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Developing Latent Fingerprints: A Study with Sacred Ash, Vermillion, Corn Flour on Diverse Surfaces

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Abstract: ***This study analyzes the development of latent fingerprints using daily materials, with a focus on creating chemical - free, non - toxic, and cost - effective fingerprint powders. Commonly used fingerprint powders often contain chemicals that may be harmful or expensive, limiting their application and availability. In this gap, this study aims to develop alternative powders using readily available materials, particularly corn flour, sacred ash, and vermilion, which are non - toxic, inexpensive, and environmentally friendly. The impact of these powders will be evaluated on a range of surfaces, including door locks, tiles, granite, eyeglasses, polished wood, stainless steel, and tempered phone glass, to assess their ability to reveal latent prints under various environmental conditions. The study will examine the powders based on factors such as visibility to make sure they meet the practical requirements of fingerprint analysis in various forensic investigations. The project aims to offer a user - friendly alternative to traditional fingerprint powders by means of using daily materials. The result will help to build inexpensive, more exact, widely usable tools for forensic investigations, therefore providing a solution that is more Suitable for a wide range of investigations.***

Keywords: Latent fingerprint, vermilion, sacred ash, corn flour

1. Introduction

A fingerprint is a mark created by the raised patterns on a person's finger. Collecting partial fingerprints from a crime scene is an important method in forensic science. The study of fingerprints, palm prints, and footprints is known as dermatoglyphics. Fingerprints are vital tools in criminal investigations because of two main features: they are unique, and they don't change over time. The specific traits of the skin ridges are present from before birth and remain until the body decomposes after death. To find hidden fingerprints, the powder method involves sprinkling a fine substance onto the fingerprint impression, often applied with a glass - fibre or camel hairbrush. The powder sticks to the sweat left behind that outlines the ridge pattern. Areas without fingerprint residue do not hold the powder. Therefore, the powder attaches to the ridges while it can easily be blown off the smooth areas. Since the powder is often coloured, the ridge pattern becomes clear, allowing the latent print to be seen.

Significance of Fingerprints:

- Recognition of offenders whose fingerprints are located at the crime scene.
- Support for prosecutors in demonstrating their cases considering the defendant's prior records.
- Sharing criminal identification information with identification agencies of other countries in relevant cases.
- Aid probation or parole officers and parole boards for their clarity in decision - making.
- Application of fairer sentences by the judiciary.
- Recognition of individuals and upkeep of identity records (service or criminal).
- Recognition of individuals experiencing amnesia.
- Recognize victims of disasters.
- Avoidance of hospital errors in the identification of infants.
- Recognition of individuals who are missing.
- Recognition of licensing processes for automobiles, firearms, aircraft, and other equipment.
- Recognition of unconscious individuals.
- Issues of erroneous identity.
- Verification of accurate identity in instances of abduction.
- Detection of fraudulent bank activities.

Types of Fingerprints:

- Latent fingerprint
- Patent fingerprint
- Plastic fingerprint

Examiners categorize fingerprints found at crime scenes or created in labs into visible, hidden, or moulded types (Lee and Gensler, 2001, P 106), although the term latent print is often used for all three. A visible print can be seen easily. Most of these prints are observable, requiring minimal imaging for preservation. A great example of a visible print is a smudge left on a glass surface. Some of the examples of visible prints include bloody fingerprints and muddy fingerprints. Good light source plays an important role in finding the visible fingerprint; A proper alternative light source is needed for finding invisible fingerprints. The word latent means not easily seen. Hidden prints remain undetectable until revealed through a developing method that is created to reveal the invisible prints. The impressions are made when the raised friction ridges press into the soft surface, creating a mold of the ridge patterns. Materials such as clay, putty, soft wax, melted plastic, thick grease, and sticky paint can help create and hold moulded prints. Moulded impressions are often photographed using angled lighting to accentuate the ridges and grooves. Additionally, silicon casting materials can be used to preserve these prints.

2. Methods of Development

Powder Technique:
The method of using powder to reveal hidden fingerprints involves sprinkling a fine mixture onto the fingerprint mark, often with a brush made from glass fibers or camel hair. The powder sticks to the moisture left by the sweat that forms the fingerprint pattern. Areas without fingerprint residue will not attract powder. Hence, the powder stays on the raised ridges, while it can easily be brushed away from the lower parts. The powder typically has color, making the ridge characters become visible and thus developing the latent fingerprint.

