Research Article

Visualization and Comparison of Latent Fingerprints on Various Surfaces Using Neem and Turmeric Powder

Vaishnavi Vivek Sawant

Volunteer AFRS, Assistant Professor of Criminology and Forensic Science at Acharya Institute of Graduate Studies, Bengaluru, Karnataka.

How to cite this article: Vaishnavi Vivek Sawant. Visualization and Comparison of Latent Fingerprints on Various Surfaces Using Neem and Turmeric Powder. Medico Legal Update, Vol 23 Special Issue 2023.

Abstract

In the research, various methods for developing latent fingerprints on various surfaces have been reported. This paper describes a new powdering method for the development of latent fingerprints that is simple and non-toxic and can be used on a variety of substrates. In this study, non-toxic, simple, and easily accessible turmeric powder and Neem powder were used, all of which are commercially available natural powders with a variety of domestic and traditional applications. These powders have been used to decipher latent fingerprints on ten different substrates, including glass, lamination sheet, transparency sheet, metal surface, wooden surface, plain paper, cardboard, plastic, tile, and steel. It has been discovered that it produces very clear results on most surfaces. The powders were used to give the best results on all surfaces except plain paper. The prints are clear with all the ridge characteristics present.

Keywords: Neem powder, turmeric powder, latent fingerprint, development, fingerprint powder

Introduction

Impression evidence is the evidence that is left behind by the criminal. The impression is from some part of the criminal, such as his shoes, his vehicle tires, his fingerprints, or a tool or instrument that he used, and it is left behind on some of the materials on the crime scene like soil, dust, or cement[1].

Fingerprints

Fingerprints are the most important evidence found at crime scene from the past till now it is considered as the most important type of impression evidence used in identification. Fingerprint Science resides in Fingerprint since time immemorial. This science is a unique one and even today it is a subject of mystery to the general public. It is not known who and when first used the Fingerprint for identification purposes. But the study of palms and the uses of fingerprints can be traced back to the beginning of civilization[2].

History of Fingerprints

Slabs of clay with fingerprints 3000 years old were found in King Tut-en- Khamen's tomb in Egypt. Chinese Emperors used thumb impressions as a seal on the documents. The seals were of clay with the impression of a thumb on one side and the name of the owner on the other. Emperor Ts-in-She was the first Emperor to use such seals[3]. This shows clearly the importance of fingerprints for identification purposes. Under the law of Taiho in 702 A.D, when a Japanese husband preferred divorce charges, he had

Corresponding Author: Vaishnavi Vivek Sawant, Volunteer AFRS, Assistant professor of Criminology and Forensic Science at Acharya Institute of Graduate Studies, Bengaluru, Karnataka.

E-mail: vaishsawant85@gmail.com

to imprint the mark of his index finger after his name on the document transcribed by another. Soleiman, an Arabian merchant wrote in 851 AD that in China Creditor's bills were marked by the debtor with their middle and index fingers together. Fingerprints along with palm prints known as 'Panja' were used for some centuries in India[4].

Forms of Fingerprint Evidence Found on the Crime Scene

- **Visible prints**

  The naked eye can see these types of chance prints. Typically, it is composed of blood, dirt, dust, oil, or any other coloured substance. It can be photographed directly if the ridges are clear enough for comparison. Only after direct photography has been taken. Every effort should be made to make it clearer.

- **Plastic Print**

  Plastic prints are three-dimensional impressions found on wax, soap, paint, and muddy surfaces. To obtain plastic print direct photography and plaster of Paris are used.

- **Latent Print**

  Latent means "hidden" or "invisible." This is the most significant print commonly found at the crime scene. This cannot be seen with the naked eye or even with a magnifying glass. The truth is that every time we touch something, we leave our impression on it. Science and technology have progressed to the point where Fingerprint Experts can develop or enhance latent fingerprints from almost any object using a variety of techniques, as they cannot be observed with the naked eye[5].

Methods used in Developing Latent Prints

- **Chemical method**

  Chemical methods are used for developing chance prints because they do not rely on moisture remaining in print but rather on a chemical reaction taking place between the developer and sweat pores. The different methods used for developing these latent prints are Iodine fuming, Ninhydrin, Cyno-Acrylate, and Silver Nitrate.

- **Powdering technique**

  The powdering technique has been used as a technique since the early 1900s. The powder is applied on the surface where the latent Fingerprint is present using brushes. Different types of brushes are used like a camel hair brush, ostrich feather brush, etc. To develop the latent fingerprint, the powder is sprayed onto the surface using an atomizer, and the excess powder is removed using an ostrich brush. The furrows do not adhere to any powder on them. The powder applied sticks to the ridges and the ridges are clearly visible. Since the applied powder is coloured the print becomes visible and is said to be developed[6,7].

