Development of Latent Fingerprints on Different Surfaces by Using Fuller Earth (Multani Mitti) and Clay Soil

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Abstract: Fingerprints are used to identify people, which is why they're so important in crime scene investigation. They are one of the most reliable evidences that can help in the determination of the culprit. Their development and identification help to prove criminals are physically present at the crime scene. The fingerprint development technique is the oldest method used in forensic science for personal identification. There are three types of fingerprints: patent, latent, and plastic. Patent and plastic fingerprints can be seen with the naked eye, while latent fingerprints are invisible and need to be developed to make them visible. Many powders and chemical processes are used to develop latent fingerprints like fluorescent powder, titanium dioxide, lead, rhodamine G, iodine fuming, ninhydrin, small particle reagent. The current study presents a new powder method for developing latent fingerprints on various surfaces. In this study, a simple, easily available, less expensive, non-toxic in nature, fuller earth (multani mitti) and clay soil powder have been used to develop the latent fingerprints on 10 different surfaces that are glass surface, aluminium foil, coloured plastic surface, stainless steel, coloured steel (water bottle), transparent plastic, marble slab, coloured iron (almira), leather and rusted iron. By using fuller earth (multani mitti) and clay soil powder we successfully developed the latent fingerprint on various porous and non-porous surfaces. After developing fingerprint on different porous and non-porous surfaces, we conclude that fuller earth (multani mitti) and clay soil is very useful for development of latent fingerprint.

Keywords: Fingerprint, fuller earth, clay soil, surfaces.

1. Introduction

The study of fingerprints is known as dactyloscopy. A fingerprint can be described as a distinctive arrangement of ridges that is formed when the tip of a finger and thumb are pressed onto a surface [1]. Fingerprints evidence is perhaps the most common type of physical evidence at the crime scenes as these prints come directly from the body of a person involved in a crime. The fingerprints are unique and very detailed patters of a person [2].

That's why fingerprints are important evidence at crime scenes because these prints are used for identification purposes and individualization. Typically, fingerprints can be categorized into three types: patent, latent, and plastic fingerprints [3]. Fingerprints that can be seen without the aid of any device are referred to as patent prints. These may be formed when a visible or coloured contaminates (such as blood, ink, paint, oil etc) are present on the fingers of the perpetrator, it will leave a patent print. These prints are already developed so they can be directly photographed and lifted by using the tape lifting method. A three-dimensional fingerprint created using soft materials like clay, soap, putty, or wax can be collected using casting techniques. Latent prints are invisible to naked eyes, which are developed by using different types of powders and chemical techniques to make them visible. After that, these prints are collected by using the tape lifting method [4-5].

Many new techniques are used for the development of latent fingerprints with time, but the traditional fingerprint development technique for treating latent prints is the powdering method [6]. When the fingerprint powder is sprinkled over an affected surface, the powder adheres to fatty acid, sweat and other material. The quality of developed fingerprints depends on the shape, density, and size of the particle of that powder [7, 3]. The intensity of latent fingerprints in based on general factors which contain environment condition, texture of surfaces, sex, etc [8]. In the past, experts have used many techniques for the development of latent fingerprints such as chemicals, powders and dyes. But, most of conventional methods contain chemicals that cause potential health hazards to the examiner during the development of prints, so to pull off this problem, some people worked on powders of herbal origin for the development of latent fingerprints such as Raspberry powder, Turmeric powder, Arrowroot powder, Rose petals, Hibiscus petals, Pomegranate peel powder, Strawberry powder, etc [9-13]. The present study aims to develop new powder methods for the development of latent fingerprints on various surfaces. In this work, fuller's earth also known as Multani Mitti and clay soil is used for the development of latent fingerprints and compared with fluorescent powder (conventional method) and normal soil powder.

Fuller's earth is a specific kind of clay which is used for cleaning purposes and also used for medical purpose due to its adsorption properties. Fuller's earth (multani mitti) is also used as a cosmetic agent due to its dirt cleaning and oil balancing properties. Many elements are present in fuller's earth (multani mitti) such as aluminium, magnesium, silicon, iron, sodium and zinc etc and it is organic in nature [14]. Clay soil is also known as Kali mitti which is generally blackish in colour. Clay soil consists of very fine particles of clay which has a high water holding capacity due to this; it is very sticky in nature. Clay soil contains different properties of clay minerals such as Montmorrilonite, Kaolinite and chemicals such as calcium carbonate, iron oxide and organic matter. Montmorrilonite is the major mineral in clay soil [15].

