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A NEW METHOD TO CREATE HIGH CONTRAST COLOR LATENT FINGERPRINTS ON NON-POROUS SURFACES

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Abstract

Fingerprint, one of the most important evidences, can be used to indentify suspects. Cyanoacrylate (Superglue) fuming is used to generate fingerprint on non-porous and semi-porous surfaces. The developed fingerprint reveals white finger mark which is not contrast with the white surface. Iodine can react with oily component of skin. The aim of the present study was to find a new method to create high contrast color fingerprints on non-porous and semi-porous surfaces. Therefore, simultaneous use of cyanoacrylate (CA) and iodine fuming was employed to produce good quality yellowish latent fingerprints which were better than those obtained from CA fuming or iodine fuming alone. The optimal condition of the new method was examined by heating 12 drops of CA at 90°C for 20 min, followed by heating iodine 0.2 g for 4 min on the turning off heater. The inked fingerprint containing 24 points minutia was used as a reference to calculate the percentage of the tested prints. The best results were obtained from aluminum can (100%), polypropylene plastic box (95.83%), ceramic dish (95.83%), A4 plastic envelope (95.83%), transparent or white high density polyethylene (plastic) bag (91.67%), poly propylene bag (83.33%), and CD disc (83.33%). The poor results were obtained from the white melamine plate (50%) and the photographic paper for printer (16.67%). The results of the present study showed that the visible yellowish latent fingerprints on non-porous surface developed by simultaneous use of CA and iodine fuming were easy to examine and the images could be retained for 3-40 days depend on the type of materials.

Keywords: fingerprint, cyanoacrylate fuming, iodine fuming

Introduction

At the crime scene, latent fingerprints are often visible in white or light color. They cannot be observed directly by naked eye and need to develop or enhance by several methods. CA fuming followed by powder dusting is the most commonly used method for fingerprint detection on non-porous and semi-porous surfaces. CA fuming fingerprints present white mark and difficult to be seen on white surfaces. The aim of the present study was to find a new technique to enhance white finger marks. Iodine crystal has been used to create yellowish color fingerprint. Iodine fuming is used with porous surface and it is not permanent due to its sublimation. Bybelezer (2008) reported the humidification method for fixing iodine-fumed latent prints to increase the contrast between the prints and the substrate, but they are not permanent. Jasuja et al. (2012) showed that the brucine solution can fix latent finger marks developed by iodine fuming on porous and non-porous substrates.

Methodology

The sample surfaces used in the present study were non-porous (aluminum can, polypropylene plastic box, ceramic dish, A4 plastic envelope, transparent or white high density polyethylene (plastic) bag, polypropylene bag, CD disc, and white melamine plate), and semi-porous surfaces (photographic paper for printer). Simultaneous use of CA fuming and iodine fuming were performed in a plastic cabinet (size 23×47×27 cm). CA (BVDA Co., Ltd.) 12 drops and iodine crystal (Fisher Scientific, UK.) 0.2 g. were separately put in an aluminum foil dish while heating (Favorit).

The optimal condition of CA fuming and iodine fuming alone were 90°C, for 20 min and 65°C, for 8 min, respectively, which were obtained by the following steps:

a) Fingerprints were prepared by using the author's clean right thumb which had been touched on an oily area (neck) before pressing on the red or white sticker papers for CA fuming and iodine fuming, respectively.

b) CA fuming was performed at 60, 70, 80, 90, and 100°C for 10, 15, 20 and 25 min. Iodine fuming was done at 50, 60, 65, and 70°C for 5, 6, 7, 8, 9 and 10 min.

Four experiments were performed in order to obtain the optimal condition of simultaneous use of CA and iodine fuming. Two right thumb fingerprints were impressed on each porous and nonporous surface; the heater was turned on at the beginning of the experiment. The 4 experiments (Exp) were as follows:

Exp 1: Simultaneous use of CA and iodine fuming were done at 90°C, for 15, 20 and 25 min.

Exp 2: Simultaneous use of CA fuming (at 90°C) and iodine fuming (at approximately 65°C) were done for 15, 20 and 25 min. This was done by putting an aluminum foil dish (containing iodine crystal 0.2 g) on a piece of ceramic which on top of an overturn ceramic dish while heating.

