

Evaluation Of Latent Fingerprints Using Titanium Dioxide Powder And Herbal Powders On Different Surfaces-An Observational Study

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Abstract

INTRODUCTION: Various methods have been reported for the development of latent fingerprints on different surfaces in the literature. This article presents a new powdering method which is simple, non-toxic for the development of latent fingerprints that can be employed on different substrates. Arrowroot is a white, flavourless powder most often used to thicken food and is comprised of starches extracted from tropical tubers *Maranta arundinacea*, the arrowroot plant. Raspberry powder (*Rubus idaeus*) is also a commonly used food product, mainly for flavouring.

AIM: The main aim of the present study is to evaluate the latent fingerprints on different surfaces using titanium dioxide powder and herbal powders on six different surfaces.

MATERIALS AND METHODS: Three different powders namely Titanium dioxide powder, Arrowroot powder (*Maranta arundinacea*), dried raspberry powder (*Rubus idaeus*) were used. Six different surfaces were selected and latent fingerprints were analysed on these surfaces. Latent fingerprint analysis was done using dusting method. For successful developments, powder was applied to a surface by sprinkling powder with the help of brush and lifting the developed prints with help of tapping method. Only ridge patterns stand out from the contrasting background. After waiting for a fraction of seconds, excess of powders adhering to the prints were dusted off to visualize clear prints. Comparative analysis was done for the powders to check for the best results obtained on the selected surfaces.

RESULTS: Titanium dioxide powder, *Maranta arundinacea* and *Rubus idaeus* showed better results while visualising latent fingerprints. The main advantage was that these powders remained stable

and they also had traces while subjecting them for removal. So they can be used for analysis in scenarios where multiple fingerprints are required from a particular crime scene.

CONCLUSION: From the present study, it can be concluded that easily and commonly accessible and less expensive reagents i.e., household kitchen powders could act as a beneficial substitute for decrypting the latent prints.

Keywords: Latent fingerprints, *Maranta arundinacea*, titanium dioxide, *Rubus idaeus*

INTRODUCTION

Fingerprints have often been and still are considered one of the valuable types of physical evidence in identification. A fingerprint is an impression of the friction skin ridges of fingers upon contact with an object or surface. Being remarkably unique to only an individual, fingerprint is essentially used as a primary robust human identification tool in forensic investigations [1]. Forensically, fingerprints can be categorised into three different classes: visible, plastic and latent. It has been reported that latent fingerprints are the most commonly found at the scenes of crime [2] and due to its invisibility, such prints often require the use of enhancing tools like powder dusting. Latent prints are not visible to the naked eye and thus require some means of development or enhancement for their visualization. New techniques have been developed for latent fingerprint detection but the traditional fingerprint detection technique for treating latent prints is powdering method. When the fingerprint powder is sprinkled over an affected area, the powder adheres to the oil, sweat or other materials left in a fingerprint. Powdering technique has been used as a technique since the early 1900s. Over this period, many fingerprint powder formulations have been in use, with each formula consisting of a colorant for contrast and a resinous material for good adhesion. [1] Hundreds of fingerprint powder formulas have been developed over the years. In general, there are four classes of fingerprint powders—regular, luminescent, metallic and thermoplastic. [3] In the past, powder dusting, ninhydrin dipping, iodine fuming and silver nitrate soaking were the most commonly used techniques for latent print development. These traditional techniques are quite effective for many surfaces. However, these traditional methods for latent

print detection are not always effective and scientists have attempted to improve the existing methods for the visualization of latent prints. Some of the chemical substances used in the fingerprint powders are toxic and pose potential health hazards. In order to overcome this disadvantage, we have attempted to use a new powder for developing latent fingerprints which is easily available, non-toxic and it has so many medicinal uses (arrowroot powder, raspberry powder). Arrowroot is a white, flavourless powder most often used to thicken food and is comprised of starches extracted from tropical tubers (*Maranta arundinacea*), the arrowroot plant. Raspberry powder (*Rubus idaeus*) is also a commonly used food product, mainly for flavouring. Furthermore, said technique has become quite the popular go-to method to visualise fingerprints due to it being inexpensive, simple and fast [4- 5]. The efficiency of such said method depends largely on the mechanical adherence of powder and general constituents of fingerprints [4, 6-7]. At present, a wide range of powder dusting variants have been introduced to manifest the utmost contrast and quality between the visualised fingerprints and the dry, non-porous object/surface. Black (carbon-based) and white (titanium-based) powders are the two most colour variants of powder dusting that are routinely used in visualising latent fingerprints. However, some of the chemicals used in the powders pose harmful threats and carcinogenic hazards towards the users. So the present study was done to assess the efficacy of herbal powders in visualising latent fingerprints.