This study provides new fingerprint powders which are organic in nature, easily available, less expensive, non-toxic in nature and prevent form health hazards to the examiner. Fuller's earth and clay soil were grinded into fine particles and then sprinkled onto the affected area where the latent fingerprint was present and the excess powder was removed by using a brush

(camel hair brush) [16-17]. The use of fuller earth in forensic fingerprint development is not completely new, as previous studies have explored for the new surfaces to develop fingerprints [18, 3]. But clay soil powder has not been reported as a developing powder for latent fingerprint. It is expected that it will provide good results for developing latent fingerprints.

2. Materials and Methodology

This study was carried in Chandigarh University. During the month of January, when the temperature was between 7 – 18°C and the humidity level was approx. 51%. The latent fingerprints were collected on different 10 surfaces which were glass surface, aluminium foil, coloured plastic, stainless steel, black steel bottle, transparent plastic, marble slab, coloured iron (almira), leather and rusted iron. To get clear prints individual was asked to wash their hand with hand wash or soap after drying their hands get sweat by rubbing or touching on the surfaces where sweat was present such as skin surfaces near the nose, forehead etc. Then before taking the latent fingerprints, the substrate was cleansed to avoid the risk of contamination.

The fuller earth (multani mitti) and clay soil was collected. Take the fuller earth (multani mitti), break into small pieces and place it in the mortar. By using mortar and pestle crush the fuller earth (multani mitti) into powder form. After crushing the fuller earth (multani mitti), transfer it into the 89 BSS sieve and collect the fine powder of fuller earth (multani mitti). The collected soil powder was kept in a sealed beaker. This process is also applied to clay soil and normal soil. Both soil powders were stored in a dry atmosphere or sealed container, and when soil was left out in the open atmosphere, it can absorb moisture from the air and clump together. The powder was sprinkled over the surface where the latent fingerprints were present and a camel hairbrush was used to develop the latent fingerprints. To obtain clear prints, the excess powder was removed by tapping method or using a brush. To check the comparative evaluation, the developed prints were photographed by using a DSLR camera. The developed prints were compared with fluorescent powder and normal soil.

Fig.1 – Fuller earth (multani mitti)

Fig.2 – Powder form of fuller earth

Fig.3 – Clay soil

Fig.4 – Powder form of clay soil

Fig.5 – Normal soil

Fig.6 – Powder form of soil

Table 1 – Showing clarity of fingerprints

Grade	Description
1	No specific fingerprints are developed.
2	Fingerprints are developed but ridges are not clear.
3	Pattern of fingerprint is visible but ridges are not that much clear.
4	Ridges are clear but somewhere minutes are not visible clearly.
5	Pattern, ridges and minutes are clearly visible.

A comparative study was conducted to find the effectiveness of fuller earth (multani mitti) and clay soil in developed latent fingerprints on different surfaces with fluorescent powder and normal soil powder.

Fig.7 – Flowchart of making fine soil powder.

3. Result and Discussion

This study shows the results of the latent fingerprint development using fuller earth (multani mitti) and clay soil powder on 10 different surfaces which are glass surface, aluminium foil, coloured plastic, stainless steel, marble slab, coloured steel (water bottle), transparent plastic, leather, coloured iron, and rusted iron. The process of developing fingerprint is powder dusting and is depend on the capacity of powders to attach with fatty acid or sweat which present in fingerprint. The developed prints were compared by fluorescent and normal soil powder. Development of latent fingerprints by using clay soil gives better result on coloured iron, transparent plastic, coloured plastic, marble slab, aluminium foil, stainless steel, and glass surface as compared to leather, rusted iron and coloured steel (water bottle). Fuller earth (multani mitti) gives better results on coloured iron, transparent plastic, marble slab, aluminium foil, stainless steel, and glass as compared to coloured plastic, rusted iron, coloured steel (water bottle) and leather.

The comparative evaluation of developed prints on different surfaces with fuller earth (multani mitti) and clay soil powder gave almost similar results to the widely used fluorescent powder (conventional method). The fingerprint developed by fuller earth (multani mitti) and clay soil gives better results when compared to normal soil powder. Although the powders made from fuller earth (multani mitti) and clay soil can be used to develop latent fingerprints because they gave better results on most of surfaces. This technique is very simple, non-toxic, less expensive and easily available to use for developing latent fingerprints.

Table 2 –Showing comparison of developed fingerprints by different powder methods.

Surfaces	Clay soil	Fuller earth	Fluorescent powder	Normal soil
1. Coloured iron (almira)				

2.Transparent plastic				
3. Leather				
4. Rusted iron				
5. Coloured plastic				
6. Coloured steel (water bottle)				

7. Aluminium foil				
8. Marble slab				
9. Stainless steel				
10. Glass				

Table 3 – Showing quality (grades) of developed fingerprints on different surfaces.