Exp 3: CA fuming was done first at 90°C for 5, 10 15 min, followed by reducing the heater temperature to approximately 65°C, then iodine fuming was performed for 15, 10, 5 min, respectively.

Exp 4: CA fuming was done first at 90°C for 20 min, followed by turning off the heater and then iodine fuming for 4 min.

The best results on most surfaces were obtained from the Exp 4. All developed fingerprints were then photographed, counted the number of minutia, calculated the percentage and noted for the visible retaining time. The 24 points minutia of the inked print was used as a reference and accounted for 100%.

Results

The results showed that good contrast yellowish fingerprints were obtained from the 4th method (CA fuming was done first at 90°C for 20 min, followed by turning off the heater and then iodine fuming for 4 min). The other methods presented unclear white fingerprints which minutia could not be counted. This probably was due to the high temperature (Exp 1 and Exp 3) and long fuming time (Exp 1, Exp 2, and Exp 3) caused iodine sublimation. The good quality of the developed fingerprints obtained by the new (Exp 4) method was found only on non-porous surface, but not on semi-porous one. The quality of the latent fingerprints was also better than those obtained from CA fuming or iodine fuming alone. With the new method, the very good results (20-24 points, 83.33-100%) (Table 1) were obtained from most nonporous surfaces, except white melamine plate (12 points, 50%). The best result was found on aluminum can (24 points, 100%) (Fig. 1), followed by polypropylene plastic box (23 points, 95.83%), ceramic dish (23 points, 95.83%) (Fig. 2), A4 plastic envelope (23 points, 95.83%), transparent (Fig. 3) or white high density polyethylene (plastic) bag (22 points, 91.67%) (Fig. 4), polypropylene bag (20 points, 83.33%), and CD disc (23 points, 83.33%) (Fig.5). The developed fingerprint images retained visible for up to 3-40 days (Table 1). The poor result was obtained from photographic paper for printer (4 points, 16.67%) (Fig.6). In Thailand, the 12 points (50% minutia) has been used for fingerprint identification in the real cases.

Fig. 1. Developed fingerprint images on an aluminium can. (A) CA fuming (83.33%) (B) Iodine fuming (29.17%). (C) Simultaneous use of CA and iodine fuming (100% minutia).

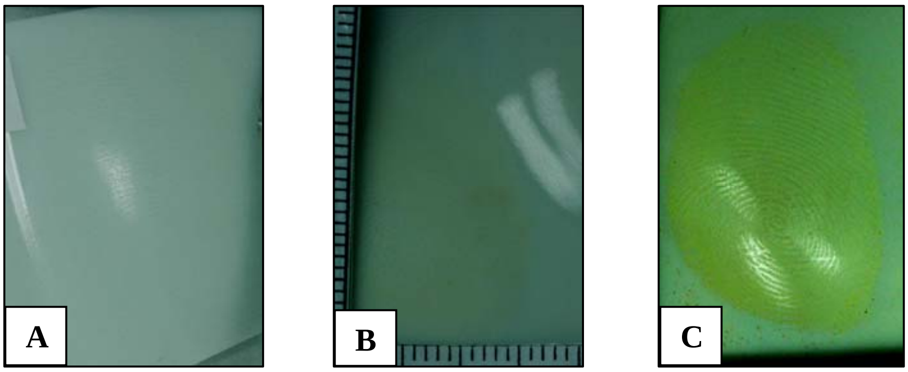

Fig. 2. Developed fingerprint images on ceramic dish. (A) CA fuming (0%). (B) Iodine fuming (0%). (C) Simultaneous use of CA and iodine fuming showing good result (95.83%).

