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REVEALING SECRETS OF LATENT FINGERPRINTS THROUGH COSMETIC PRODUCTS

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ABSTRACT

Fingerprints are the inescapable means of identification in the illicit cases. Commonly found fingerprint at crime scene are Latent Fingerprints which are left unnoticed by the perpetrator. The adoption of method for developing latent fingerprints solely depends on the type of surface, efficiency and simplicity. Powder dusting method is the most common technique for the development of latent fingerprints. In our present study we have used cosmetics- which can be either natural or man-made. After the study it was found that the use of the cosmetics in development of latent fingerprints was successful on the Porous as well as Non porous substrates. Its easy accessibility and fiscal aspect can serve as a extensive technique for developing the prints.

Results: Aluminium foil paper was visualised as the best substrate on to which the latent prints were developed by using either of the cosmetics reagents. Bleach and Face pack were considered to the best reagents for developing the prints.

Conclusion: Cosmetic powders in the coming future, will serve as the most commonly employed technique for developing the prints, because of its handiness and low cost.

KEYWORDS: fingerprints; Latent Fingerprints; Cosmetics; Bleach; face pack; Development; Foil-Paper; Glass; Wood; heena; Eye-shadow.

The majority of civil and criminal cases are solved in all over the world with the help of Fingerprints present on the crime scene. Fingerprint proves to be the crucial physical evidence in different kinds of cases hence fingerprint individuality is accepted over the world. The latent fingerprints, the prints which are not visible to the naked eye, are the most commonly found fingerprint at the scene of crime which the perpetrator leave unintentionally. The development of these type of fingerprints solely depends on the type of surface, that is, the surface is porous, non porous or semi porous; simplicity of the technique and the efficiency of the technique. The most common and simplified method for the development of the latent fingerprints is the Powder Method. In this method, the finely grinded and divided formulation is applied on the finger mark impression by the glass fibre or a camel hair brush [1]. The latent fingerprint gets developed when the sprinkled powder gets adhered to the oil, sweat and other fingerprint residue left when the ridges of the fingerprint touches any surface. The latent fingerprints are detected on the non porous surfaces for example plastic, metals, glass, poly bags by the new class of organic fluorescent powders . the detection was also done on coloured and coloured glossy surfaces [2]. Even if the surfaces are holding latent prints strongly luminescence, the fingerprint detection process is done by laser technique [3].

In our present study, the use of cosmetic powders like face powder, face pack, eye shadow etc was attempted for the development of latent fingerprints on the porous as well as non porous substrates. These powders are selected as these powders are easily available and non hazardous in nature. Cosmetics are basically are made up of the natural or chemical substances. These powders for the purpose of better binding with the skin, are made up of powder phase and a binder phase. In most of the cosmetic powders talc, chalk, mica, titanium oxide and zinc oxide constitutes the powder phase. For better adherence, the binder phase constitutes the polymeric materials, zinc stearate and magnesium. The cosmetic powders which are taken up for our study are:

1. BLEACH (ACTIVATOR):

The bleach used by the ladies is basically used for lighting up their skin surface. Bleach is a cream and for activating it, an activator is used which is in powdered form. For our study, the activator used in bleach creams was used for the decipherment of latent prints. The essential ingredients of the bleach activator are:

Aluminium starch octenyl succinate: this chemical is used in cosmetics as an anticaking agent and for increasing the non aqueous viscosity in cosmetics. Aluminium starch octenyl succinate is formed when the octenyl succinic anhydride reacts with starch and then this aluminium salt is formed [5].

Ammonium bicarbonate: when excessive evolution of oxygen taken place, it gives rapid bleaching on the skin and hair shaft even before the penetration has occurred. And due to this reason strong solution of ammonia is used [6].

