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DEVELOPMENT OF LATENT FINGERPRINTS BY USING ANIMAL HAIR POWDER

A novel approach to preparing unconventional powder

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Abstract: In forensic investigations, the relationship between the criminal, the victim, and the crime scene can be firmly established through the detection of latent finger marks. Latent fingerprints are one of the most frequently found evidence in crime scenes and are widely recognized as a tool for human personal identification. The purpose of this research is to investigate the feasibility and effectiveness of using unconventional powder in forensic investigations, as well as to emphasize their contributions to sustainable and ecologically conscientious crime scene analyses.

In this research paper, a new method for the development of Latent fingerprints is used that's Animal hair powder. The fine particles of animal hair Powder get combined with the fatty acid & oil present in the sweat of a fingerprint and the print is visible to our naked eyes. Animal hair, which is considered as animal waste, it is a much cheaper and readily available option.

This paper presents a non-destructive powder dusting method which is simple, non-toxic, most convenient, easily preparable, not time – consuming and the powder is available in black color. Moreover, it was also good for environmental waste management.

This research not only presents a novel approach to fingerprint development but also highlights the potential for the application of unconventional powders in forensic investigations. This study also opens up the scope of further study in this way.

Index Terms *- Latent Fingerprint, Unconventional Powder, Animal Hair, Non-Destructive***.**

I. INTRODUCTION

A fingerprint is an impression made by the friction ridges on a human finger. "Fingerprints" a combination of loops, whorls, arches, deltas, ridges and other physical characteristics of fingers are used for personal individual identification. Chance prints generally known as latent fingerprint, which are invisible in nature and mostly found on a crime scene [1].The papillary ridges on the tip of the fingers and thumbs provide an impression that known as fingerprint [2]. The ridges on fingertips begin to form on the palmer surface during the third month of pregnancy. And that remains unchanged in his/her entire life. [3] Fingerprints are distinct and do not change with age or growth. Fingerprint evidence at crime scene are important because to own individual characteristics, which is unique, permanent, universal, inimitable and classable.

Fingerprints are the most common form of physical evidence found at a crime scene. Whenever a person touches, holds or picks up an object, there's a high chance of transfer of their fingerprints onto the surface [4].

Based on locard's exchange principle as "Every contact leaves traces" the latent fingerprint is the most encountered print from crime scene. In the criminal justice system, fingerprint evidence is primary evidence at crime scene. Fingerprint of twins are also different.

Latent fingerprint impressions can discovered at crime scenes on variety of surface including porous, semi- porous and non-porous. The unique characteristics of fingerprint are often identified through minutiae points(ridge characteristics).The combination and arrangement of these minutiae points make each fingerprint unique[2].

The crime scene investigators often follow a two stage process when searching for fingerprint at the crime scene. First stage, they look for a patent or visible and plastic or 3D print since them visible or not, often times a flashlight are used during this time. The second stage involves a blind search for latent prints [5].

There are various methods used for the development of chance prints on crime scene. Especially, dusting method is one of the best and easiest methods used for development of chance print on crime scene. Commercial powders are sometimes hazardous to human health. Powders have been used to produce latent fingerprint, because the stick to sweat, oil, and other materials found in fingerprints. The print becomes apparent when the powder is placed to it. Fingerprint powders used in the past contained materials that were considered carcinogenic and toxic. In particular, lead and mercury components were removed from fingerprint powders due to associated cases of mercury lead poisoning[6]. Individuals who frequently use these powders should thus take the required precautions to reduce the risk of respiratory illness, such as wearing gloves and mask.

The most often used techniques for developing latent finger prints are silver nitrate, iodine fuming, ninhydrin dipping. Due to the potential for harmful and health-harming chemical substances, these approaches are not always effective and have certain limitations. In order toovercome this limitation, non conventional powders are employed in this study because they are inexpensive, easily available and it is safe, they won't hurt anyone.

In this study, We are going to develop a new fingerprint powder method which has different application comparing to the prevailing powder methods.In this study, we are going to develop a fingerprint powder for the development of latent fingerprints from black goat hairs. As it is radiantly available and can be prepared in few hours and nor it was harmful. The fine powder particle of animal hairs provides a good adhesion on both porous and non-porous surfaces.

II. OBJECTIVES

- To make cost effective fingerprint developing powder.
- To develop the latent fingerprint by animal hair powder.
- To develop black powder from animal hair for latent fingerprint visualization.
- To synthesis the unconventional powder for development of invisible fingerprint impressions.
- To use animal hair powder for visualization of latent fingerprints on different kinds of light surfaces.

III. MATERIALS

Animal hair (Black goat- Capra aegagrus hircus) , Mortar and pestle , Muslin cloth (Fine fabric cloth), Sieve, Small bowl, Gloves, A fine brush with soft bristles (Fingerprint Brush) ,Air tight plastic bottles ,Mobile phone.

IV. METHODOLOGY

4.1 Procedure for preparation of unconventional animal hair powder

Large amount of black goat hair was collected from the butcher shop. The collected hair samples were washed to remove the unwanted dust particles. And then dried under Sun light source, after that use the fire source as lighter or match box to fire the dried hair in order to reduce the quantity of hair sample. After then, crushed the fired hair by using hand and it was sieved using stainless sieve. Then using motar and pestle to grind the hair until it become into powder. After that using Muslin cloth to filter the powder (2

or 3 times). Now, fingerprint powder is prepared and transferred to an air-tight plastic container at room temperature until further use.