Factors Influencing the Effectiveness of Fingerprint Powders

- **Surface type**: The type of surface on which the fingerprint is deposited can affect the effectiveness of fingerprint powders. Porous surfaces, such as paper or cardboard, may require different powders than non-porous surfaces, such as metal or glass.
- **Age of the fingerprint**: The age of the fingerprint can also impact the effectiveness of fingerprint powders.
- **Environmental conditions**: The environmental conditions in which the fingerprint was deposited can also affect the effectiveness of fingerprint powders. For example, humidity, temperature, and exposure to sunlight or other environmental factors can impact the visibility of the print.
- **Quality of the powder**: The quality of the fingerprint powder used can also impact the effectiveness of fingerprint powder. High-quality powders are more likely to produce clear and visible prints.
- **Application technique**: The technique used to apply the fingerprint powder can also influence the effectiveness of fingerprint powder. Applying the powder too thickly or too thinly can impact the visibility of the print.

- **Chemical composition of the surface**: The chemical composition of the surface can also impact the effectiveness of fingerprint powder. For example, surfaces treated with certain chemicals may require different powders to visualize latent fingerprints[8].

Some of the chemical substances used in the fingerprint powders are toxic and cause potential health hazards and also these methods are expensive in nature. In order to overcome this disadvantage in this research new powders, which are simple, nontoxic to human health, easily available, cheap in nature, has many medical uses, and as well can be utilized for the development of latent fingerprints on various surfaces[9,10]. This method is simple and easy. The powders which are used in this research are Turmeric powder and Neem powder.

Turmeric Powder

Turmeric (Curcuma longa) is a Zingiberaceae (ginger) rhizomatous herbaceous perennial plant. Turmeric rhizomes are short, thick, and stubby. Turmeric powder is a yellow-orange spice that is made from the ground root of the turmeric plant. It has a warm, slightly bitter flavour and is commonly used in cooking, particularly in Indian and Middle Eastern cuisines. Turmeric is also used as a natural food colouring agent, and it has been used for medicinal purposes for thousands of years in traditional Ayurveda and Chinese medicine. Turmeric is rich in curcumin, which is a natural anti-inflammatory and antioxidant compound. Curcumin is believed to have numerous health benefits, including reducing inflammation, improving brain function, and reducing the risk of chronic diseases such as heart disease, cancer, and Alzheimer's disease. In addition to its health benefits, turmeric powder has several culinary uses. It is commonly used to flavour curries, stews, and soups, and it is often added to rice dishes to give them a bright yellow colour. Turmeric can also be used as a natural food colouring agent to give a yellow hue to baked goods and other foods. Turmeric powder was used for body, clothing, utensils, and ceremonial purposes in Micronesia, according to Friedrich Ratzel's 1896 report in "The History of Mankind". Colour is one of the functional uses of curcumin as a food additive.

Neem Powder

It thrives in tropical climates such as India and Myanmar. Neem powder is a natural powder made from the leaves, seeds, and bark of the neem tree (Azadirachta indica), which is native to the Indian subcontinent. The neem tree has a long history of traditional use in Ayurvedic medicine for its antimicrobial, antifungal, and anti-inflammatory properties. Neem powder is rich in antioxidants, flavonoids, and other biologically active compounds, including nimbin, nimbidin, and nimbinene. These compounds are believed to provide numerous health benefits, including supporting healthy digestion, boosting the immune system, promoting healthy skin, and helping to reduce inflammation and oxidative stress. In addition to its medicinal uses, neem powder is also commonly used in cosmetic and personal care products due to its antimicrobial and anti-inflammatory properties. It can be found in products such as soaps, shampoos, and toothpaste. When using neem powder, it is important to use high-quality powder from a reputable source. Neem powder can be used internally, in the form of capsules or tea, or externally, as a paste or oil applied to the skin. However, it is important to consult with a healthcare professional before using neem powder or any other natural supplement or remedy, especially if you have a medical condition or are taking medications.

All of these powders are safe and simple to use. These powders are used to create prints from surfaces. The surface on which the print is present on the scene helps in determining which method of the collection must be used. The surface has three general properties: porous, non-porous smooth, and non-porous rough.

The ability to absorb liquids distinguishes porous from non-porous surfaces. When liquids are dropped onto a porous surface, they sink in, whereas non-porous surfaces sit on top of them. Paper, cardboard, and untreated wood all have porous surfaces. Varnished or painted surfaces, plastics, metal surfaces, and glass are all examples of non-porous smooth surfaces.