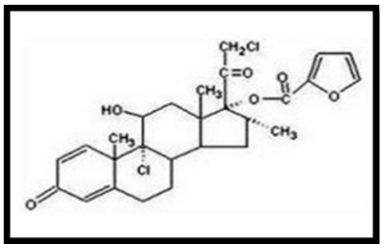


Fig. 1: Aluminium starch Octenylsuccinate[7]

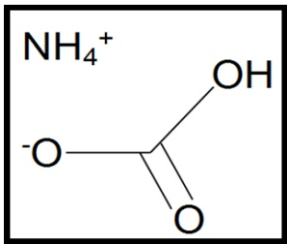


Fig. 2: Ammonium Bicarbonate[8]

2. EYE SHADOW:

Eye shadow is a cosmetic which is applied on the upper eyelids of eyes for coloration and providing the shade. The eye shadow is mostly composed of petroleum jelly base (60%), fats (10%)(e.g., mineral oil or jojoba oil), waxes (e.g., beeswax, lanolin (6%), or ozokerite).

The eye shadow is coloured with the ultra marine color dyes having brown, pink and blue color. Also some chemicals like carmine, titanium dioxide, bismuth oxychloride and zinc oxide are also present in the composition of eye shadow[9][10][11].

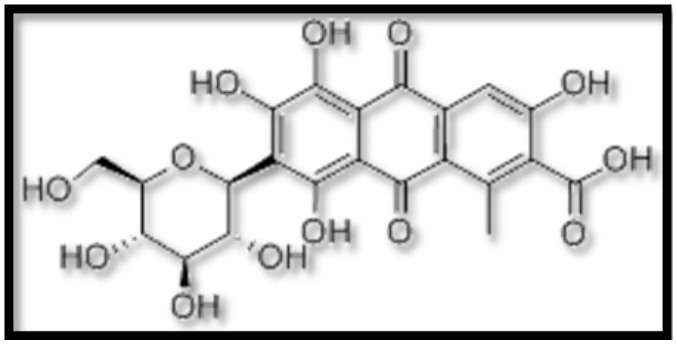


Fig. 3: Carmine

3. FACE PACK:

Face packs are functionally characterised depending upon the active ingredients present in their composition and the base formula. Functionally, the face packs can also be differentiated and include exfoliating masks, clay masks and peel off masks. The face masks are developed for different skin types classified as oily, dry and normal[12][13].

4. Henna (Lawsoniainermis):
Henna which is also known as lawsoniainermis contains the lawsone which is molecule of which is also known as hennatonic acid. Henna contains a red-orange pigment. When the henna leaves are crushed and mixed in the acidic medium and is applied onto the skin or hair, the lawsone molecule present in the henna paste migrate from the paste and transverse to the stratum corneum, the outermost layer of the skin and hence gives the red- orange coloration. The diffusion of the molecule of pigment occurs deeply into the skin when the henna paste is applied for long. [14].

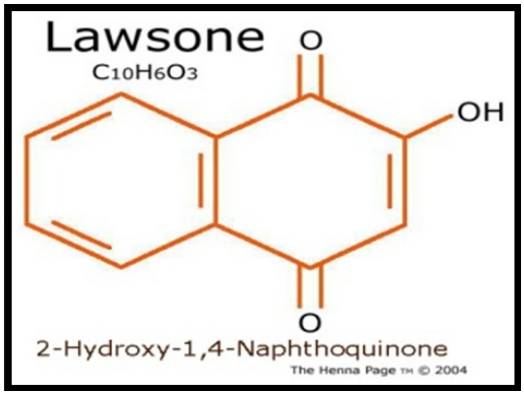


Fig. 5: Lawsone

5. FACE POWDER:
The face powder is a compact powder which has been compressed into cake and is applied with a powder puff. Face powder also known as compact powder is easy to apply and is stored conveniently and thats why have great popularity in ladies. The face powder is the loose powder which is compacted by the binding agents which make the powder particles to held together and do not crumble and chip under the various weather conditions [15]. The essential ingredients of the face powder are:

a. Titanium Dioxide: One of the primary function of the face powder is to mask minor skin blemishes, covering power must receive careful consideration. There are two basic opacifiers employed in face powder formulas: zinc oxide (ZnO) and titanium dioxide (TiO2). Titanium dioxide (TiO2) is three to four times better as a covering agent than zinc oxide (ZnO), but it has less adhesion and cannot be blended quite as well[16].

