Forensic Physics Practical

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Class-MSc-2

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Cement as forensic evidence

- Cement is a mixture of chemicals such as mostly **calcium carbonate, silica, alumina, and iron oxide-bearing materials**, etc.
- Adulteration is done in cement by **addition of visible or invisible contaminants** to the cement that alters the standard composition set by the manufacturing company of cement.
- Adulteration of the quality cement is one of the major cause of structural failure.
- In major structural failure cases, whether it is a multi-storeyed building or a transport bridge, analysis of the cement is one of the major elements for understanding the standard quality and strength.

Scope of cement sample examination.

1. To check adulteration in cement
2. To check quality of cement
3. To identify nature of adulterants used in cement.

Sampling

1. Mix thoroughly each sample of cement separately and collect about 100 gms of each sample in porcelain dish or watch glass.
2. Dry for 30 minutes in oven at 105 degrees and then cool at room temperature.
3. Place it in desiccator and mark as “representative sample”.
4. All exhibit samples containing cement are to be place in a dry atmosphere.

1.Fineness test of cement

AIM- Performing fineness test for cement sample examination

Introduction-

- Fineness test of cement is done by sieving cement samples through standard sieve.
- Particle size distribution plays an important role in attaining the final strength of cement while its used for commercial purposes.
- Small particles are found to be more hydrated as compared to larger ones.
- The weight and percentage retained is calculated.
- Value below 10% makes us to conclude that cement is in good condition.

Experiment

Requirements:-

Sieve of 90 micrometer

Analytical balance with accuracy +-0.0002

Cement sample.

Procedure-

- Collect about 50 g of representative sample of cement (1.2) and weigh accurately to the nearest 0.01 g.
- Place it on a clean and dry 90mm IS sieve with pan attached.
- Holding the sieve in both hands and sieve with a gentle wrist motion more or less continuous rotation of sieve should be carried out through out the sieving.
- The underside of the sieve should be slightly brushed using a nylon or pure bristle brush after every five minutes of sieving.
- Weigh the mass of cement sample retained and calculate percentage.

Calculation

1. Initial weight of cement sample taken=Wo gm=50gm
2. Weight of cement sample retained on sieve= W1 gm
3. Percent cement sample retained on sieve= W1/W0*100
4. Percent cement sample passed through sieve=100-x

Observation

Sr. No.	Sample No.	Initial weight of cement sample Wo gms	Wt. Of sample retained on 90mm sieve W1 gms	% cement sample retained on 90mm sieve	% cement sample passed through 90mm sieve
1.	a	50	1.15	2.3%	97.7%
2.	b	50	1.05	2.1%	97.9%

Result

The percentage of cement sample passed through seives calculated for two samples of cement taken were-

Sample A- 97.7 %

Sample B- 97.9%

Conclusion

As the percentage of retained cement is less than 10% we can conclude that the cement samples are in good condition.

2.Bromoform test for cement.

Aim - Perform bromoform test for cement analysis.

Introduction-

- Bromoform test is used to separate the adulterated components from pure cement.
- Adulterated cement when added in bromoform tends to float or partially settle.
- Unadultered cement tends to settle completely.

Experiment

Requirements-

Test tube/gradient tube

Bromoform

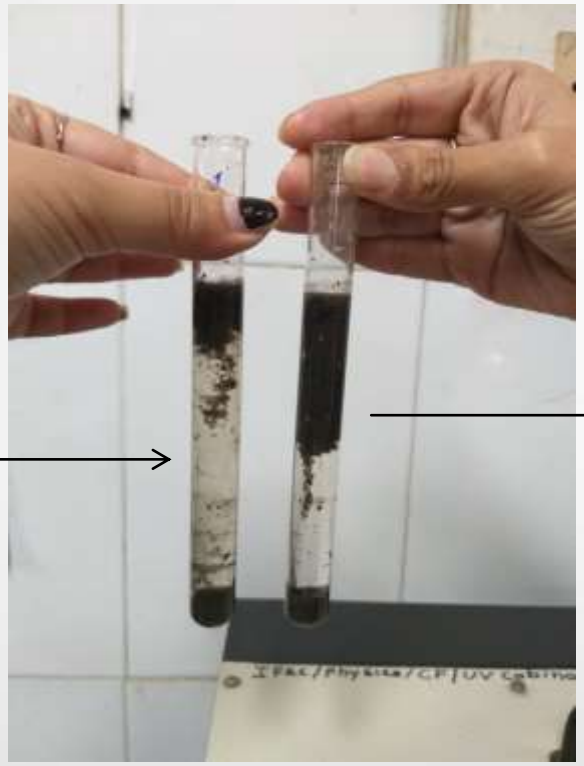
Cement sample.

