Efficacy of Robin® powder blue for latent fingerprint development on various surfaces

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Abstract: Latent fingerprints are subject to easy damage and destruction owing to their fragile nature. Powder dusting is the easiest and fastest of the methods used for latent fingerprint development (LFPD). In the present study, Robin® powder blue, a common household product (used as a post-wash whitening agent and popularly known in India as ‘neel’) which is user friendly, less expensive, non-toxic, non-hazardous, environment friendly, simple and easily available substitute to the commercially available and costlier powders, has been used for LFPD. The powder was tested on twenty-four strategically chosen surfaces, keeping in mind the high frequency at which they are commonly encountered on various crime scenes. It was shown that this powder gives very good results, even on most of the intricate and multi-colored surfaces tested.

1. Introduction

Finger or thumb impressions are often encountered in civil and criminal cases as major evidence.1–3 Whenever a person touches, holds, and/or lifts any object, there is a more than certain chance that the fingerprints would get transferred onto the touched surface. Fingerprints may be classified as latent (invisible), visible and plastic prints. Locating a plastic or visible print at the crime scene is a comparatively simpler task since they are generally visible to the searching naked eyes. However, finding latent or invisible prints is much harder and requires the utilization of proper visualization and/or development technique. There are several methods for the visualization of the latent prints, the choice of which depends upon the surface under examination, ease of use, effectiveness and efficiency as well as health and safety considerations among other factors.4

Powder dusting is a method of physical enhancement that relies on the mechanical adherence of fingerprint powder to the moisture and oily components of skin ridge deposits left at the surface.5 The effectiveness of the powder adhering to the prints depends on the particle size and shape among other things. Smaller and finer particles generally adhere more easily than larger and coarser ones.6

Several researchers7–19 in the past have attempted the use of various conventional, unconventional and commercially available powders, dyes and pigments for latent fingerprint development. In the present work, we demonstrate the use of Robin®
powder blue (whose major and active component is Ultramarine blue pigment), a common post wash fabric whitening agent, popularly known in India as ‘neel’, for visualization of latent fingerprints.

The name “Ultramarine” comes from Latin *ultra* = beyond and *mare* = sea. Ultramarine blue is an inorganic and complex compound formerly obtained from lapis lazuli but now prepared artificially. This famous blue pigment dates back to the early 19th century. Chemically, these are the most complex out of all inorganic class pigments. It consists of sodium, aluminum, silicate lattices and polysulphide (-S-S-S) chains. It is produced by heating kaolin, sodium carbonate, sulfur and other inexpensive ingredients together. The blue color of the pigment is due to the $S_2$-radical anion, which contains an unpaired electron. In chemical composition and

Figure 1  Touch screen glass of a smartphone.

Figure 2  Phone back (Plastic).

Figure 3  Credit card (Front).

Figure 4  Magnetic strip credit card (Back).

Figure 5  Pen drive (White).
structure it is similar to the natural ultramarine and has an approximate chemical formula \( \text{Na}_{6-10}\text{Al}_6\text{Si}_6\text{O}_{24}\text{S}_{2-4} \) or \( 3\text{Na}_2\text{O}\cdot2\text{Al}_2\text{O}_3\cdot6\text{SiO}_2\cdot2\text{Na}_2\text{S} \) which can vary with the manufacturing conditions, purity and the different proportions of the ingredients.

Ultramarine blue is the most commonly used laundry blue. It is a fine powder and gives violet blue color. It is not harmful to the fabrics and is resistant to heat and alkali. It is very safe, environment friendly, multipurpose and non-hazardous. The available toxicity information indicates that ultramarine blue is of low or no toxicological concern. This is consistent with the fact that it is insoluble; and therefore is likely to be poorly absorbed by any route in the body. The synthetic manufacturing process and control over its physical, chemical, and color characteristics enable it to be produced in many other types, which are readily used by plastic, printing ink, paints including kids’ fingerpaints, modeling clays, cement, soaps, cosmetics (eye shadows and eye pencils), detergents, paper and many other industries. It has excellent light-fastness and heat stability (up to 350 °C), due to these advantages it is preferred over other organic pigments and dyes. Synthetic ultramarine is more vivid blue than natural ultramarine, since the particles are rounded, finer and more uniform.

To the best of our knowledge, the use of this powder has not been attempted in the past for LFPD and/or on the surfaces selected by us, hence, this study.

2. Methodology

Ten healthy adult subjects (aged 18–28 years), free from any disease, disorder or pathology of the hand were selected. They
were informed about the nature, purpose and method of the study. The subjects were asked to wash and dry their hands clean, to eliminate the possibility of contamination by any extraneous substance, dirt or dust. Keeping the palm in closed position (fist) for around 2 min ensured fair amount of sweating. The participants were then asked to hold/touch the given objects surfaces as they would normally do in daily routine, thereby leaving their fingerprints on them. After deposition, the prints were left as such (in open) for around 24 h in laboratory (room) condition. The experiment was carried out in the month of March–April. The temperature ranged between 32 and 43 °C and relative humidity around 64–73%. The Robin® powder blue manufactured by Reckitt Benckiser (India) Ltd. was used to develop latent fingerprints on all the surfaces. It was noted that the powder if kept in the open may form clumps probably due to the absorption of moisture from the surrounding atmosphere and for better results it is advisable to keep it in the oven for around 15 min at 60 °C. The powder was then kept in sterile air-tight glass bottles and sealed.