b. Bismuth Oxychloride: It is used as a Frosted look material, the synthetic pigment bismuth oxychloride was developed to replace guanine. Although photosensitive, bismuth oxychloride is quite adaptable for use in frosted face powders to impart a metallic, pearl-like lustre[17].

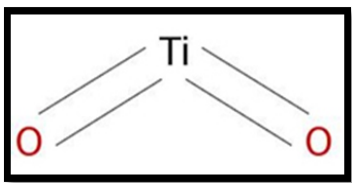


Fig. 6: Titanium Dioxide

Fig. 7: Bismuth Oxychloride

MATERIALS AND METHODOLOGY:
In this present study, the latent fingerprints (thumb impressions) were developed on various porous and non-porous substrates employing powder dusting method using various easily available, cost effective and non-hazardous cosmetic products.

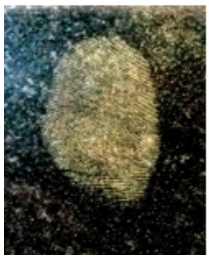
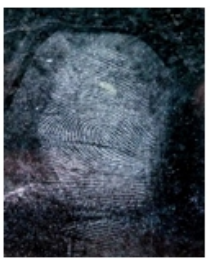
Few grams of certain cosmetic products like face powder, face pack, bleach activator, eye shadow and heena (mehendi) were taken. The powders taken were then sprinkled over the latent fingerprints with the help of feather brush. The latent fingerprints were developed by the adherence of minute powder particles over the sweat component. The excess of powder particles were dusted off from the prints to visualize the prints even through naked eyes. The developed prints were photographed and recorded for analysing, comparing and for future reference.

Substrates used in this study included both porous and non-porous surfaces. Cardboard, paper, leather and wood were taken under the class of porous surfaces and Granite, glass, metal (aluminium foil) and plastic were taken under the class of non-porous surfaces.

Comparative analysis was done to check the best results obtained by powders on specific substrates.

OBSERVATIONS
Table. 1a-1b: Decipherment of Latent fingerprints by various Cosmetic products on Porous and Non Porous substrates respectively.

Table-1: a. Decipherment of Latent fingerprints by various Cosmetic products on Non Porous substrates

	POWDERS → NON POROUS SUBSTRATES ↓	HEENA	FACE POWDER	FACE PACK	BLEACH (ACTIVATOR)	EYE SHADOW(PINK)
1.	**METAL (Aluminium foil)** **S1**					
2.	**GRANITE** **S2**					
3.	**GLASS** **S3**					

4.	**PLASTIC** **S4**					

Table 1: b. Decipherment of Latent fingerprints by various Cosmetic products on Porous substrates

S.NO.	POWDERS→ POROUS SUBSTRATES↓	HEENA	FACE POWDER	FACE PACK	BLEACH (ACTIVATOR)	EYE SHADOW(PINK)
5.	**WOOD** **S5**					
6.	**LEATHER** **S6**					
7.	**PAPER** **S7**					
8.	**CARDBOARD** **S8**					

CLASSIFICATION OF LATENT PRINTS ACCORDING TO COSMETIC POWDERS USED

Table 2: LATENT PRINTS DEVELOPED BY BLEACH:

COMPLETE IDENTIFIABLE PRINTS	PARTIAL IDENTIFIABLE PRINTS	LEAST IDENTIFIABLE PRINTS
FOIL PAPER	LEATHER	CARDBOARD
GRANITE		PAPER
GLASS		
PLASTIC		
WOOD		

COMPLETE IDENTIFIABLE PRINTS- Pattern and minutiaes are clearly visible.