Procedure-

- Take 200-300 mg of each cement sample is taken and then sieved separately.
- Placed into separate test tube/ gradient tube containing 5 ml Bromoform.
- Shake vigorously the tube and keep it for setting for 1 hr.

Observation

For sample A its observed that few particles float and rest have sunk.



For sample B majority of the particles in the sample are seen to be floating

Result

As sample containing lighter particles in cement tend to float on the surface and indicates adulteration thus sample B was found to be adulterated and sample A was pure cement.

Conclusion

From observing the two samples in the bromoform solution on the basis of the rate of flotation we can conclude that sample B had more adulterated and lighter particles as compared to A

THANK YOU!

DENSITY MEASUREMENTS OF GLASS AND IGNITION TEST FOR SOIL SAMPLES

PRESENTED BY – DIVYA MHATRE,

MSC II

ACADEMIC YEAR-2019-20

DENSITY MEASUREMENTS FOR BIGGER FRAGMENTS OF GLASS

→ The physical properties of density are used most successfully for characterizing glass particles.

→ The characterizing properties of a glass depend not only on the constituent elements, but also on the manner in which the glass has been treated during manufacture.

→ Glass of similar composition posses different properties depending upon the mechanical and heat treatments, which they have received. It is for this reason, that considerable importance is attached to physical properties of density and refractive index, as a means of comparing glass samples.

→ This fundamental parameter, though class characteristic in nature, provide sufficient data to the analyst , to exclude glass fragments that originate from different sources.

→ Density or Specific gravity of glass from various sources such as windowpanes, automobile headlights, bottles and plate glass doors, all may have slightly different densities.

FORENSIC SIGNIFICANCE -

→ The different types of glass that are often found, such as glass from a window, lamp, headlights, or bottles, each have unique properties that can be measured and compared.

→ When glass is shattered by a forceful impact, it scatters for distances up to nine feet or so, and can easily become lodged in a suspect's shoes, clothing, or hair.

→ Examination of glass fragments can be done for comparison of two glass sample to determine a origin.

→ Density is a class characteristics, hence it can help to exclude the glass fragments as having originated somewhere other than the crime scene.

→ Broken or shattered glass found at a crime scene is an important piece of forensic evidence.

→ Windows are frequently broken in burglaries, headlights in hit-and-run cases, and bottles or other objects may break or leave fragments on personal belongings of suspects involved in various types of crimes.

Broken Window

Car Window glass

Broken Glass bottle pieces

→ Density measurement is one of the most important analyses for comparing the glass samples under investigation.

→ The comparison of densities can give a proof of a connection, if at all, between a suspect and crime scene.

→ If the density of a sample glass specimen and the one under consideration do not matches then it can be proved that they do not share a common source or origin.

→ But, if the densities match and prove the origin to be common, then it becomes very easy to trace the type of glass used by the criminal to conduct the crime and can be helpful in leading the forensic expert to the suspect.

