

Study on Grab mark analysis: - Detection of Fingerprints with the grab impressions on various substrates of synthetic and natural fibre clothes using chemical methods

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Abstract- Dermatoglyphics, a study of fingerprints is one of the most accurate things in the field of forensic technology because of its uniqueness. Most of the time, the prints found on the crime scene are latent prints, and require a chemical process, to develop or visualize them. Fingerprints are the impressions left on any material when it comes in contact with any surface by the friction skin of the fingers. The presence of a dermatoglyphic pattern on different types of cloths, but not belong to the user of that garment is found to be potential evidence. Clothing methods are one of the most commonly encountered exhibits in crimes. Consequently, that clothing may reflect nature, the location or participants in the crime. The study had been carried out for development of latent prints by using common chemical methods such as silver nitrate and ninhydrin methods on different fabrics. So, experiments were conducted on 6 different fabrics and their reactions with the above chemicals have been analyzed. The six fabrics used were: cotton, nylon, cotton + polyester, khadi, lawn and banyan (innerwear) which are white in colour.

Keywords- Fingerprints, Dermatoglyphics, Natural fibres, Synthetic Fibres, Grab Marks, Chemical Methods.

I. INTRODUCTION

Fingerprints are thought to be excellent individualizing evidence, because fingerprints are considered unique, no two people have same fingerprints. The existence of a dermatoglyphic pattern on apparel, but not belong to the user of that garment is found to be potential evidence. Fingerprints are defined as imprints deposited on surface or material by friction ridges on a fingertip. There are three types of fingerprints: visible print, plastic print and latent print but only latent prints are available at crime scene as physical evidence. Latent finger prints cannot be seen with naked eye so physical and chemical methods are used to develop them. Fabrics can be a repository for wide variety of useful information. Garments may retain various type of evidence that have been deposited onto them in a wide variety of ways, most importantly during a crime event. To explore the possibility of developing grab impressions and fingerprints on fabrics by using common chemical methods, the main objectives of this study is to study and compare the various methods of chemical development methods for the detection of fingerprints on different fabrics, also to analyze the different stages of development of fingerprints on fabrics and to explore the possibility of using silver nitrate and Ninhydrin methods for finger print detection and development.

II. MATERIALS AND METHODS

Following are the Chemicals used to develop latent prints along with their manufacturer name.

Chemicals Used:	Manufactured By :
Acetone	Cisco Research laboratories
Silver nitrate	Merck Specialities Pvt ltd
Ninhydrin	Qualikems fine chemicals ltd
Distilled water	Prepared in lab

Table 1- Denotes the chemicals used to develop latent prints

Instruments Used:	Company Name
FT-IR	Bruker
Docucenter Nirvis	Projectina
Stereo microscope	Zeiss
Magnifier lens	-
Camera 13MP	Htc – Desire 816g

Table 2- Denotes the instruments used to visualise latent prints

2.1 Methods used for the Development of Fingerprints on fibres

The fabric samples are all white cloths (cotton + polyester, nylon, cotton, lawn, khadi, knitter) cut into 18cm*12cm to reduce the cost and we can cover whole impression in the particular portion, During the course of this study the following chemicals were used for development of finger prints from fibres. They are:

Silver Nitrate method

Ninhydrin method

2.2 Procedure used to develop fingerprints and grab impression on fabrics

Silver Nitrate: Approximately 1mg of silver nitrate was weighed and mixed with 60ml ml of distilled water. The samples are dipped in silver nitrate solution and exposed to sunlight for the development of fingerprint.

Ninhydrin: Approximately 1mg of ninhydrin was weighed and mixed with 60ml ml of acetone. The solution was sprayed on the samples and exposed to water vapour to develop fingerprints.

III. EXPERIMENT AND RESULT

The fabrics containing fingerprint samples were analyzed using both silver nitrate and ninhydrin methods by using procedures discussed above. Then, each fabric is analyzed individually for a particular method, and later comparisons are made between different fabrics in each particular method.

3.1 Results for silver nitrate method

The results for silver nitrate method for individual fabrics are discussed below.

Results on Cotton+ Polyester fabric for silver nitrate

The results on Cotton+ Polyester fabric for silver nitrate have been shown in Figure.

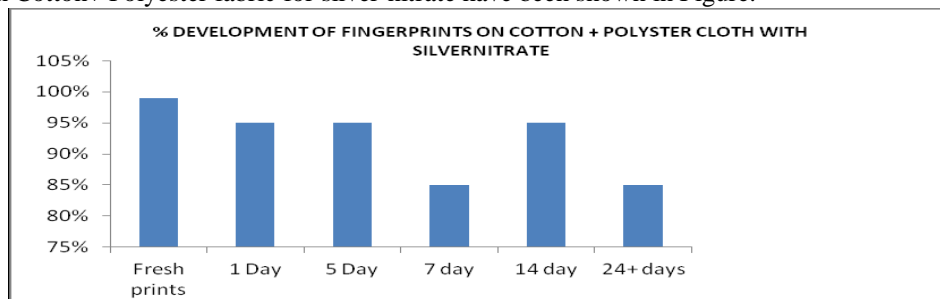


Figure 1. Results of fingerprints on Cotton+ Polyester with silver nitrate

It has been observed that Cotton+ polyester gave very good results. Ridge characteristics could easily be read. It could be seen that results very instantly visible on application of silver nitrate solution but quality of the ridge prints slowly decreased by the passage of time.