Ex- Foil paper, granite, glass, plastic, wood

PARTIAL IDENTIFIABLE PRINTS- Pattern is visible but minutiaes are not clearly visible.

Ex- Leather

LEAST IDENTIFIABLE PRINTS- Pattern and minutiaes are not visible.

Ex- Cardboard, Paper

Table 3: LATENT PRINTS DEVELOPED BY FACE PACK:

COMPLETE IDENTIFIABLE PRINTS	PARTIAL IDENTIFIABLE PRINTS	LEAST IDENTIFIABLE PRINTS
FOIL PAPER	PAPER	CARDBOARD
GRANITE	LEATHER	
GLASS		
PLASTIC		
WOOD		

COMPLETE IDENTIFIABLE PRINTS- Pattern and minutiaes are clearly visible.

Ex- Foil paper, granite, glass, plastic, wood

PARTIAL IDENTIFIABLE PRINTS- Pattern is visible but minutiaes are not clearly visible.

Ex- Paper, Leather

LEAST IDENTIFIABLE PRINTS- Pattern and minutiaes are not visible.

Ex- Cardboard

Table 4: LATENT PRINTS DEVELOPED BY FACE POWDER:

COMPLETE IDENTIFIABLE PRINTS	PARTIAL IDENTIFIABLE PRINTS	LEAST IDENTIFIABLE PRINTS
FOIL PAPER	GRANITE	CARDBOARD
GLASS	PAPER	
WOOD	PLASTIC	
	LEATHER	

COMPLETE IDENTIFIABLE PRINTS- Pattern and minutiaes are clearly visible.

Ex- Foil Paper, glass and wood

PARTIAL IDENTIFIABLE PRINTS- Pattern is visible but minutiaes are not clearly visible.

Ex- Granite, paper, plastic and leather

LEAST IDENTIFIABLE PRINTS- Pattern and minutiaes are not visible.

Ex- Cardboard

Table 5: LATENT PRINTS DEVELOPED BY HEENA:

COMPLETE IDENTIFIABLE PRINTS	PARTIAL IDENTIFIABLE PRINTS	LEAST IDENTIFIABLE PRINTS
FOIL PAPER	GRANITE	WOOD
PLASTIC	LEATHER	
	PAPER	
	CARDBOARD	

COMPLETE IDENTIFIABLE PRINTS- Pattern and minutiaes are clearly visible

Ex-Foil paper, Plastic

PARTIAL IDENTIFIABLE PRINTS- Pattern is visible but minutiaes are not clearly visible

Ex-Granite, leather, paper, cardboard

LEAST IDENTIFIABLE PRINTS- Pattern and minutiaes are not visible

Ex- Wood

Table 6: LATENT PRINTS DEVELOPED BY PINK EYE SHADOW:

COMPLETE IDENTIFIABLE PRINTS	PARTIAL IDENTIFIABLE PRINTS	LEAST IDENTIFIABLE PRINTS
FOIL PAPER	GRANITE	CARDBOARD
GLASS	LEATHER	PAPER
PLASTIC	WOOD	

COMPLETE IDENTIFIABLE PRINTS- Pattern and minutiaes are clearly visible.

Ex- Foil paper, Glass, Plastic

PARTIAL IDENTIFIABLE PRINTS- Pattern is visible but minutiaes are not clearly visible.

Ex- Granite, leather, Wood

LEAST IDENTIFIABLE PRINTS- Pattern and minutiaes are not visible.

Ex- Cardboard and Paper

The classification of fingerprints are done by assuming some of the differentiating parameters like the clearly identifiable prints, partially identifiable prints and least identifiable prints.

Fig. 1: An example of clearly visible print is considered for reference purpose in which the pattern of the print is clearly identifiable and minutiaes are also clear and marked.