Dusting powders is the most straightforward and widely used method for revealing latent fingerprints. It is also the oldest technique employed by fingerprint specialists. This method does not need advanced tools. A beginner can collect the prints just by brushing and tapping. The prints can be discovered both at the scene of the crime and in the lab. This technique relies on the mechanical sticking of fingerprint powder to the damp and oily residues found in the skin ridge deposits. Common types of fingerprint powders include black, white, gray, magnetic, fluorescent, and several others.

Various elements affect how effective fingerprint powders are:

- Fineness: The powder must be fine so that it can reproduce the details of the fingerprint. Fine powders can display more detail than those that are coarser.
- Adhesion: The powder should have an appropriate sticking quality, which allows it to attach to the fingerprint residue (typically oils) without adhering to other areas of the surface, which could make the print harder to see.
- Sensitivity: Sensitivity relates to adhesion, and it indicates how well the powder connects with the surface.
- Color: The fingerprint powder needs to be a suitable shade for the surface.
- Flow: The powder should move freely on the surface and not form a clump.

Powders and their Characteristics
At present, fingerprint experts are utilizing powders such as gray, white, and black as a method for developing fingerprints. Powders consist of two main parts: Pigments and Binders. Pigments provide color for the powder, while binders assist with the powder sticking to the moisture found in fingerprints. Specific features are necessary for a powder to be efficient in developing fingerprints, including fine granules, strong adherence to surfaces, a contrasting hue, and good flow to avoid clumping. Temperature plays a major role in the visibility and creation of fingerprints. This study took place in Chennai during February and March 2025, as the temperature ranged between 28.5°C (83.3°F) and 23.8°C (74.8°F), with humidity levels from 60% to 70%.

3. Review of Literature

R. K. Gargi and colleagues (2011) examined a technique for developing fingerprints using different colored soil. They applied this powder method to materials such as plastic, aluminum, motorbike parts, painted areas, car hoods, glass tables, CDs, transparencies, cotton, and skin. The soil was put in an oven for 20 minutes to dry before using it for latent fingerprint development. After drying, the soil was passed through a 100atm sieve to collect fine powder from the base pan for developing fingerprints. The study was conducted in September and October, with temperatures ranging from 18 to 36 degrees Celsius and humidity between 38 and 90 percent. The powder was spread over the surfaces in question, creating clear prints. They tested both porous and non - porous materials. A 16 - megapixel camera with a 5 - element lens and F/2.078 - degree wide angle captured the images. This method successfully developed latent fingerprints on all surfaces, except for skin and cotton. The soil was effective in absorbing fingerprint residues, resulting in clear ridge patterns.

R. Aditya and Suneetha V (2015) investigated "A latent fingerprinting method using turmeric, chili, pepper, and coal for forensic purposes. " This research presented a new powdering technique that used easily obtainable and non - toxic materials like coal, pepper, turmeric, and chili. Solid turmeric was made into a powder by grinding it in a mortar and pestle. The powder was then dried to eliminate moisture. Similar methods were used to create powders from pepper and coal. After finely processing the powders, they were utilized in the dusting process. The images developed from coal powder were the clearest, while turmeric powder provided better results than pepper and chili powders. Chili and pepper did not produce good prints because the ridge clarity was insufficient.

4. Methodology

Materials Required:
1) Surface: Mirror, Polished wood, Titles, Phone temper, Stainless steel, Helmet, Eyeglass, Plastic bottle, Sunglass, Granite.
2) Powders: Sacred ash, Vermillion, and Corn flour.
3) Other Materials: Gloves, Mask, Camel hand brush or ostrich feather brush, Camera.

Sample Preparation:
For this research, 40 samples were gathered from 10 distinct surfaces using four different easily available powders. This research was carried out in Chennai during the months of February and March 2025. Different powders used include Sacred ash, Vermilion, and Corn flour. The powders were sourced commercially, finely ground, and stored in paper bags to maintain moisture. Sacred ash is supplied by the brand Kashi Vibhuti Bhasma. Vermilion is provided by the brand Madurai Thalampoo in pink and yellow hues. Corn flour is sourced from the brand Tasty Nibbles. We created fingerprints on surfaces by rubbing our fingers on hair, around the nose, and behind the ears, allowing sweat to accumulate on our fingers to transfer onto surfaces. The temperature varies from 28.5°C (83.3°F) to 23.8°C (74.8°F). The humidity levels range from 60% to 70%.