Importance of Fingerprint Development

Fingerprint development can help in finding the real culprit and also in eliminating suspects.

If Fingerprints are found on any surface at a crime scene, then they can be matched with older records or with inmates, or with suspect Fingerprints, this can help in finding the real culprit who might have done the crime. Latent Fingerprints found on a crime scene can be developed and marched with other records and the perpetrator can be found. The development of Fingerprints has helped a lot in solving cases for years and it is still considered the most trustable method for identifying the culprit[11,12].

Importance of Using Natural Powders

Natural Powders are easily available in the market and can be used for the development of latent Fingerprints. The powders which we normally use in the laboratory for the development of latent fingerprints are harmful and contain toxic chemicals that can affect our health very badly. The toxic chemicals have adverse effects on our health. The naturally available powders don't contain any harmful chemicals which may affect our health. As these natural powders are easily available everywhere we can use these powders for developing latent fingerprints when the chemical powders are not there. Chemical powders are not available everywhere whereas natural powders are easily available and are present in our homes as those are mainly for traditional purposes[13,14].

Methodology

There are various crimes that are going on across the world like murders, theft, suicide, homicide, kidnapping, and abduction in which fingerprints can be left as evidence. The most common type of fingerprint found at the crime scene is a Latent Fingerprint which cannot be seen by the naked eye. The type of surface, effectiveness, and simplicity are the only factors that affect whether a technique for creating latent fingerprints is adopted. Latent Fingerprints can be developed by various methods. Powder methods are most commonly employed for the development of such prints. These techniques exhibited quite effective results for many surfaces but to increase their efficiency and simultaneously diminution the price, some advances were needed. The powder used is made up of chemicals that may be harmful to us and may have adverse effects on our bodies. And most of the powders are not easily available and it's expensive. So, in order to overcome this disadvantage, developed latent fingerprints using powders like Turmeric and neem. These powders are simple, nontoxic, and may be easily available. The powders used in the study are household products that have so many medicinal uses also.

Materials and Methods

1. **Surface selection:**

   Different types of surfaces were selected such as plastic, Wood, plain paper, steel, metal, Lamination sheet, cardboard, transparency sheet, Glass, and Tile.

2. **Preparation of powders:**

   Commercially available turmeric powder was taken and then further ground in a blender in order to get a very fine powder to the level of talcum powder. Then keep it in the glass tubes and seal it. Maintain it in laboratory condition. Similarly, the above method was followed for the preparation of neem powder.

3. **Procedure for developing latent fingerprints:**

- Prepared powders (Neem and Turmeric) are used for the development of latent fingerprints present on different types of surfaces like plastic, wood, plain paper, steel, metal, cardboard, transparency sheet, Glass, and Tile.
- Powders are applied on the surface containing the Fingerprint using an Ostrich feather brush
- After the development of the latent fingerprint photograph of the developed print is taken.
- Then the print is lifted using adhesive tape. Then the tape is stuck on the fingerprint lifting card.
- At last, the prints are compared to each other based on the Clarity of the developed Fingerprint on different surfaces