Fig 1: An example of clearly identifiable print

Fig. 2: An example of partially identifiable print is also considered in which the pattern of the fingerprint is clearly identifiable but the minutiaes are not clearly visible.

Fig 2: An example of Partially identifiable print

Fig. 3: Also, the example of least identifiable print is considered in which neither the print nor the minutiaes are clearly visible.

Fig. 3: An example of Least identifiable print

RESULTS & DISCUSSION

The results of the latent fingerprint development using different commercially available cosmetic powders on different Porous Substrates(S1to S4) and Non Porous substrates(S5 to S8) are shown in the Table-1 and Table-2 respectively. The comparative evaluation of different cosmetic powders on substrates –Foil paper, granite, glass, plastic, wood reveals that it gives complete identifiable prints (clear ridges) when developed using bleach (activator), whereas leather, Cardboard and paper were grouped under partial and least identifiable prints respectively.

When developed by face pack, similar observations were noticed under complete identifiable prints as that of Bleach (activator). Here Paper was classified under partial identifiable prints as its clarity got better unlike the above method.

Substrates – Foil Paper, wood and glass showed clear fingerprints details when developed by face powder. Partial Identifiable prints were visible in granite, paper, plastic and leather. Cardboard possess very poor quality of fingerprint. Presence of Titanium Dioxide in face Powder aids in development of latent fingerprints[9]

Foil paper and plastic gave best latent fingerprints when developed by heena, and partial prints were developed on Granite, leather, cardboard and paper.

The last cosmetic powder used is Pink eye shadow which gives best results on Foil paper, glass and plastic and least on Cardboard and paper

Above observations clearly depicts that the best results can be obtained on Aluminium foil paper when developed using either of the cosmetic products used and least identifiable prints were visualised on the cardboard when developed using the same powders. It can also be concluded that powder Method works best on the majority of the Non porous substrates.

CONCLUSION

It is hereby concluded from the present investigation that these easily and commonly available and less expensive powders i.e., Cosmetic products could be a better substitute for the decipherment of latent prints deposited on different substrates.

REFERENCES

1. G.S Sodhi, J. Kaur, "Development of latent fingerprints using powder method", Forensic science international (2001), vol. 120, 172-176.
2. F.M. Kerr, I.W. Barron, F. Haque & A.D. Westland, "Organic-Base Fluorescent Powders for Latent Fingerprint Detection on Smooth Surfaces", Canadian society of forensic science journal (1982), vol. 16, 39-44.
3. G. S. Sodhi, Jagjeet Singh Saroa, Rakesh K. Garg, "Evaluation of fingerprint powders", Journal of forensic identification (2006), Vol. 56, 186-197.
4. Menzel E., Fox K., "Laser Detection of Latent Fingerprints: Preparation of Fluorescent Dusting Powders and the Feasibility of a Portable System", journal of forensic science (1980), vol. 1, 180-183.
5. Cosmetic ingredient review, 2002, https://www.ncbi.nlm.nih.gov/pubmed/12042058
6. Cosmetic specialty ingredients, https://www.indiamart.com/continentalchemicals-delhi/cosmetic-specialty-ingredients.html.
7. Chemistry, http://chemistry.stackexchange.com/questions/31977/are-these-3-molecular-structures-of-ammonium-bicarbonate-the-same.
8. Chemical composition of everyday products, https://books.google.co.in/books?id=UnjD4aBm9ZcC&pg=PA29&lpg=PA29&dq=eyeshadow+composition&source=bl&ots=9lhElhllYZ&sig=110LFle5dAWZlgvRN7ixJ5DvfmA&hl=en&sa=X&ved=0ahUKEwjitfOJ04fTAhXKQo8KHf6ZDmAQ6AEIZzAS#v=onepage&q=eyeshadow%20composition&f=false
9. David C. Wade, " Development of latent fingerprints with titanium Dioxide", Journal of Forensic Identification; Alameda