Application Procedure:
Prior to applying the powder formulation, the surface should be inspected visually for the fingerprint impression. This is commonly accomplished with the aid of an intense light source combined with a magnifying glass. The print should initially be photographed using a suitable filter. Subsequently, the appropriate powder should be applied in a circular motion

using a fingerprint brush. It is essential to avoid smudging the imprint. Any excess powder should then be removed by gently tapping the surface. The developed print should be photographed once more.

About Powders:

SACRED ASH

Sacred ash is also referred to as Vibhuti and Tiruniru in Tamil. It is produced from burnt dried wood, cow dung, or cremated remains and is utilized in various Hindu rituals, practices, and medicinal applications. Sacred ash is particularly associated with Lord Shiva, who is frequently depicted as wearing ash on his forehead and other body parts. Devotees of Shiva also apply sacred ash as a sign of reverence, devotion, and purification. It is white in color and fine in texture, commonly found in most households. In this research, I utilized wood - based Vibhuti from the brand Kashi Vibhuti Bhasma.

Vermillion

Vermillion is also known as a Sindoor; it typically appears red but can be found in various textures and colors. It is derived from pure sulfur and mercury. Chemically, it is identical to cinnabar, a natural mineral. Vermillion is involved in healing rituals, symbolizing purification for women. Therefore, it is a customary item in every household. The traditional vermilion that every Indian woman applies is a natural form of turmeric mixed with certain dyes to create various shades of red. This powder absorbs amino acids from sweat, enhancing the visibility of latent prints collected from subjects. In this research, I employed pink and yellow variants of vermillion.

Corn Flour

Corn flour is a white powder, which is free - flowing and created through the wet grinding of maize, through the process of rinsing, concentrating, spinning, drying, and milling to yield a natural powder. It possesses a moist texture and has a comparatively high viscosity, making it easily diffused in cold water. It is readily available in every household.

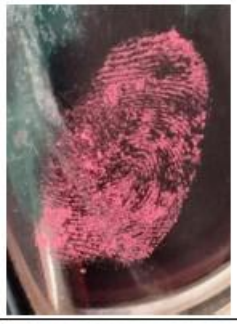
Home Office Grading Scale

0: No usable fingerprint
1: Poor quality fingerprint
2: Fair quality fingerprint
3: Good quality fingerprint
4: Very good quality fingerprint
5: Excellent quality fingerprint

5. Results

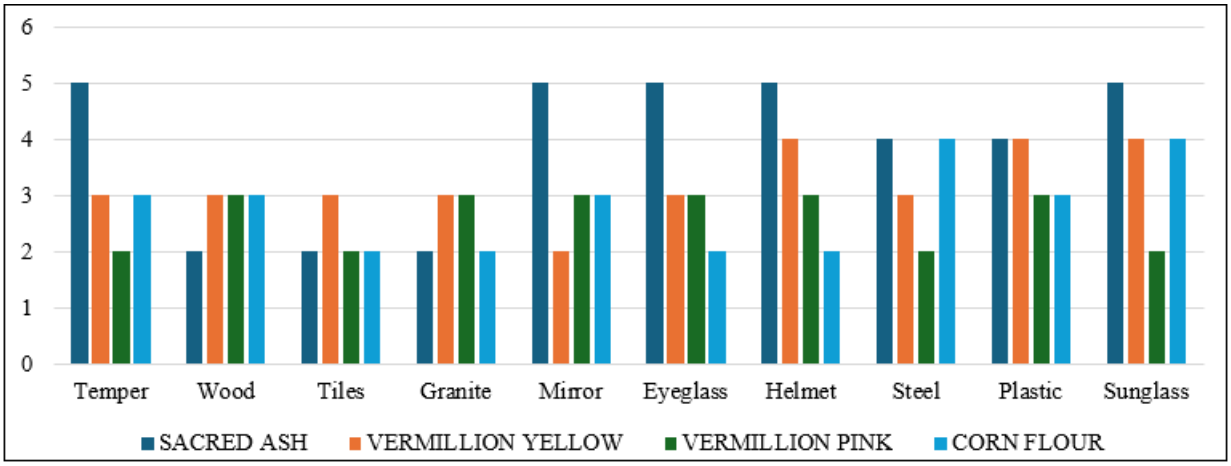
In this study, fingerprints were developed by the readily available powders such as Sacred ash, Vermillion pink, Vermillion yellow, and Corn flour on 10 different surfaces by using a fingerprint brush. The developed prints are analyzed by the HOME OFFICE GRADING SCHEME, and the values are derived.

