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New Visualizing Agents for Developing Latent Fingerprints on Various Porous and Non-Porous Surfaces Using Different Household Food Items

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Abstract - **Most of the time it is seen that the conventional fingerprint powders used for developing latent fingerprints are toxic and pose potential health hazards. In order to overcome this disadvantage I have attempted to use new powders for developing latent fingerprints which are simple, non- toxic, less expensive than the commercially used fingerprint powders. These are easily available in every house. In the present study a preliminary attempt has been made to develop latent fingerprints with commonly used household kitchen food products such as cocoa powder, custard powder, corn flour, baking soda, baking powder, black salt, edible food (orange colour) and turmeric powder. This type of work has not been reported previously and can provide useful information to the investigators in cases of scarcity or non-availability of regular conventional fingerprint development powders. The use is simple and a novice in the field of forensic fingerprinting can also do it.**

Keywords: **Latent Fingerprints, Food Products, Porous, Non-Porous surfaces.**

I.INTRODUCTION

Criminal offenders usually tread carefully and try to not leave any traces at the scene of crime and handling objects. Yet, latent fingerprints are found in majority of the crime scenes. The surface onto which a fingerprint is deposited is often the primary decipher as to which technique is selected for enhancement. There is a vast range of porous and non-porous surfaces and specific enhancement techniques are selected based on the surface type and porosity, the condition of latent marks and the level of contamination which has occurred [1]. New techniques have been developed for latent fingerprints detection but the traditional fingerprint detection technique for treating latent prints is powdering method, which consists of a colorant for contrast and a resinous material for good adhesion. When powder is sprinkled over an affected area, it adheres to oil, sweat or other material left in the print while colorant in the powder gives contrast to the print from its background thus, helping in visualizing the print. Researches have been done on visualizing latent fingerprints on various surfaces using powder form of turmeric [2]; synthetic food and festival colours [3] and silica gel G [4]. In their study it was concluded that turmeric powder and Silica gel G are good substitutes to other conventional powders like black magnetic powder, grey powder etc. Although the results found by turmeric and synthetic food and festival colours were best for contrast surfaces. The development of latent fingerprints present on surfaces like, simple paper, bond paper, thermal paper, aluminum foil, transparency sheet, wood (sun mica-glossy), plastic sheet, painted steel, top and writing surface of the CD showed clear ridges [2][3][4]. Singh et al [5] determined that fingerprints could be successfully enhanced and recovered from food surfaces such as banana, apple and potato when using black powder although Iodine fuming was also successful on apples. A further study by Trapecar and Vinkovic [6] focussed on similar fruits and vegetables with some successful results. The process of cyano-acrylate fuming was also investigated in their study however, results proved less successful. Fergusan et al. [7] conducted a similar study focussed on latent fingerprints enhancement and recovery on different fruits, vegetable and dairy product (egg). Black magnetic powder proved most successful on all surfaces. They also observed that using SPR developed more than twice the amount of fingerprint albeit at a lower rating. R. Rohatgi et al. [8] conducted experiment with SPR based on crystal violet dye for developing latent fingerprints on wet non-porous surfaces and found similar positive results on ceramic tile, glass and aluminium surface when immersed in clean water. Some of the chemical substrates used in fingerprint powders are toxic and pose potential health hazards. In order to overcome this disadvantage we have attempted to use new powders for developing latent fingerprints which are simple, non- toxic, less expensive than the commercially used fingerprint powders. These are easily available in every house. In the present study a preliminary attempt has been made to develop latent fingerprints with commonly used household kitchen food products such as cocoa powder, custard powder, corn flour, baking soda, baking powder, black salt, edible food (orange colour) and turmeric powder. This type of work has not been reported previously and can provide useful information to the investigators in cases of scarcity or non-availability of regular conventional fingerprint development powders.