MATERIALS AND METHODS

Latent fingerprints were collected on six different surfaces. The method used in the development of latent prints is powder dusting. It is a physical method of enhancement of latent prints and works on the mechanical adherence of the fingerprint powder particles to the oily components of the skin ridge

deposits. Application of powder to the print by brushing is a simple and an easy technique but it also has disadvantages that the brush on coming in contact with the surface having the print destroys the print and hence the ridge characteristics get destroyed. In order to develop latent fingerprints with the help of arrowroot powder and raspberry powder, few grams of pure (freshly grinded from arrowroot and dried raspberry) commercially available arrowroot powder and raspberry powder was taken in the present study and then further ground in a blender in order to get a very fine powder to the level of talcum powder. The powder so prepared was kept in the glass containers, sealed and were stored at the laboratory conditions. The powders when kept in the open formed the masses probably due to

the absorption of water from the atmosphere and on again grinding in the blender formed the same type of powder. The experiments were carried out in the months of January and February when the temperature varied from 26 to 32 C and the relative humidity between 60% and 70%. The powder is sprinkled over a surface and then excess of powder is removed by tapping in order to get a clear print. In order to check the comparative evaluation, the arrow root powder, raspberry powder and titanium dioxide particle powder has been applied on porous and non-porous surfaces. The types of surfaces which have been employed in this investigation are –normal paper, granite slab, glass window, cupboard wooden surface, black board, plastic container as well as door surfaces.



Fig.1 Image showing the dusting method used for latent fingerprint analysis.

RESULTS

The observational study results of the latent fingerprint development using arrowroot powder, raspberry powder and titanium dioxide powder on six different surfaces are shown in (Fig2,3). The latent fingerprints present on majority of the surfaces examined can be successfully developed with raspberry powder. The comparative evaluation of different surfaces with herbal powders reveals that it gives better results with raspberry powder

when compared to arrowroot powder. The fingerprint developed by raspberry powder gave results almost similar to the widely used titanium dioxide powder. The main advantage was that these powders remained stable and they also had traces remaining even after they were subjected for removal. So they can be used for analysis in scenarios where multiple fingerprints are required from a particular crime scene.

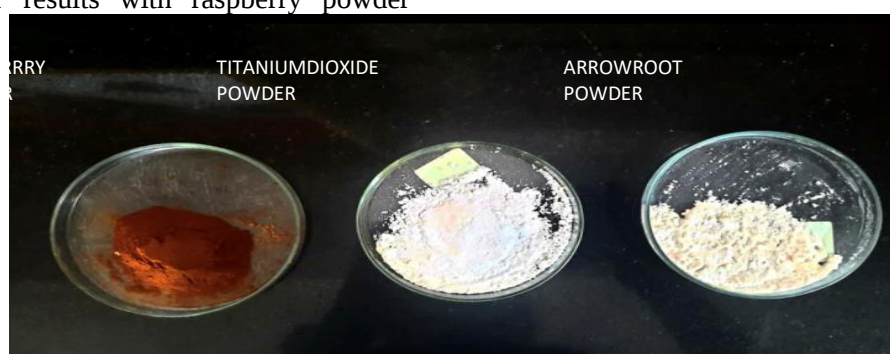


Fig.2 Image showing the various powders used for latent fingerprint analysis

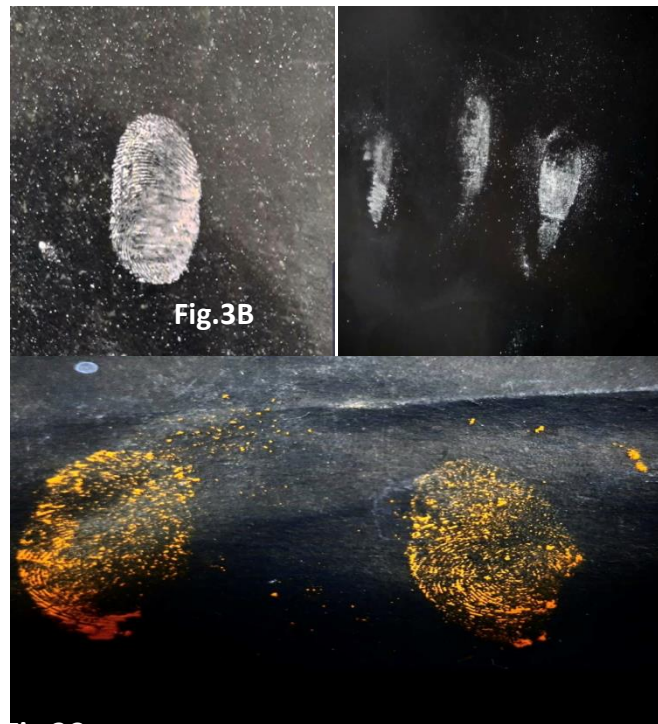


Fig.3 Image showing the observational study results of various powders used.