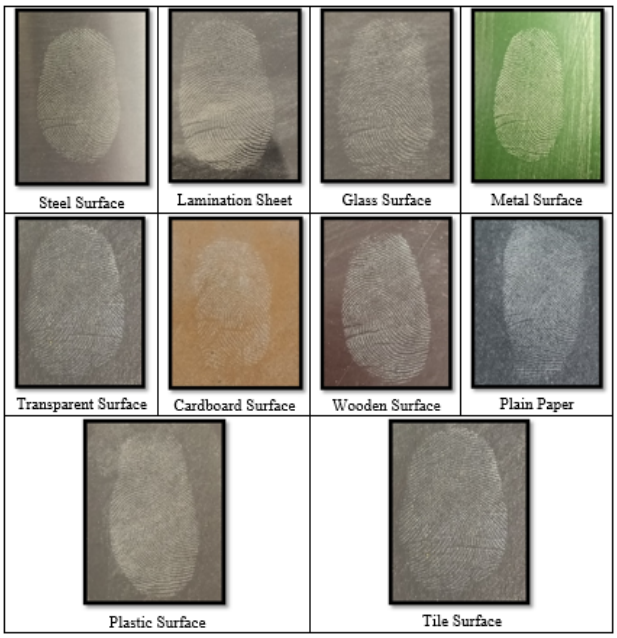

Figure 1: Development of Latent Fingerprint Using Neem Powder

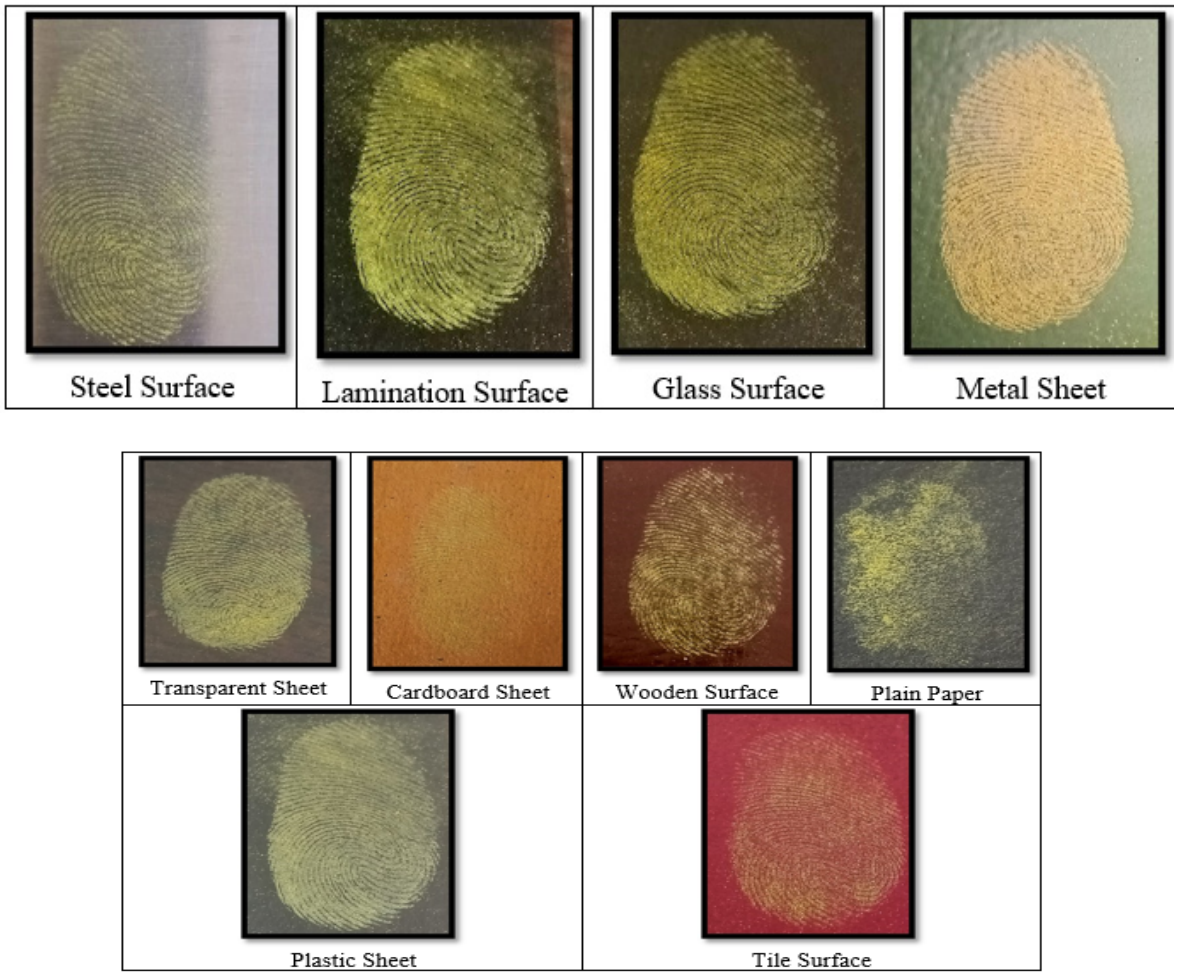

Figure 2: Development of Latent Fingerprint Using Turmeric Powder

Data Analysis

Table 1: Development of latent fingerprint using Neem powder

Surface	Development
Glass	Developed
Lamination sheet Developed	
Metal	Developed
Tile	Developed
Cardboard	Developed
Transparency sheet	Developed
Steel	Developed
Plain paper	Developed
Wood	Developed
Plastic	Developed

Latent Fingerprint on different surfaces using Neem powder was successfully developed. The ridge characteristics can be clearly seen on almost all the surfaces like lamination sheets, glass, plastic, steel, cardboard, transparency sheet, metal, wooden surface, and tile. On paper, the print was developed, and the ridge characteristics can be seen but the absence of clarity was noticed.