II.MATERIALS AND METHODS

10 test latent fingerprints were collected on various porous and non-porous surfaces each. Porous surfaces used for the study were normal paper, currency note, fruit peel (pomegranate), glazed magazine cover paper, card sheet, card board and thermocol while non-porous surfaces were

granite, wood (sun-mica coated), glass, mirror, aluminium foil, ceramic tile, plastic sheet, steel, writable surface of CD and rubber. The test sebum latent prints were collected from the subjects on different surfaces. For collecting sebum prints, subjects were asked to touch their forehead or face for getting sebum on their fingertips these in turn were applied to various substrates. No particular care was taken for contamination on fingertips as sebum prints are a complex mixture of natural secretion and contaminants from the environment. The method used in development of prints was powder dusting without using brush as preliminary study. Application of powder to the prints by brushing is a simple and easy technique but it also has a disadvantage that the brush on coming in contact with the surface having prints destroys the print and hence the ridge characteristics get destroyed. In order to develop latent fingerprints with food products, 20-30 grams commercially available cocoa powder, custard powder, corn flour, baking soda, baking powder, black salt, edible food (orange colour) and turmeric were procured in dry powder form. The powders (as available in the market) were weighed and dried in oven (for 5 minutes at 500C) and sprinkled over the affected surface. The excess powder was removed by tapping in order to get clear prints. This method was repeated for all powders and on all surfaces, ten times each (for 10 test latent prints on each surface per powder). Out of these only the best developed prints were recorded for the result computation.

The experiment was carried out in the month of June-July 2014 when the temperature varied from 31-420C and the relative humidity between 46% and 70%. In order to check the comparative evaluation of surfaces, the different powders were applied on all mentioned porous and non-porous surfaces respectively as shown in Tables 1 and 2 and Graphs 1 and 2.

III.RESULTS AND DISCUSSION

The results obtained from present investigation using different food products in powder form on various porous and non-porous surfaces are shown in Figures -1 to 4. The latent fingerprints present on majority of the surfaces examined can be successfully developed with all employed food products. It has been observed that latent fingerprints were not developed on rubber using any powder. In case of white ceramic tile the prints were developed but lacked contrast in cases of corn flour, custard powder, black salt, baking powder and baking soda. Most clear and visible prints were developed on almost all porous surfaces such as currency note, card sheet, plain paper, glossy magazine cover as revealed by Figures 1 and 3. While non-porous surfaces such as aluminium foil, steel (spoon) and plastic sheet showed very clear decipherable prints with all powders as revealed by Figures- 2 and 4. Among the food powders used for this experiment, cocoa powder, custard powder, corn flour, baking soda and turmeric powder demonstrated best results on all porous and non-porous surfaces. It was noted that all these powders give better results on contrast surfaces. The latent fingerprints present on surfaces such as plain paper, currency note, fruit peel (pomegranate), glazed magazine cover paper, card sheet, card board, thermocol, granite, wood (sun-mica coated), glass, mirror, aluminium foil, ceramic tile, plastic sheet, steel and writable surface of CD, were developed and showed clear ridges as is evident from the figures with all food powders used in the present experiment. The negative results were obtained on white ceramic tile, transparent polythene and thermocol due to poor contrast in cases of custard powder, corn flour, baking soda, baking powder and black salt. However, these surfaces showed clear visible fingerprints with edible (orange) colour and turmeric. No prints could be developed on rubber and card board due to lack of adherence of sebum from latent fingerprints and developing agents on these surfaces. The present study is a preliminary work in this field which is based on 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.

These preliminary observations indicate that the common food products can also be used for the visualization of latent fingerprints present on various porous and non-porous substrates. A similar study conducted by Garg et al. [2] revealed development of latent fingerprints using turmeric powder on varied surfaces. Similarly, in another study by Kumari et al. [3] new method of visualizing latent fingerprints using synthetic food and festival colours was reported. The present study also substantiated that decipherment of fingerprints depends upon the type of powder used and the type of surface on which the finger prints are present.

IV.CONCLUSION

It can be concluded from the present study that these commonly and easily available as well as less expensive and non-toxic agents could be a useful substitute for the decipherment of latent fingerprints deposited on different surfaces. These can provide a good substitute for fingerprint visualization in comparison particularly to commercially available chemical powders, under the instances of scarcity. Further work on the decipherment of aged latent fingerprints needs to be taken up.