AIM – To determine density measurements for bigger fragments of glass

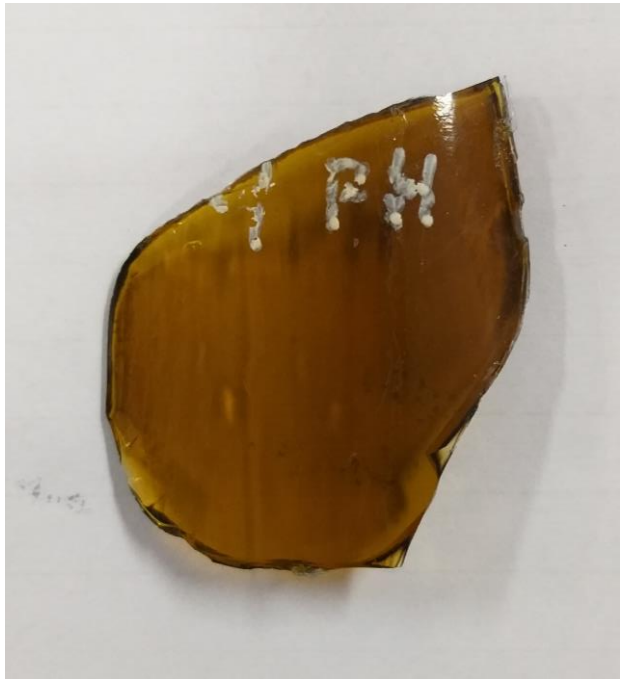
REQUIREMENTS – Laboratory mono pan balance with sensitivity ± 0.01 gms or better, Hook and support rack provision, piece of thin weightless string, 250ml. Capacity beaker, distilled water.