Fig.3A Latent fingerprint development using Titanium dioxide powder.Fig.3B Latent fingerprint development using Arrowroot powder.Fig.3C Latent fingerprint development using Raspberrypowder.

DISCUSSION

Eversince Sir Francis Galton, who was the first to show how fingerprints could be used to identify individuals, methods for collection and processing have come a long way.[11]Fingerprints are used to determine the physical identity of the people associated with crime and are used as evidence in the court of law. Fingerprint evidence rests on two basic principles.(a) A persons “friction ridge patterns”(swirled skin on fingertips) don’t change the pattern over the years.

(b) No two people have the same pattern of friction ridges including identical twins. [12]

Fingerprints consists of ridges,which are raised lines, and furrows, which are the valleys between those lines and it is the pattern that they make is different for everyone. [13]

According to Forensic Science there are three different types of fingerprints. Patent prints, Plastic prints and Latent prints.[14]Latent prints, is the most common type of print and take the most effort to locate since they are

invisible. Latent prints occur when someone touches any porous or nonporous surface.[15]

The easiest method to collect a Latent fingerprint is called dusting, where a very fine powder that can stick to the oil in the fingerprint. Once visible it can be lifted from the surface using a clear tape, transfer to another surface which then can be taken to the laboratory for further analysis.[14,15]. The type of surface investigated often determines the technique used to collect fingerprints.

On nonporous surfaces such as glass, marble, metal, plastic the powder technique is used to find latent prints but this technique is not effective in porous surfaces such as fabric and paper. Here Chemical methods such as iodine fuming,silver nitrate or ninhydrin is used.[15]

There are several factors which influence the fingerprint powder quality. They are fineness, adhesion, sensitivity, colour and flow. Fineness of the powder determines its ability to show the detail of the fingerprint. The powder must have the right level of adhesion so that it

will adhere to the residue of the fingerprint. This is also known as 'painting'. Sensitivity relates to adhesion and is how well it adheres to the surface. The colour of the powder must be a suitable colour depending on the surface in question. The powder should have a suitable flow so that it won't solidify into a block which would render it useless. When these qualities are not present in one material a composition of various materials is used.

Keeping these factors in mind this study was done to compare "Titanium dioxide powder" with "Arrowroot powder" (*Maranta arundinacea*), and "Raspberry powder" (*Rubus idaeus*). Titanium dioxide is a white powder, routinely used contains chemicals which are toxic Carcinogens which pose potential health hazards to the users. The powder used in this study Arrowroot powder (*Maranta arundinacea*), and Raspberry powder (*Rubus idaeus*) are easily available, non-toxic with many medicinal values.

Results between the three powders showed similar results. A comparison between Arrowroot powder (*Maranta arundinacea*), and Raspberry powder (*Rubus idaeus*) were then made, which showed that the Raspberry powder showed better results than the Arrowroot powder. Both these powders remained stable when subjected to removal.

In order to check the comparative evaluation, the Arrowroot powder (*Maranta arundinacea*), Raspberry powder (*Rubus idaeus*) and titanium dioxide particle powder has been applied on porous and non-porous surfaces. The types of surfaces which have been employed in this investigation are – normal paper, granite slab, glass window, cupboard wooden surface, black board, plastic container as well as door surfaces. The experiments were carried out in the months of January and February when the temperature varied from 26 to 32 C and the relative humidity between 60% and 70%. Arrowroot powder is whitish yellow in color whereas Raspberry is brown in color.

A Similar study done using Turmeric (*Curcuma longa*) previously showed similar good results but the study only showed its effectiveness on nine different surfaces.[16] These powders are found to be

environmental friendly and is found to be economical also.[17,18].

The present study was done on six different surfaces but also compared its effectiveness with titanium dioxide which is a commonly used dusting powder by the investigators. Though the present study clearly favours these two powders because of its cost, availability, non-toxic and effectiveness this is a preliminary study. Further investigations are required to find the stability of the powder under different temperatures.

CONCLUSION

The results of the present study revealed that herbal powders (*Maranta arundinacea* and *Rubus idaeus*) showed good results in visualising latent fingerprints. When compared between the two herbal powders Raspberry powder (*Rubus idaeus*) showed better results almost similar to the widely used titanium dioxide powder in visualising latent fingerprints. Easily, commonly accessible and less expensive reagents i.e., household kitchen powders could act as a beneficial substitute for decrypting the latent prints.

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