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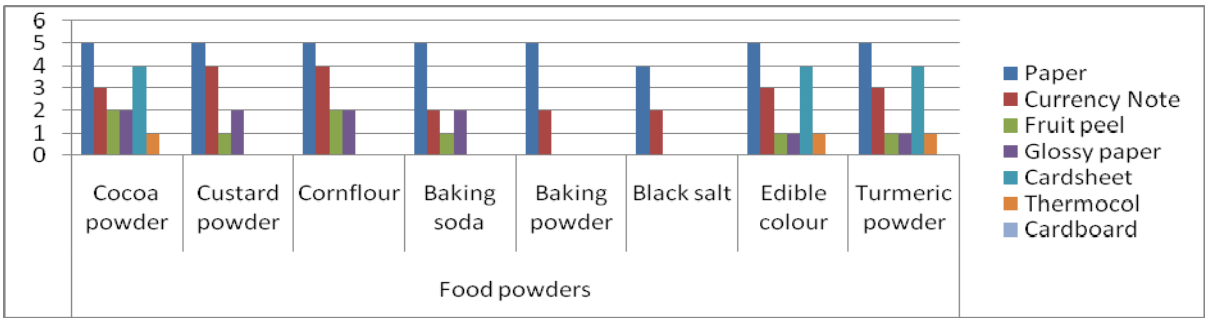
TABLE 1 QUALITY OF DEVELOPED FINGERPRINTS ON POROUS SURFACES

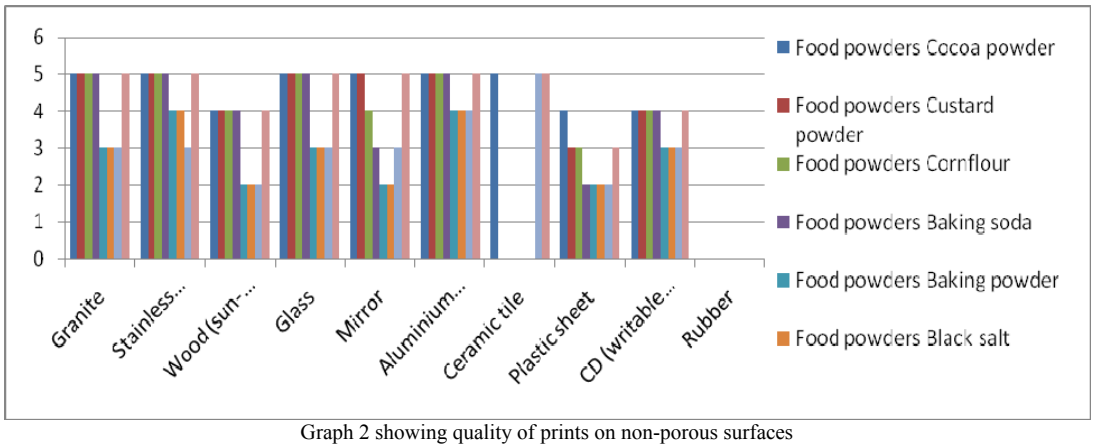
Porous surfaces	**Food powders**							
	Cocoa powder	Custard powder	Cornflour	Baking soda	Baking powder	Black salt	Edible colour	Turmeric powder
Paper	5	5	5	5	5	4	5	5
Currency Note	3	4	4	2	2	2	3	3
Fruit peel	2	1	2	1	0	0	1	1
Glossy paper	2	2	2	2	0	0	1	1
Cardsheet	4	0	0	0	0	0	4	4
Thermocol	1	0	0	0	0	0	1	1
Cardboard	0	0	0	0	0	0	0	0



Graph 1. showing quality of prints on porous surfaces

TABLE II QUALITY OF DEVELOPED FINGERPRINTS ON NON-POROUS SURFACES

Non-porous surfaces	**Food powders**							
	Cocoa powder	Custard powder	Cornflour	Baking soda	Baking powder	Black salt	Edible colour	Turmeric powder
Granite	5	5	5	5	3	3	3	5
Stainless steel spoon	5	5	5	5	4	4	3	5
Wood (sun-mica)	4	4	4	4	2	2	2	4
Glass	5	5	5	5	3	3	3	5
Mirror	5	5	4	3	2	2	3	5
Aluminium foil	5	5	5	5	4	4	4	5
Ceramic tile	5	0	0	0	0	0	5	5
Plastic sheet	4	3	3	2	2	2	2	3
CD (writable surface)	4	4	4	4	3	3	3	4
Rubber	0	0	0	0	0	0	0	0



