaces, as these surfaces will appear black in photographs. The black powder, consisting of charcoal, is utilized on white or light-coloured surfaces[5]Magna-brushes and magna-powders can be utilized to prevent smearing[6]. Magna-powders are produced by integrating coarse, spherical iron particles with traditional powders. The magnetic iron serves as a carrier for the non-magnetic formulation, creating a brush when the powder is collected using a magnetized applicator. Upon brushing the imprint, only the minute particles of the formulation stick to the fingerprint remnant. After the print has been produced, the surplus powder may be removed from the applicator by retracting the magnetized steel rod.To enhance the efficacy of magnetic applicators, magnetic flake particles may supplant magna-powders. In these formulations, the coarse iron particles are substituted by magnetic flakes that are drawn to the magnetic applicator[7].Common examples of inorganic-based fingerprint powders include formulations of ferric oxide and rosin, manganese dioxide and rosin, titanium dioxide and kaolin, as well as lampblack and fuller's earth [8]. The performance of the composition may be enhanced by applying the powder onto fine quartz or plastic particles. A black powder including iron oxide, quartz, kaolin, and carbon soot exemplifies a coated dusting formulation [9].

New chemical free Powder methods

In recent years, the cost-effective, strong adhesive properties, clear visibility, and non-toxic nature of waste materials have been derived from the peels and petals of oranges, lemons, roses, and hibiscus.New methods endeavoured to utilize several powders derived from waste materials for the development of latent fingerprints. These powders are readily accessible, non-toxic, and economical. Comparative analysis of latent fingerprint formation with orange peel powder (Citrus X sinensis) and lemon peel powder (Citrus limon) on various porous and non-porous substrates. These powders are far more economical, dependable, and environmentally sustainable than conventional fingerprint powder[10].The red beet, a reddish-purple vegetable, contains colours composed of a combination of betacyanin (betanin and its epimer isobetanin) and betaxanthins[11]. These veggies serve as a pigment component for fingerprint formation.Hibiscus sabdariffa is a reddish shrub extensively utilized in trade. The pigments contained inside it are anthocyanins, classified as flavonoids[11].

CONCLUSION

This paper concludes that fingerprint creation processes have to be substituted with eco-friendly, non-hazardous, and non-carcinogenic powder methods. Additionally, they may consist of plant-derived waste products. These solutions safeguard the health of forensic professionals engaged in crime scene investigations.

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