Powdering method using a suitable (soft feather) brush has been used, wherein, the powder blue was sprinkled over the surface carrying the latent fingerprints. Excess powder was removed by gentle tapping and by slowly using the brush in order to get clear prints. As a precautionary measure (to be) routinely followed in forensic practice, hand gloves and face masks were used by the operators. To exclude the possibility of intra-developer and inter-developer errors, both the authors independently performed the development procedure thrice after an interval of two-two days.
Photographs were taken using a DSLR camera (Nikon D3100- 14.2 MP- AF-S NIKKOR 18–55 mm lens kit). For best results, use of tripod is recommended. The photographs clicked were transferred on to a laptop and were cropped and resized in “Microsoft Office Picture Manager” software.

The twenty-four surfaces used were: touch screen of smartphone (Corning Gorilla Glass), phone back (plastic), credit card (front), Magnetic strip of credit card (back black portion), pen drive (white and black), computer mouse, computer keyboard (spacebar), metallic door knob, glass, steel cupboard (painted surface), lock, stainless steel, silver surface, keychain, electric switch, currency coin, glossy laminated cover page, simple paper, multicolored glossy paper, wooden door, plastic petrol can, plastic water bottle, inner surface of rubber glove.

These surfaces in the form of evidence are generally encountered at the scene of crime of burglary, house break and theft, trespassing, data stealing or theft (at home, office and/or corporate setup), arson, etc.

3. Results and discussion

The use of Robin© powder blue (whose major component is ultramarine blue pigment) in the present study proved highly efficacious for the development of latent fingerprints (Figs. 1–24). Powder dusting-light brushing method used developed clearly visible ridges. Good contrast was seen owing to the bright blue color of the developed prints on light-colored surfaces [Fig.: pen drive-white, credit card (front)]. Appreciable results have been obtained on multicolored surfaces too [multicolored glossy paper]. Clearly visible ridge details have been
observed on black as well as dark surfaces (phone back, magnetic strip of credit card, keyboard, mouse, pen drive). Due to very good contrast, the prints were easy to be photographed. Tape lifting of the developed prints was also possible. Previously, the success rate has been low in regard to certain tricky surfaces such as door knobs, keys, and gloves among many others. Therefore, efforts have been made to examine the possibility of developing prints on these unlikely items and surfaces that are most often ‘touched’ but are fairly ignored in the process of investigation. A little extra time and effort by the investigator in this regard will definitely help reveal the fingerprint details that may help solve many routine cases (burglary, theft, etc.).

Although the method is simple and efficient, care has to be taken while powdering, for, the marks are very sensitive and can easily get smudged and become unusable. Problems that are probable to be encountered during the process include moistening of the powder, over-powdering and brushing. While, moisture from the powder can be removed by short oven drying but rest of the two are solely dependent on the skills of the investigator.

The results obtained in the current preliminary study were in accordance to many other researchers who also demonstrated the potential of many other common powders for effective latent print development. Kumari et al. presented a new powdering method (synthetic food and festival color – gulal) for the development of latent fingerprints on different substrates as preliminary studies and observed that the application of colors to latent finger prints gives clear results particularly on aluminum matrices. Garg et al. used, turmeric...
powder, a common ingredient in Indian food, to decipher the latent fingerprints on nine different substrates and found that it gives very clear results in majority of the surfaces. Singh et al. had used silica gel G powder (usually used in TLC plates preparation) to develop latent fingerprints on eight commonly encountered different substrates i.e., plastic, glass, ordinary mirror and metallic substrates, aluminum foil sheet, carbon paper, matchbox, cardboard, glossy-painted wooden substrates, top and writable surface of CD and glazed colored magazine paper surface. They observed very clear results on most of the substrates with clear ridges.

4. Conclusion

Our current study is basically a preliminary observation aimed to bring forth the efficacy of Robin® powder blue for the development of latent fingerprints on a wide range of surfaces. It can be concluded from the present study that this commonly available; less expensive; non-toxic powder can be successfully used for the decipherment of latent fingerprints deposited on a broad spectrum of non-porous, porous and semiporous surfaces. It also proves to be efficient in visualizing prints on multi-colored surfaces giving excellent results. It effectively and successfully proves its usefulness in forensic latent fingerprint development. Further studies with respect to the factors affecting the prints under varied conditions of temperature, humidity, seasonal variation, time lag, thorough comparison between the new powder and conventional ones using split marks, depletive series of marks, of different ages, etc. are in progress.

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Conflict of interest

None declared.

Ethical approval

Necessary ethical approval was obtained from the institute ethics committee.

Informed Consent

Informed consent was obtained from the participants of the study.
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