Suspected sample A

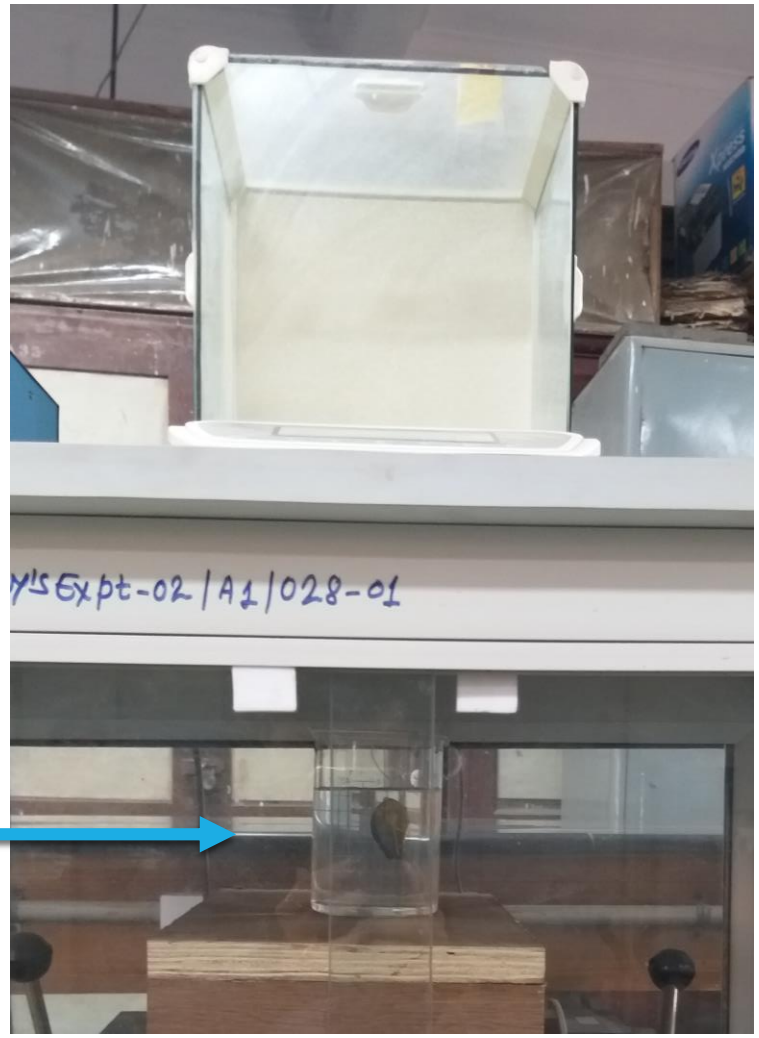
Suspected sample B

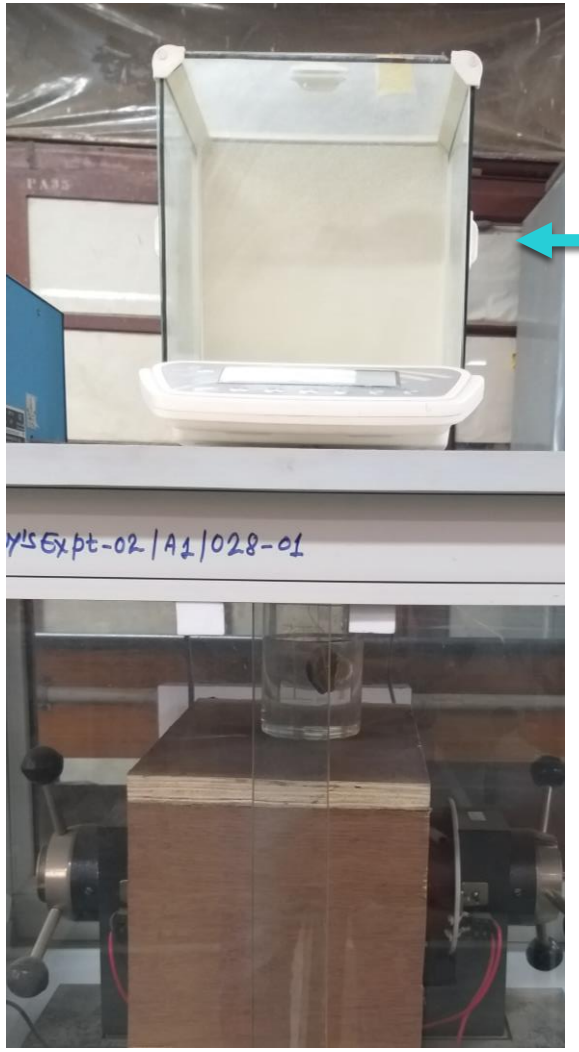
Suspected sample C

EXPERIMENTAL SETUP -



Control Sample





PROCEDURE -

i. Use a laboratory balance with sensitivity ± 0.01 gms or better, along with support rack provision, a 250 ml. capacity beaker and a piece of string of required length.
ii. Tie the string around the glass fragment and suspend it from the pan support hook of the balance, after the preliminary adjustments are made with the balance, before weighing.
iii. Weigh the glass fragment in air and record its value (W1).
iv. Place the 250 ml. beaker nearly filled with water on the support rack
v. Support and suspend the glass in the water. Adjust the glass height, so that it does not touch the walls of the beaker, inside the water.
vi. Weigh the glass fragment suspended in water and record this value (W2)

CALCULATIONS -

- Weight of the glass fragment in air (W1)
- Weight of the glass fragment in water (W2)
- Determine the density of glass fragment by the following relationship:

  1. Density of object = (Weight of object in Air) /(Loss of weight of object in water)

  2. Density of glass = (W1)/(W1-W2)

OBSERVATION TABLE -

Exhibit Glass fragments marked	Weight in Air W1 (in gm)	Weight in water W2 (in gm)	Loss of Weight (W1-W2) (in gm)	Density (W1)/(W1-W2)
Suspected A	4.8611	2.9389	1.9222	2.5289
Suspected B	4.8387	2.9537	1.8833	2.5692
Suspected C	27.6935	16.9713	10.7222	2.5828
Control Sample	10.3955	6.2497	4.1458	2.5074

OPINION AND CONCLUSIONS -

→ From the density measurements I am of the opinion that density of control sample and that of suspected sample A are found to be of same origin.

→ Hence, the density of the bigger fragment of glass was determined.

IGNITION TEST ON SOIL SAMPLES

→ Soil is composed of living organism, water, carbonates, carbon containing material, decomposing matter and much more.

→ To determine how much of these soil components make up the entire soil mass, ignition test is done.

→ The ignition test is part of elemental or oxide analysis of mineral.

→ The volatile material lost usually consists of “combined water” and carbon dioxide from carbonates.

→ It consists of strongly heating a sample of the material at a specified temperature, allowing volatile substances to escape, until its mass ceases to change. This may be done in air, or in some other reactive or inert atmosphere.

→ The amount of mass lost after ignition test is equal to the mass of the component of the soil.

FORENSIC SIGNIFICANCE -

→ Soil is a common form of physical evidence found at the scene of crimes such as hit- and- run accidents, automobile collisions, rapes and burglaries.