Surface	Scared Ash	Vermillion (pink)	Vermillion (yellow)	Corn Flour
1. Temper				
2. Polished Wood				
3. Tiles				

4. Granite				
5. Mirror				
6. Eye glass				
7. Helmet				
8. Steel				
9. Plastic bottle				

10. Sun glass				

The photographs were taken during the daytime, and the temperature ranged between 28.5°C (83.3°F) and 23.8°C (74.8°F). The development of fingerprint depends on various factors such as surface type, adherence of the powder to the surface, fineness, color of the powder, color of the surfaces, and many more. Comparatively, sacred ash is a fine powder as it is made from burning wood and cow dung, and it adheres well to surfaces. It is a holy powder that is easily available in every house. Vermillion is a finer powder, but the powder adheres less to the surfaces. Corn flour is a fine powder, and it adheres less to the surfaces. The developed prints were lifted by tape and preserved in the black chart for future reference. Four different powders are used on 10 different surfaces to develop prints. It is analyzed using a home office scale, which is given below.



Bar Graph: Overall scale value of different powders.

When Sacred ash Powder was applied over the sample of fingerprint on surfaces like temper, mirror, eyeglass, helmet, and sunglass, it was successfully developed. On surfaces like steel and plastic, the ridges are very visible and can be used for comparison and identification purposes. On surfaces like polished wood, tiles, and granite, some areas are faded, but it can still be used for comparison purposes. When Vermillion pink colour powder was applied over the sample of fingerprint on surfaces like granite, polished wood, mirror, plastic, eyeglass, and helmet, it is fairly developed, and the rides are visible, and it needed enhancement for further process. On the surfaces of steel, temper, sunglasses, and tiles, it is partially developed, and some areas are fainted, still, it can be used for comparison purposes. When Vermillion yellow colour powder was applied over the sample of fingerprint on surfaces like sunglass, helmet, plastic it is successfully developed with clear ridges. On surfaces like tempered, polished wood, granite, steel, eyeglass, and tiles, it is fairly developed with visible ridges. On surfaces like mirrors, some areas are faded, but still, it can be used for comparison purposes. When Corn flour powder was applied over the sample of fingerprint on surfaces like sunglass and steel, it is fully developed with clear ridges. On surfaces like polished wood, temper, plastic, and mirror, it is fairly developed with visible ridges. On surfaces like tiles, granite, helmet, eyeglass some areas are fainted but still it can be used for comparison purposes.

6. Discussion

The study on the development of latent fingerprints using Sacred ash, Vermillion, and Corn flour powders recommends that naturally and locally available powders can be used as an alternative to conventional fingerprint powders. The exploration of non - conventional powders for fingerprint development is an important step toward safer, sustainable, and efficient forensic practices. Scared ash is a fine powder made from the burning of wood and cow dung, and has strong adhesion to the latent fingerprints in surfaces like temper, mirrors, eyeglass, helmets, and sunglass making ridges highly visible, particularly on dark backgrounds. But still due to its fineness it possessed a risk of smudging especially on surfaces like polished wood, tiles, and granite, where ridges are fainted and absorption affects the ridge clarity. Vermillion pink colour powder, which is highly pigmented, has strong contrast and visibility on different surfaces. It is more effective on dark - coloured surfaces such as granite, polished wood, mirrors, plastic, eyeglasses, and helmets. It is less effective on the surfaces of steel, temper, sunglass, and tiles. Vermillion yellow colour powder, which is highly pigmented, has strong contrast and visibility on different surfaces. It is more effective on surfaces like sunglass, helmets, and plastic. It is less effective on surfaces like temper, polished wood, granite, steel, eyeglass, and tiles. While using corn flour, has contrast on dark surfaces but lacks visibility on lighter colour