Surfaces	**Clay soil**	**Fuller earth**	**Fluorescent powder**	**Normal soil**
1.Coloured iron (almira)	5	5	5	3
2. Transparent plastic	5	5	5	4

3. Leather	4	3	5	3
4.Coloured plastic	5	4	5	4
5. Rusted iron	4	4	4	4
6. Coloured steel (water bottle)	4	3	5	4
7. Aluminium foil	5	5	3	5
8. Marble slab	5	5	5	4
9. Stainless steel	5	5	4	5
10. Glass	5	5	5	5

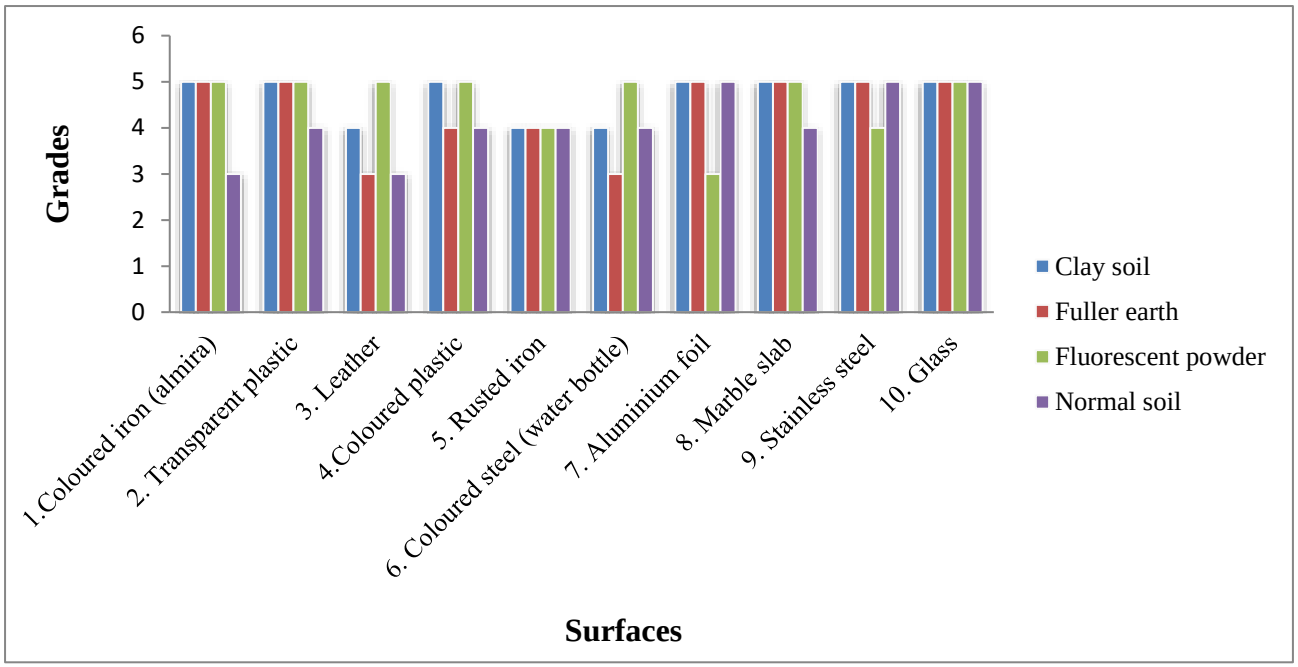

Fig.8 – Showing comparison of developed prints on different surfaces.

4. Conclusion

The powder dusting method is an easy and rapid way to develop latent fingerprints on different surfaces. In this study, latent fingerprints are developed on different surfaces by using two easily available materials, fuller earth and clay soil powder and developed prints are compared with fluorescent and normal soil powder. In this study, a simple, easily available, less expensive, non-toxic in nature, fuller earth (multani mitti) and clay soil powder have been used to develop the latent fingerprints on 10 different surfaces that are glass surface, aluminium foil, coloured plastic surface, stainless steel, coloured steel (water bottle), transparent plastic, marble slab, coloured iron (almira), leather and rusted iron. The result of the present study revealed that fuller earth and clay soil powder showed good results on different surfaces in developing latent fingerprints. When developed prints are compared with fluorescent powder, they give good results almost similar to the widely used conventional method (fluorescent powder) and give better results as compared to normal soil powder. As a

substitute, these powders can be utilized to the conventional powders on different surfaces because these are non-toxic, less expensive and easily available. Thus, the technique has a future scope and applications. If these powders can be combined with different nanoparticles and developed at a large scale can be proven as a substitution for chemical powders and can be used in forensic laboratories. This study also explored to development of latent fingerprints on various surfaces.

5. References

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