Table 2: Development of latent fingerprint using Turmeric Powder

Surface	Development
Glass	Developed
Lamination sheet	Developed
Metal	Developed
Tile	Developed
Cardboard	Developed
Transparency sheet	Developed
Steel	Developed
Plain paper	Not developed
Wood	Developed
Plastic	Developed

The latent fingerprint was developed using turmeric powder on ten different surfaces (plain paper, cardboard, glass, plastic, wood, transparency sheet, lamination sheet, metal, steel, and tile).

The latent print was successfully developed on all surfaces except plain paper. The developed print was clearly visible with all the ridge characteristics.

Comparison

The powders give positive results on all surfaces. Prints can be developed on surfaces like glass, tile, wood, and steel using both powders (neem and turmeric). The ridge characteristics are also visible. The print was successfully developed using neem powder on metal, lamination, plastic, and transparency sheet but in turmeric, the print developed and little smudging was observed. On the cardboard surface, the print developed using neem powder contain all the ridge details but with turmeric powder, the print-developed and ridge characteristics were not visible. On plain paper the print was developed using neem powder but ridge characteristics were absent. In turmeric powder, the prints were not developed.

Major Findings

Turmeric powder

- The latent fingerprint developed using Turmeric powder on glass, tile, Steel, and wooden surface was successfully developed all the ridge characteristics were clearly visible.
- On transparency sheets, lamination sheets, plastic, and metal the latent fingerprint was developed the ridge characteristics can be seen but little smudging was observed. On the cardboard surface, the print developed but the ridge characteristics were not visible and can't be used for any further analysis.
- On plain paper the latent fingerprint can't be developed because the sweat is being absorbed by the paper and the power doesn't attach to the surface.

Neem Powder

- Latent print on different surfaces using Neem powder was successfully developed all the ridge characteristics were clearly seen on almost all the surfaces like lamination sheet, glass, plastic, steel, cardboard, transparency sheet, metal, wooden surface and tile.
- On paper the print was developed the ridge characteristics can be seen but absence of clarity was noticed the developed print was used for further comparison

Conclusion

Turmeric powder and Neem powder which are natural, easily available, non-toxic and simple can be used successfully on various surfaces to develop prints in crime investigations. And the print developed on most of the surfaces has clear ridge characteristics present. Neem powder gives positive results on all surfaces (Plastic, Wood, paper, steel, metal, cardboard, transparency sheet, Lamination sheet, glass, and tile). All the latent fingerprints get developed using these powders. But in turmeric powder, the print developed on all surfaces except on plain paper.

Conflict of Interest: Authors do not have any conflict of interest.

Source of Funding: No funding provided.

Ethical Clearance: No ethical required for the work.

References

1. Bapuly, A. K. Forensic science-it's application in crime detection, Paras Medical Publisher. 2006.
2. Johari, S.K. Forensic Science identification of Fingerprints published by Asia Law house. 2018.
3. Daluz, H., M. Fingerprint Analysis Laboratory Workbook published by Taylor and Francis. 2014
4. Sharma, B., R. Forensic Science in Criminal Investigation and Trials 6Th Edition 2020 published by Lexis Nexus. 2019
5. Nabar, B., S. Forensic Science in Crime Investigation published by Asia Law house.
6. Hawthorne. Fingerprints Analysis and Understanding (Pb) published by Routledge Taylor and Francis group. 2008
7. Sehgal, V., N. Forensic Science in Criminal Investigation & Court Evidence published by selective and scientific books. 2018
8. Hawthorne. Fingerprints 2021 Edition published by T&F Crc Press. 2021
9. Vadivel, R., Nirmala, M., & Anbukumaran, K. Commonly available, everyday materials as non-conventional powders for the visualization of latent fingerprints. Forensic Chemistry, 24, 100339. 2021
10. Rathod, A. L. Deciphering of Latent Fingerprints on Nonporous Surfaces by Domestic Visualizing Agents-A Primary Evaluation Study. IPJ, 44. 2021
11. Pacheco, B. S., Da Silva, C. C., Da Rosa, B. N., Mariotti, K. C., Nicolodi, C., Poletti, T.. ...& Pereira, C. M. Monofunctional curcumin analogues: evaluation of green and safe developers of latent fingerprints. Chemical Papers. 75(7), 3119-3129. 2021.
12. Sari, S. A. Development of Eco-Friendly Fingerprint Visualization using Herb. Asian Journal Of Chemistry, 31(11), 2601-2606. 2019.
13. Madhavan, A. A. & Sharma, B. K. Latent fingerprint development with biosynthesized Nano rist. In 2019 Advances in Science and Engineering Technology International Conferences (ASET) (pp. 1-4). IEEE. 2019
14. Yi, R. Novel powder methods for the visualization of latent fingerprints: The case for tumeric and other spices. 2018.