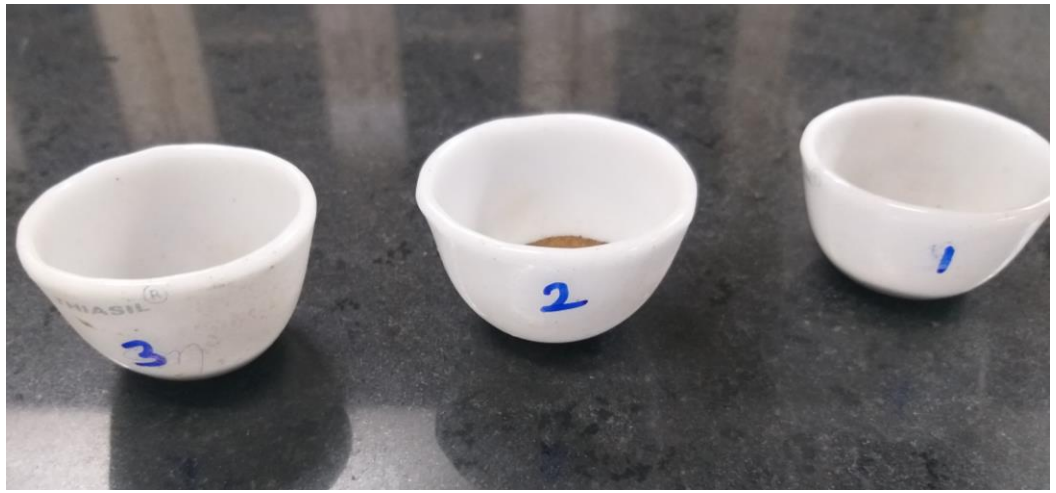
→ Soil from the crime scene may be picked up by an automobile (tires), thus, providing a valuable link between the automobile and the crime.

→ Similarly, soil or mud found adhering to clothing or shoes may provide the clue that can link a suspect to a particular crime site.

→ Hence such techniques can be used for identification of source correspondence such as detecting the various components as well as for comparison of two soils.

AIM – To perform ignition test on soil samples.

REQUIREMENTS – Analytical balance with an accuracy ± 0.0002 gm, Standard Weights, Alumina crucible, Muffle furnace of high temperature range (1000°C) and soil samples.



Soil Samples in crucible

Muffle Furnace

PROCEDURE -

→ Weigh the empty crucible that the sample is to be placed.

→ Place the sample in the empty crucible and weigh the crucible again with sample in it. The total sample weight is minus the empty crucible weight.

→ Then place the alumina crucible containing the soil sample in a muffle furnace.

→ Heat it at temperature between 750-800 °C for 1 hr. And then, cool it to room temperature.

→ Reweigh accurately and record the loss in weight on ignition.

→ Calculate the percentage of loss on ignition.

OBSERVATION TABLE -

Sr. No.	Sample No.	Weight of empty crucible	Before ignition		After ignition		Percent weight loss on ignition
			Weight of crucible + Sample.	Weight of sample	Weight of crucible + sample	Weight loss on ignition	
		X gm	Y gm	Wo=(y-x) gm	z gm	y-z gm	
1.	1.	16.44	18.40	1.96	18.04	0.36	18.3%
2.	2.	18.48	20.46	1.98	20.33	0.13	6.5%
3.	3. (Control sample)	16.65	18.62	1.97	18.33	0.29	14.7%

RESULT -

→ Percentage of weight loss on ignition test for soil sample 1 was 18.3% , for sample 2 was 6.5% and for sample 3 was 14.7%

CONCLUSION -

→ The following conclusions (reports) can be formatted according to information required. The above scientific examinations reveal that both the suspect soil sample marked (2) and control soil sample marked (3) are appear to be similar with respect to their ignition weight loss , while suspect soil sample marked (1) and control soil sample marked (2) are dissimilar with respect to their ignition weight loss


Thank
you

INSTITUTE OF FORENSIC SCIENCE, MUMBAI
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FINGERPRINT ENHANCEMENT TECHNIQUES AND FINGERPRINT TREATMENT METHODS ON CHALLENGING SURFACES

COURSE- M.Sc. (Forensic science)
SEMESTER- 3
SUBJECT- PSFSQ 302 Advanced Fingerprint Technology- I
TOPIC- Fingerprint enhancement techniques and Fingerprint treatment methods on challenging surfaces.
GUIDED BY- Fayth D'Silva
PRESENTED BY- Mohini Kumari Singh
ROLL NO- 03