Graph 2 showing quality of prints on non-porous surfaces

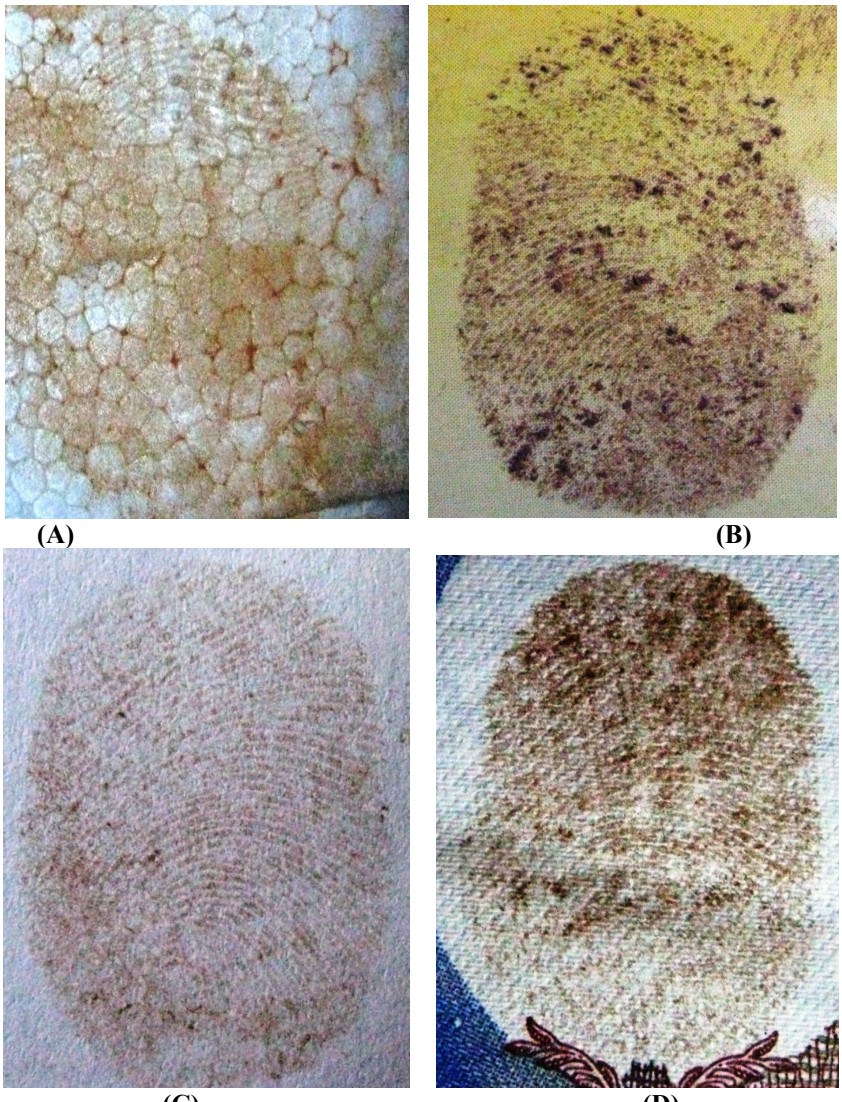


Fig. 1Showing comparative visualization of latent fingerprints on porous surfaces- (A) thermocol; (B) glossy magazine cover; (C) card sheet and (D) currency note with cocoa powder.