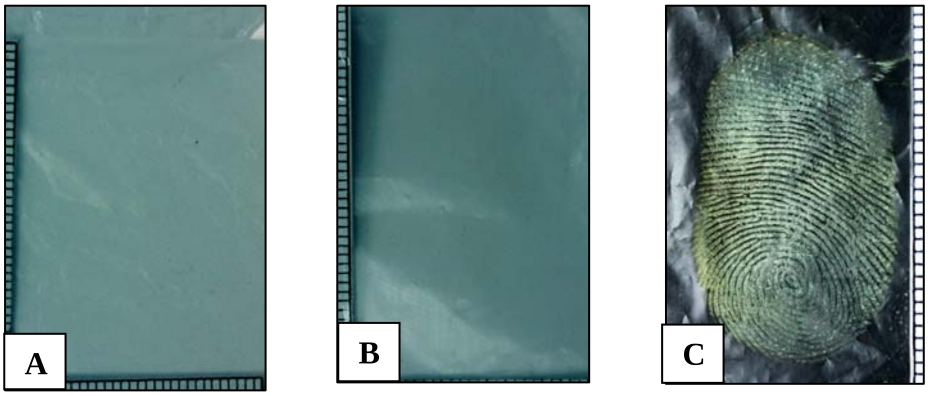

Fig. 3. Developed fingerprint images on transparent high density polyethylene (plastic) bag. (A) CA fuming (0%). (B) Iodine fuming (0%). (C) Simultaneous use of CA and iodine fuming (91.67%).

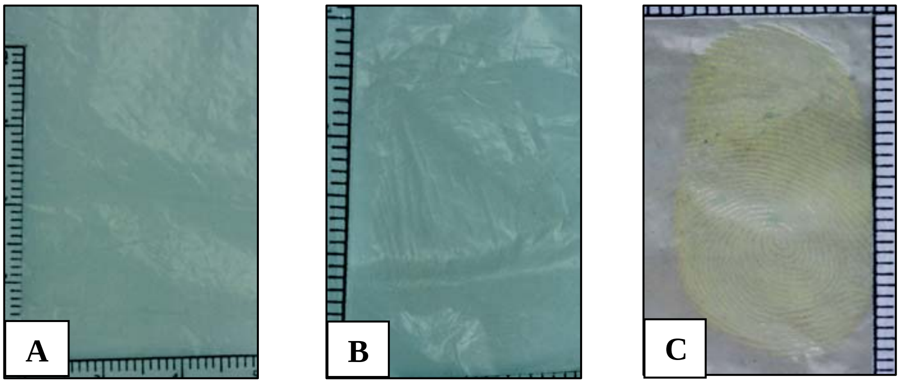

Fig. 4. Developed fingerprint images on white high density polyethylene (plastic) bag. (A) CA fuming (0%). (B) Iodine fuming (0%). (C) Simultaneous use of CA and iodine fuming (91.67%).

For polypropylene plastic bag, similar result was obtained from CA fuming alone and simultaneous use of CA and iodine fuming (20 points, 83.33%). For CD disc, the best result was obtained from iodine fuming alone (23 points, 95.83%) followed by simultaneous use of CA and iodine fuming (20 points, 83.33%) (Fig. 5, Table 1). CA fuming alone presented uncontrast fingerprint and poor minutia (7 points, 29.17%).

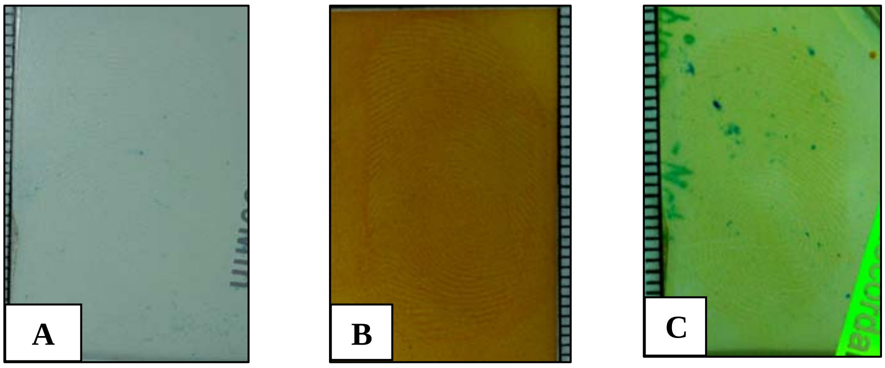

Fig. 5. Developed fingerprint images on CD disc surface. (A) CA fuming (29.17%). (B) Iodine fuming (95.83%). (C) Simultaneous use of CA and iodine fuming (83.33%)