CONTENTS

INTRODUCTION TO FINGERPRINT ENHANCEMENT TECHNIQUES-

- The goal of an enhancement is to **improve the clarity of ridge structures of fingerprint images** in **recoverable regions and to remove the unrecoverable regions**. The ridge structures in poor-quality fingerprint images are not always well-defined and they cannot be correctly detected.
- The group of **'optical' processes** are processes that essentially **utilize the differences between the response of the fingermark and the surface to electromagnetic radiation** in the **ultraviolet (UV), visible and near-infrared (IR)** regions of the spectrum to visualize the mark.
- Such processes can be used in **two ways-**
    - **To detect fingermarks in a mostly non-destructive way** without the need to apply any chemical or physical treatment.
    - **To enhance the contrast between a fingermark already developed** by another process and the surface it has been deposited on.

FINGERPRINT ENHANCEMENT TECHNIQUES

01

THERMAL FINGERPRINT DEVELOPER

02

ANTI- STOKE POWDER IMAGING

THERMAL FINGERPRINT DEVELOPER

HISTORY-

- Thermal development of fingermarks was **first observed** as an **fortuitous consequence of the exposure of paper items to heat**, with the **paper selectively darkening** in the region where **fingermark ridges** were present.
- Before, fingerprints were visualized by the application of **heat** (**greater than 100°C**) and they **darkened more rapidly** than the surrounding paper. Also, before they become dark enough, they became **fluorescent** and could be visualized by **fluorescence examination** using **blue-green to green region**.
- Now, it has been observed that more **gentle heating (less than 80°C)** can be used to visualize fingermarks specifically for **thermal papers**, however, it is **not fluorescent**.
- Commercial equipments, the **Foster & Freeman TFD-2 (THERMAL FINGERPRINT DEVELOPER- 2)** and the **Consolite Forensics Hot Print System (HPS)** has subsequently been manufactured for thermal development process in laboratories.

THERMAL FINGERPRINT DEVELOPER

THEORIES-

- The theory associated with thermal development on conventional paper substrates has not been conclusively established.
- **Song et al.-** Attributes thermal development to the presence of the fingermark locally changing the thermal properties of the paper, resulting in these regions heating more rapidly than the paper substrate and thus discoloring more rapidly by thermal degradation.
- **Dominick et al.-** An alternative theory is proposed in which the fluorescence and subsequent visual discoloration observed is said to be due to the degradation of the amino acid constituents of the fingermarks.
- The **thermal degradation of amino acids in fingermarks** has been studied, but the **formation of fluorescent degradation products under the conditions used for thermal development** has not been conclusively proven.