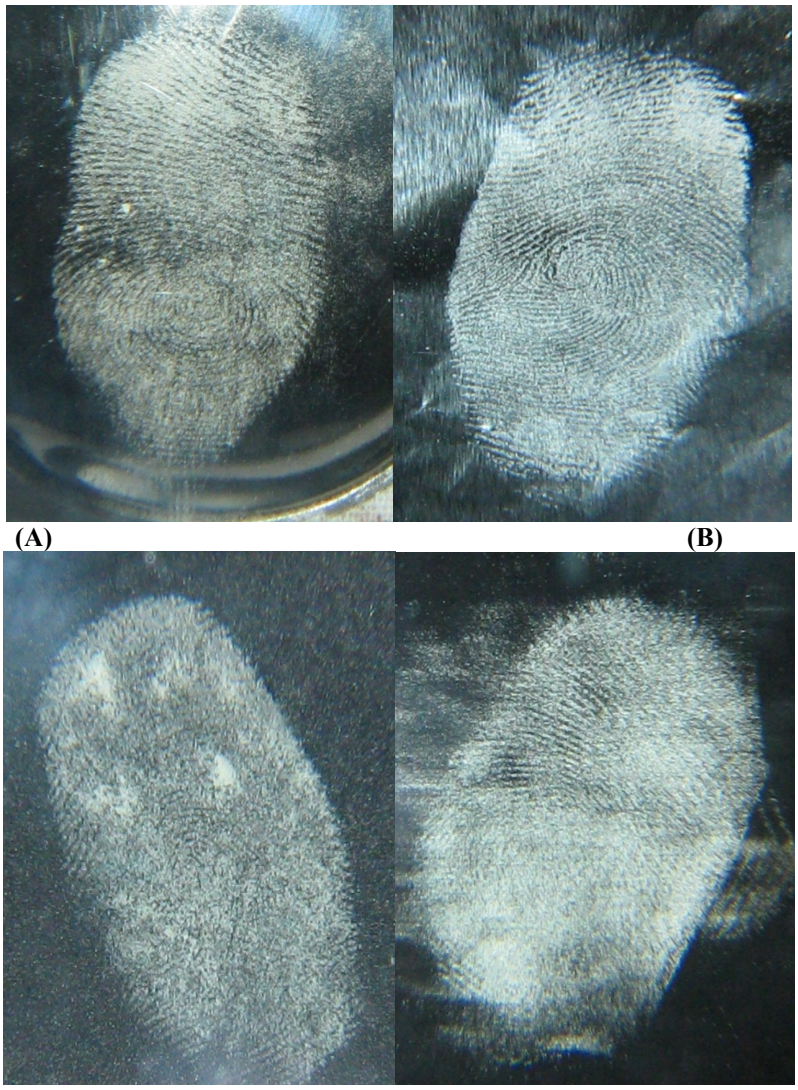
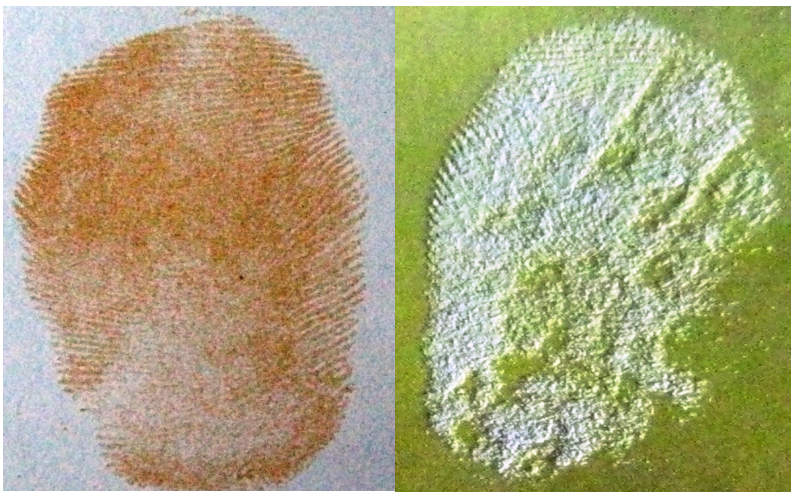
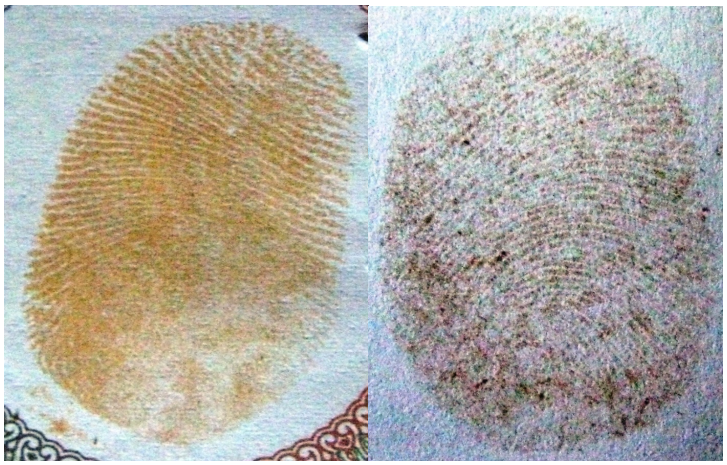