A. In the stage of partially crushed animal hair.

B. In the stage of fully grinded animal hair

C. In the stage of finely filtered animal hair powder.

4.2 Procedure for developing the latent fingerprints by using animal hair powder

For this study, latent finger prints are collected from donors on different chosen surface which include porous, non-porous, semi porous. The finger marks were obtained in natural condition, without any grooming to increase the amount of sebum on the finger-pads. The donors were instructed to sequentially apply their finger-pads to separate areas of the dictated surface type with light pressure.

The animal hair powder is sprinkled all over the questioned surfaces and fine powder will interact with the chemical composition of finger print and adhere with it and the ridges were developed. I had applied this powder with the help of fingerprint brush and it provides good adhesions on traces of perspiration with clear visibility of ridges. And at the end the developed fingerprint impressions was photographed by using mobile phone and transferred into laptop for future analysis (editing).

V.RESULT

Paper surfaces

Coated papers (Approx 10-100 nm porous size)

Fig 1: Latent fingerprints developed on ECF Paper (elemental chlorine free).

Fig 2: latent fingerprints developed on brown sheet cover (plastic coated).

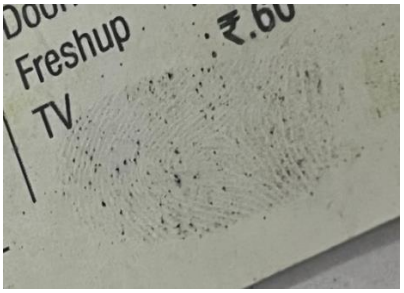

Fig 3: latent fingerprints developed on visiting card or business card.

Uncoated papers (Approx 100-1000 nm porous size)

Fig 4: latent fingerprints developed on A4 sheet.

Fig 5: latent fingerprints developed on chart paper.

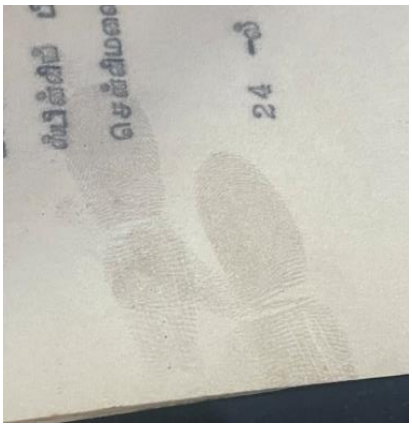

Fig 6: latent fingerprints developed on judicial bond paper.

Other surfaces

Fig 7: latent fingerprints developed on steel water bottle cap.

Fig 8: Latent fingerprints developed on plastic light switch.

Fig 9: latent fingerprints developed on white wall.

Fig 10: latent fingerprints developed on laptop.

Fig 11: latent fingerprints developed on mobile back case.

Fig 12: latent fingerprints developed on chalk piece.

Fig 13: latent fingerprints developed on heat oven outer surface (surface enlarged by magnifying glass).

Fig 14: Latent fingerprints developed on Thermocol sheet.

Fig 15: Latent fingerprints developed on plastic container cap.

VI .DISCUSSION

This research study shows that 15 samples of invisible fingerprints are successfully developed on different chosen surfaces with the help of animal hair powder. The development of invisible fingerprints on chosen surfaces such as Paper [Coated(elemental chlorine free paper, brown sheet cover, visiting card), Uncoated(A4 sheet, chart paper, judicial bond paper)], Steel water bottle cap, Plastic light switch, White wall, Laptop, Heat oven outer surface, Mobile back case, Chalk piece, Thermocol sheet, Plastic container cap could be successfully done. Through the figures 1-15 the Pattern and ridge characteristics of sample fingerprints are clearly observed and easily identified. These result advices that this animal hair powder is to be successfully employed as a new powder method on questioned surface for the enhancement of the latent finger prints It is also observed that after development of latent finger impression on various surfaces it is also clearly visible for certain days (with taping). Even it does not fade until and unless without any

destruction onto the surface it provides a positive impact. This powder is not examined on wet surfaces & also the surfaces which are in extreme heat and cold conditions. While the study provides a good substitute for fingerprint visualization, there are some potential issues that may arise during the process, such as inhalation of fine powder. Nevertheless, the use of everyday materials to reveal latent fingerprints is an important development in forensic science. This research has significant implications for forensic investigations, as it suggests that animal powder could be served as an effective unconventional powder. By improving the ability to detect and visualize latent fingerprints, this study could ultimately aid in the identification and helps to capture of perpetrators of crimes.

VII . CONCLUSION

The following research paper concluded that animal hair powder can be successfully used on various surfaces for the development of latent fingerprints. While preparing the powder, some properties such as size, stickiness and how the powder interacts with fingerprint residue are need to be considered. In that way, animal hair powder has good stickiness and adherence property and its size was too much reduced while grinding, mashing and crushing process. The feasibility of unconventional powders to create latent fingerprints was successfully demonstrated in the study, highlighting their importance in the forensic sciences. The scope for further enhancement on fingerprint powders using animal hair powder includes improving material selection, developing better formulation, exploring new application techniques, ensuring compatibility with surface. This type of research work is very beneficial to our criminal justice system and aid to solve crime. This type of work has not been reported previously and can provide useful information to the investigators in cases of shortage or non-availability of systematic conventional fingerprint development powders. Overall, it significantly improves the reliability, safety, and ethical standards in forensic fingerprint analysis.

FUTURE RECOMMENDATIONS

- To examine this powder on other latent prints such as palm prints, sole prints, lip prints for development.
- To examine this powder on the surface which are in extreme heat and cold conditions.
- Doing further study in more surfaces to determine the effective development.

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