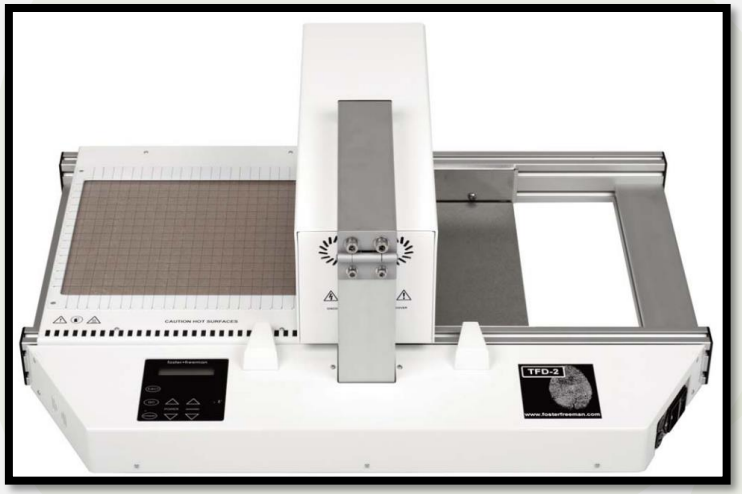
THERMAL FINGERPRINT DEVELOPER

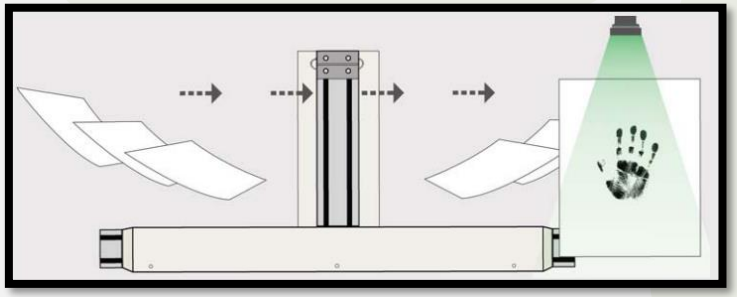
THERMAL FINGERPRINT DEVELOPER- 2-

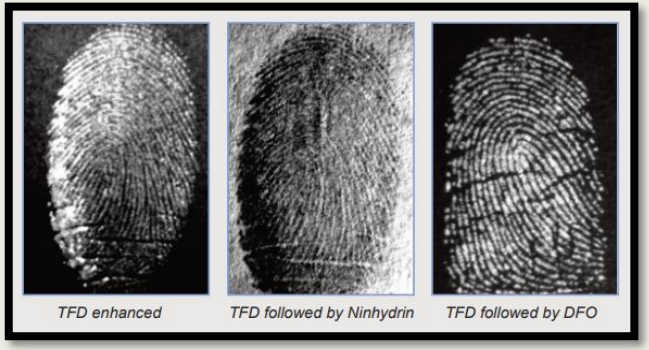
- **Designed and manufactured by Foster + Freeman**, is used for **detection and enhancement** of latent fingerprints using **non-destructive thermal development**.
- The TFD-2 is an **automated, high-throughput device** capable of developing fingerprints on **large quantities of documents**.
- The simple process of heating a document to an **optimum temperature** induces a chemical reaction between the **latent fingerprint and the paper** to produce a **fluorescent by-product** that is **visible under intense blue or blue/green illumination** when viewed through an appropriate filter.
- Controls maintain the **optimum temperature and scan speed** to ensure that documents are **undamaged** and also to keep track of the development.
- Developed fingerprints **remain visible for more than 2 years**.
- The TFD-2 consists of a **flat bed that holds the paper**, this is then ‘scanned’ underneath an **infrared heating element**.