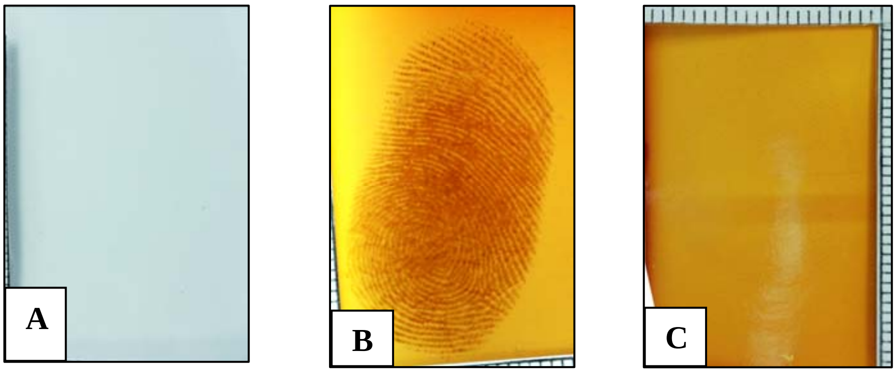

Fig. 6. Developed fingerprint images on photographic papers. (A) CA fuming (0%). (B) Iodine fuming (83.33%). (C) Simultaneous use of CA and iodine fuming (16.67%).

The unclear images on photographic papers (4 points, 16.67%) were obtained from the new method. The iodine fuming alone gave better result (20 points, 83.33%) (Fig. 6).

Table 1. The percentage of minutia and retain visible time of developed fingerprints obtained by the new method (CA+Iodine fuming) and CA fuming or iodine fuming.

Surfaces	**CA Fuming**		**Iodine Fuming**			**CA + Iodine Fuming**		
	Number of Minutia	Minutia %	Number of Minutia	Minutia %	Retain Visible fingerprint images (min)	Number of Minutia	Minutia %	Retain Visible fingerprint images (Days)
Non-porous Surface								
1. Aluminum can (กระป๋องน้ำอัดลม)	20	83.33	7	29.17	3	24	100	7
2. Ceramic dish (จานกระเบื้อง)	0	0	0	0		23	95.83	20
3. Polypropylene Plastic box (กล่องใส่กระดาษทิชชูม้วน)	0	0	3	12.5	3	23	95.83	37
4. A4 Plastic envelope (ซองพลาสติคใส่วารสาร)	0	0	0	0		23	95.83	40
5. Transparent high density polyethylene (plastic) bag (ถุงกรอบแกรบใส)	0	0	0	0		22	91.67	40
6. White high density Polyethylene (plastic) bag (ถุงกรอบแกรบขุ่น)	0	0	0	0		22	91.67	40
7. Polypropylene bag (ถุงพลาสติคใส่อาหารร้อน)	20	83.33	0	0		20	83.33	3
8. CD disc	7	29.17	23	95.83	3	20	83.33	3
9. White Melamine plate (จานเมลามินสีขาว Superware)	0	0	0	0		12	50.00	3
Semi-porous Surface								
10. Photographic paper (for printer) (กระดาษพิมพ์ภาพ)	0	0	20	83.33	3	4	16.67	1

0% = Blurred image, minutia cannot be counted.

Discussion and Conclusion

The best results were obtained from the Exp 4, CA fuming was done first at 90°C for 20 min then followed by turning off the heater and iodine fuming for 4 min. The result showed good contrast yellowish fingerprints on non-porous surface, but not on semi-porous one. The quality of the latent fingerprints was better than those obtained from CA fuming or iodine fuming alone. On the other hand, the results obtained from the Exp 1, 2 and 3 showed the unclear white fingerprints and the minutia could not be counted. This was due to the high temperature and long fuming time caused iodine quickly sublimated and completely evaporated.

In the Exp 4, the quality of latent prints could be from 100% (24 points minutia,) to 83.33% (20 points minutia). The partial 50% (12 points minutia) developed latent print was also found on some porous and semi-porous surface samples. The poor latent print 16.67% (4 points minutia) was obtained from semi-porous surface samples.

In conclusion, the results of the present study showed that our new technique (Exp 4), simultaneous use of CA and iodine fuming, produced good contrast yellowish latent fingerprints on most non-porous surfaces and the visible images were retained for a longer period compared to those obtained from iodine fuming alone.

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