Results of cotton+ polyester on Ninhydrin solution

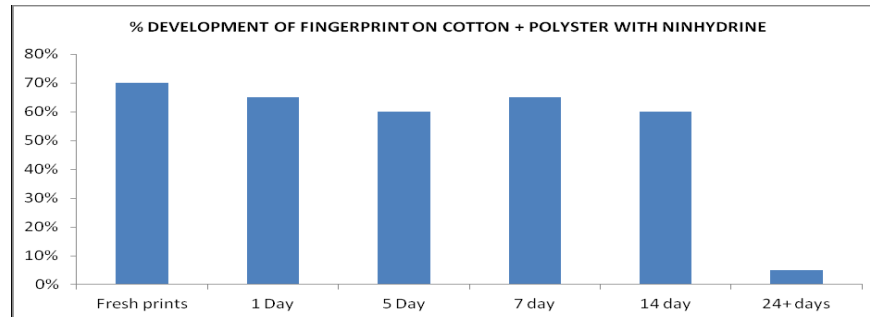


Figure 2. Results on cotton+ polyester on ninhydrin solution

It has been observed that there is a substantial decrease in quality of images of ridge prints in cotton+ polyester fabric over the passage of time. Fresh prints show quality of approximately 70% which decreases to less than 10% after 24 days.

3.3 Comparison between different fabrics

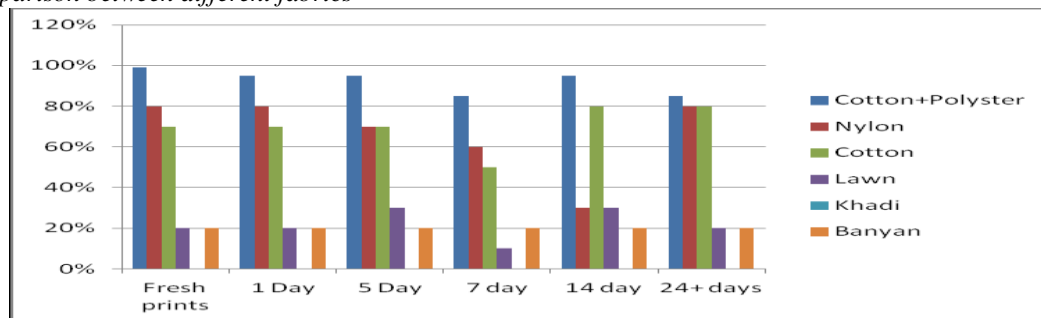


Figure 3. Overall % determination of fingerprints on clothes with silver nitrate

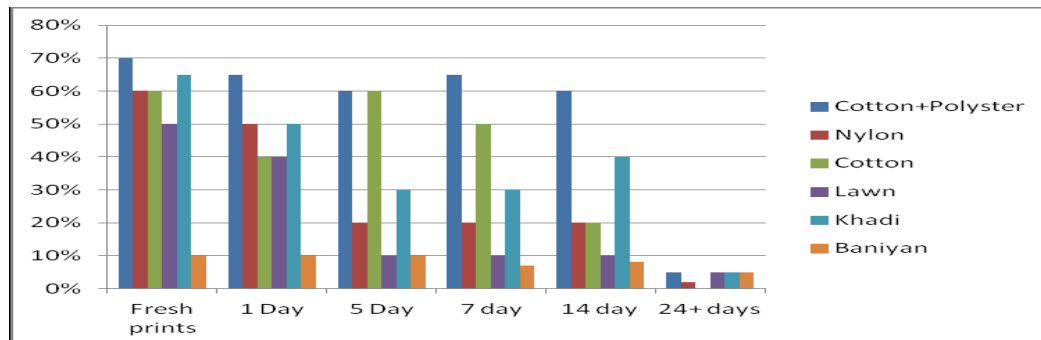


Figure 4. Overall % determination of fingerprints on clothes with Ninhydrin

It is observed that cotton+ polyester gave the best results on reaction with silver nitrate solution and khadi did not yield any results. Nylon gave reasonable results but the quality of its results kept increasing with time. Cotton on the other hand gave good results when the prints were fresh but on passage of time the quality of results diminished. However results of lawn remained constant over the period of 24 days.

IV. CONCLUSION

The fabrics that were examined for the detection of fingerprints (grab marks) were found to appear consistently with greater ridge details. They were very much remarkable and distinct as far as the specific types of the fabrics are concerned such as the blend of Cotton and Polyester and nylon clothes by silver nitrite and ninhydrin methods. There were less resolved patterns seen in cotton, lawn, and knitted (vests) clothes and showed only grab impressions without any ridge details. There were consistent results obtained with the marks found on the fabrics irrespective of the age of the print (as late as 24 days). Only in case of Khadi (handloom) clothes, there were less significant results found by silver nitrite method except for the detection of the grab marks, whereas there was a significant result obtained with the grab impressions and ridge details of finger marks while ninhydrin method was employed.

There were significant results obtained with the age old samples. The results obtained with the Ninhydrin method were less significant when compared with those of silver nitrate method. In other words, by employing ninhydrin method, the grab marks only were detected. In case of silver nitrate method, there were consistent results obtained with all the samples studied irrespective of the age of the prints.

With the least success rate in the conventional powder methods, the fingerprints (grab marks) on fabrics were found to be successfully detected with the silver nitrate method consistently in every case of samples including the very old prints of 24days. Silver nitrate method is found to be more suitable for the detection of age old prints on various fabrics of natural and synthetic fibres origin.

There is good scope of utilizing this technique for the detection of the grab marks and the latent prints over the cloth fibres those are many hours and days old. This would be more useful in the crime scenes where in the possibility of the clothes' involvement in almost very much common (specifically crimes against individuals). This method could be well incorporated for the better results of identification of the perpetrators.

V. REFERENCES

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