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Visualisation and Enhancement of Latent Fingerprints Using Citrus Fruits (Citrus Limon Powder)

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ABSTRACT
Numerous techniques for revealing latent fingerprints on different surfaces have been documented in the literature. This research introduces a new, straightforward, and non-toxic powdering method for developing latent fingerprints on various substrates. The study employed lemon powder, an affordable, easy-to-use, and readily available material, to detect latent fingerprints on nine different substrates. The findings indicate that this method yields highly clear results on most surfaces.

KEYWORDS: Citrus Limon, Latent Fingerprints,Forensic Science,Powder Method.

1. INTRODUCTION

Fingerprints have long been considered a crucial form of physical evidence for identification. Generally, three types of fingerprint evidence can be found at a crime scene: patent (visible) prints, plastic (impression) prints, and latent fingerprints. Latent prints are typically invisible and can be present on various surfaces, requiring some method of development or enhancement for visualization. While new techniques for detecting latent fingerprints have emerged, the traditional method remains the powdering technique. In this method, fingerprint powder is dusted over an area, adhering to the oils, sweat, or other substances left by a fingerprint. This technique has been in use since the early 1900s. Over time, numerous fingerprint powder formulations have been developed, each containing a colorant for contrast and a resinous material for effective adhesion. Hundreds of such formulas have been created over the years. Fingerprint powders are generally categorized into four types: regular, luminescent, metallic, and thermoplastic. Traditional methods for developing latent prints include powder dusting, ninhydrin dipping, iodine fuming, and silver nitrate soaking. While these conventional techniques are highly effective on many surfaces, they are not always successful, prompting scientists to seek improvements. Various powders are used to develop latent fingerprints on different surfaces, as shown in Table 1. However, some fingerprint powders contain toxic chemicals that pose health risks. This issue has been addressed by using a powder that is readily available, non-toxic, and has numerous medicinal uses—lemon powder. Lemon (Citrus limon), a member of the Rutaceae[1] family, is known for its bright, intense yellow color due to its high concentration of citric acid, with a pH of 3-6. It has been cultivated in India since the British era. The authors of this study have endeavored to develop a novel method for identifying latent fingerprints on various surfaces using lemon powder.

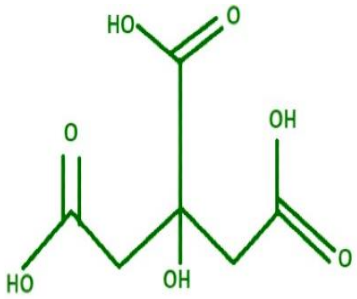


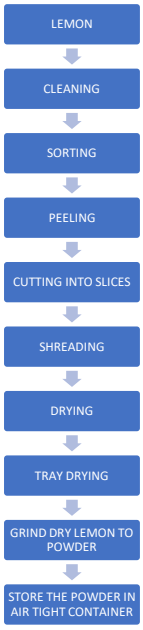
Fig 1. structure of citric acid.

TABLE 1- TYPES OF POWDER FOR DEVELOPMENT OF FINGERPRINTS

S.No.	NAME OF THE POWDER
1.	Phloxine B dye[2]
2.	Congo red dye[3]
3.	Azure 1 dye[4]
4.	Rhodamine 6G[5]
5.	Lead powder[6]
6.	Sudan III[7]

2. MATERIAL AND METHOD

Seven healthy adults (ages 18-28), free from any diseases, disorders, or infections, were selected for the study. Each participant was informed about the nature, purpose, and method of the research. Latent fingerprints were collected using sebum from their foreheads and faces. The development of these latent prints utilized the powder dusting technique, which works on the principle of adherence, as the powder sticks to the sweat components of the skin ridge deposits. A brush is used to apply the powder, but one drawback is that contact with the surface can sometimes damage the prints. For this study, a few grams of fresh lemon powder were prepared by drying lemons and then blending them into a fine powder. This prepared powder was sealed in an airtight container and stored under laboratory conditions.



3. Result and discussion

The results of developing latent fingerprints using lemon powder on various surfaces are illustrated in Figures 2-6. Lemon powder effectively reveals fingerprints on a range of surfaces due to the formation of hydrogen bonds between the fatty acids in sebum and the hydroxyl (-OH) and carbonyl (C=O) groups in citric acid ($C_6H_8O_7$). Comparative evaluations showed that beetroot powder yielded better results on smooth, high-contrast surfaces.

The study involved developing latent fingerprints on surfaces such as plain paper, hard plastic, painted metal, glass, wood, and CDs. It was suggested that beetroot powder is particularly effective for visualizing latent fingerprints on smooth, high-contrast surfaces. Fingerprints developed on CDs, including the top and writable areas, remained visible and the CD was still functional, with no data loss after fingerprint development (Fig. 6). However, latent prints on skin were less clear due to the skin's less smooth and low-contrast surface.

The study indicates that while beetroot powder can be used on most surfaces, it is less effective on skin. This preliminary examination suggests potential for further exploration, including studies on temperature, humidity, and chemical analyses using these powders. The authors have also experimented with developing latent fingerprints using colored powder dyes and various spices.

Fig 2 development of latent fingerprint On plain paper

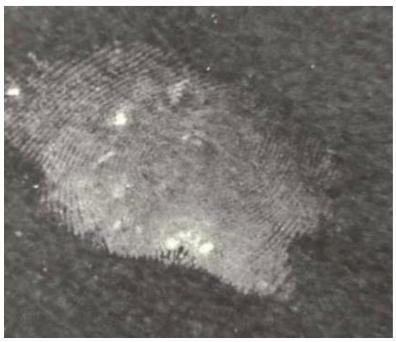


Fig 3 development of fingerprints on marble stone

Fig 4 development of fingerprint on wooden surface

Fig 5 development of fingerprint on coloured plastic sheet

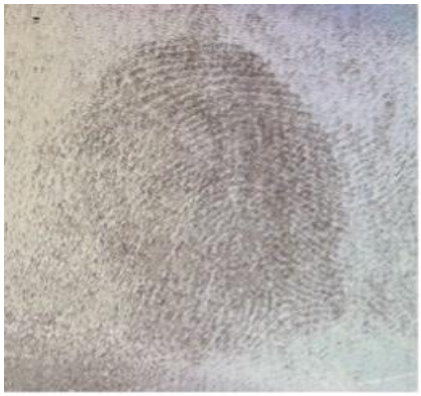


Fig 6 development of fingerprint on CD

4. CONCLUSION

It is concluded that beetroot powder is both inexpensive and non-toxic, making it suitable for use on various surfaces. Consequently, lemon powder can also be employed at crime scenes for developing fingerprints. The resulting prints, as shown in the photographs, exhibit exceptionally high visual quality.

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