surfaces. It is more effective on surfaces like sunglasses and steel. It is less effective on surfaces like tiles, granite, helmet, and eyeglass. Among the tested powders, sacred ash and vermillion show promising results, particularly on non - porous surfaces, where they effectively adhere to the fingerprint residue and provide a good contrast. Sacred ash and corn flour show less visibility on light - coloured surfaces. Vermillion powders show some clumping issues while developing fingerprint. The effectiveness of these powders may vary due to certain factors such as particle size, adhesion property, environmental condition, surface type, and application technique. The focus of this study is to explore using readily available powders for developing latent fingerprints in situations where proper forensic equipment is unavailable. While challenges remain, continued research and development may unlock new chances for their widespread adoption in forensic investigations. By addressing these challenges, these natural powders could become a more practical and widely accepted tool for fingerprint development in real - world investigations.

7. Conclusion

Among the tested powders, sacred ash and vermillion show promising results, particularly on non - porous surfaces, where they effectively adhere to the fingerprint residue and provide a good contrast. Sacred ash and corn flour show less visibility in light colored surfaces. Vermillion powders show some clumping issues while developing fingerprints. The images developed from sacred ash were the clearest, while vermillion provided better results than corn flour. Corn flour did not produce good prints because the ridge clarity was insufficient. The effectiveness of these powders may vary due to certain factors such as particle size, adhesion property, environmental condition, surface type, and application technique. By addressing these issues, these natural powders could become a more practical and widely accepted tool for fingerprint development in real - world investigations.

8. Limitation

- Powders may not be sensitive enough to identify damaged or erased fingerprints.
- Powder could not adhere properly to rough or porous surfaces.
- Using too much powder can damage the fingerprints.
- Inhaling powders can cause health issues, and skin and eye irritation can occur if proper protective equipment is not used.
- Since powders may not spread uniformly on rough surfaces, this results in incomplete fingerprints.
- The surface might need further cleaning or a handling process since powders do not adhere well to greasy or dirty surfaces.
- Photographs should be taken for the lifted fingerprints because they fade fast.

9. Future Scope

- Using powder methods is vital in forensic science to match suspects to crime scenes by means of developing fingerprints.
- Using fingerprints found at crime scenes, the powdered method aids event reconstruction.
- Using the powder technique to develop fingerprints confirms identity and ensures accurate people identification.
- The powder technique has potential in research and development for enhancing fingerprint detection technologies.
- Training and education for forensic experts call for the development of fingerprints using powder techniques.
- The power approach guarantees quality control by preserving the integrity of the data.

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References

[1] Lee, H. C., & Gaensslen, R. E. (2001). Methods of latent fingerprint development. In *Advances in fingerprint technology* (2nd ed., pp.105–176). CRC Press.
[2] Jeevanandan, G., & Thomas, E. (2018). Volumetric analysis of hand, reciprocating and rotary instrumentation techniques in primary molars using spiral computed tomography: An in vitro comparative study. *European Journal of Dentistry, 12*, 21–26. https: //doi. org/10.4103/ejd. ejd_247_17
[3] Kapoor, N., Moon, P., Pradesh, P., & Badiye, A. (2023). Introduction to fingerprints. In P. Srivastava, J. A. Lorentz, A. Srivastava, A. Badiye, & N. Kapoor (Eds.), *Textbook of forensic science*. Springer. https: //doi. org/10.1007/978 - 981 - 99 - 3931 - 9.
[4] A technique for visualization of latent fingerprints using *Curcuma longa* (turmeric) on electronic surfaces. (2021). *Indian Journal of Medical Toxicology and Legal Medicine, 24* (3–4). https: //www.indianjournals. com/ijor. aspx?target=ijor: ijmtlm&volume=24&issue=3and4&article=022
[5] Development of latent prints with talc powder. (n. d.). *Google Scholar*. https: //scholar. google. com/scholar?start=40&q=development+of+latent+prints+with+talc+powder&hl=en&as_sdt=0, 5#d=gs_qabs&t=1725515983134&u=%23p%3DIhFNcwxohnYJ
[6] Olsen, R. D. Sr. (1972). The chemical composition of palmar sweat. *Fingerprint and Identification Magazine*, 3–23.
[7] Olsen, R. D. Sr. (1978). *Scott's fingerprint mechanics*. Charles C. Thomas.

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