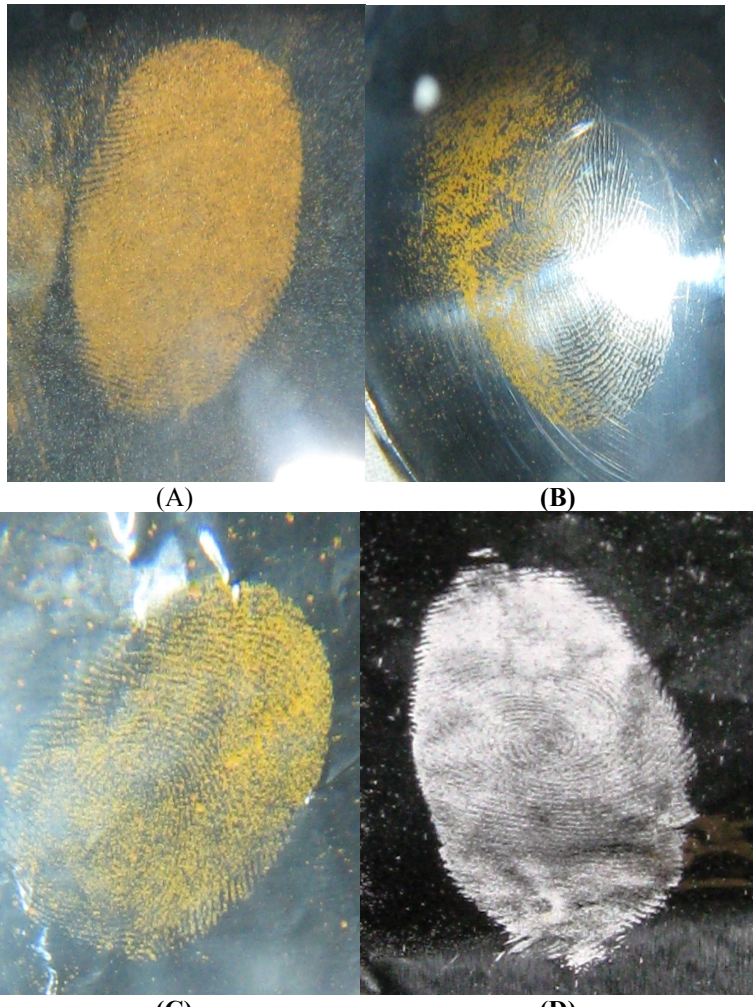
Fig. 2 Showing comparative visualization of latent fingerprints on non-porous surfaces- (A) spoon with custard powder; (B) aluminium foil with corn flour; (C) plastic with black salt and (D) mirror with baking soda.





(C) **(D)**

Fig. 3 Showing comparative visualization of latent fingerprints onporous surfaces-(A) plain paper with edible (orange) colour; (B) magazine cover with corn flour; (C) currency note with turmeric powder and (D) card sheet with cocoa powder.



(A) **(B)**

(C) **(D)**

Fig. 4 Showing comparative visualization of latent fingerprints on non-porous surfaces- (A) plastic with edible colour; (B) spoon with turmeric powder; (C)aluminium foil with turmeric and (D) aluminium foil with custard powder.