THERMAL FINGERPRINT DEVELOPER

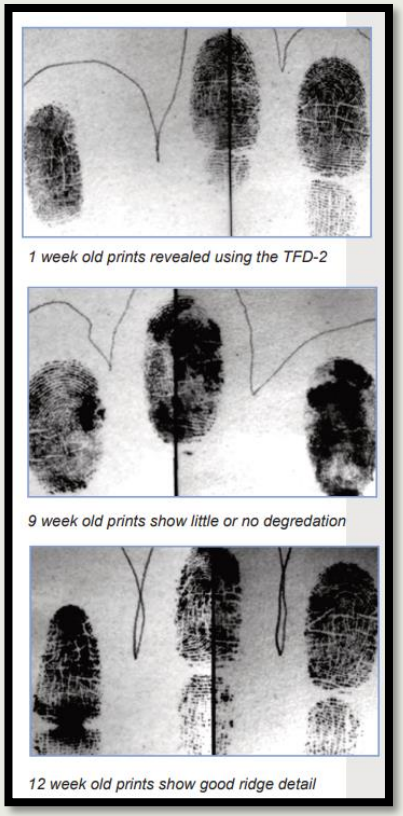
THERMAL FINGERPRINT DEVELOPER- 2-







TFD enhanced | TFD followed by Ninhydrin | TFD followed by DFO



1 week old prints revealed using the TFD-2

9 week old prints show little or no degredation

12 week old prints show good ridge detail

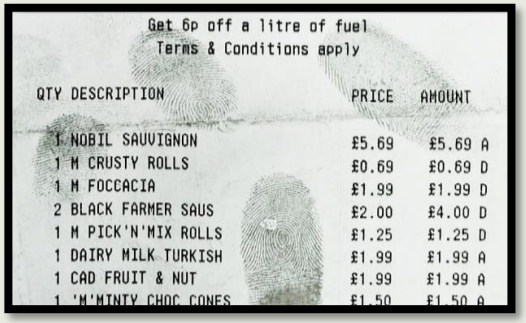
THERMAL FINGERPRINT DEVELOPER

HOT PRINT SYSTEM-

- The Hot Print System (HPS) is **developed by Consolite Forensics Ltd.**
- The HPS is a system to **automatically and consistently** develop **fingerprints on thermal paper** in minutes, without the use of chemicals.
- The system works using **thermal technology along with an optical detection system** to ensure a fully controlled automated development method that doesn't turn the paper black.
- **Fingerprints over two years old** are routinely developed and recovered.
- The **heat plate** carefully **heats the thermal paper** after starting the system. The **optical system detects the slightest change** on the paper, following which the cooling cycle begins.
- The whole process **takes 2-3 minutes** and involves no pre-treatment.
- The HPS can be used **in sequence with Ninhydrin and alike** to develop prints on the **non-thermal side of the paper** and **DNA swabs can be taken before if required**.

THERMAL FINGERPRINT DEVELOPER

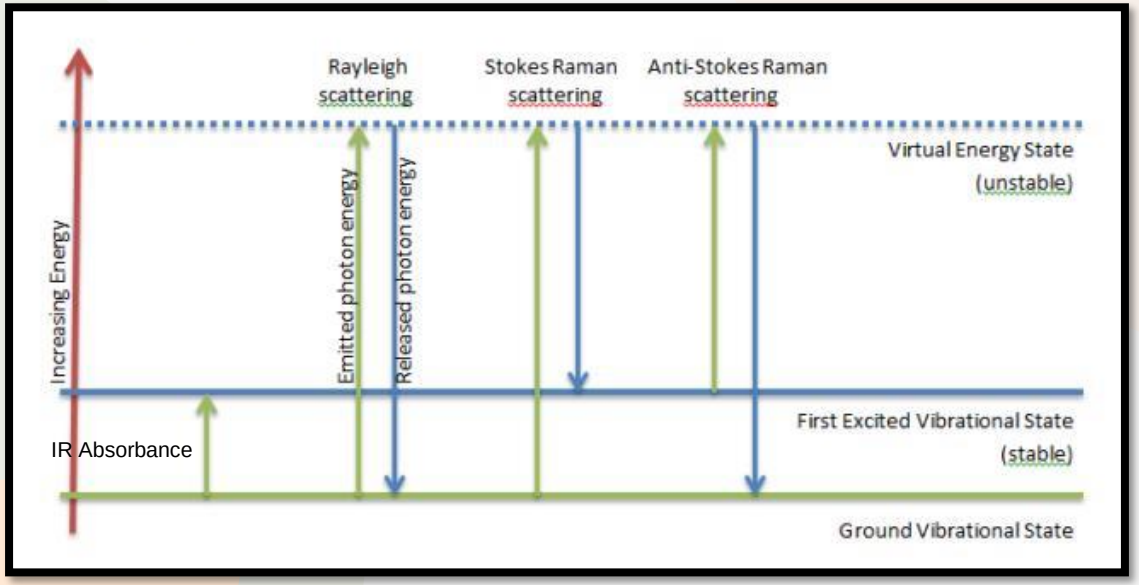
HOT PRINT SYSTEM-



ANTI- STOKE POWDER IMAGING

STOKE AND ANTI- STOKE LINES-

The **stokes lines have typically longer wavelengths than the wavelength of the exciting radiation** responsible for fluorescence or the Raman effect whereas **anti-stokes lines represent the radiation of particular wavelengths present in fluorescence and in Raman spectra when the atoms or molecules of the material exist in an excited state** and typically have a **shorter wavelength compared to the light that produces them**.



ANTI- STOKE POWDER IMAGING

STOKES AND ANTI- STOKES LINES-

CHARACTERISTICS	STOKES LINES	ANTI- STOKES LINES
Definition	Represent radiation of particular wavelengths present in the line spectra that is associated with fluorescence(emission of light from a substance that has absorbed energy previously) and the Raman effect (change in the wavelength of light that happens when a light beam is deflected by molecules).	Represent the radiation of particular wavelengths present in fluorescence and in Raman spectra when that atom or molecule of the material exist in an excited state.
Excitation	Not in the excited state.	Already in the excited state.
Energy	Reduction of energy of the scattered photons is usually proportional to the energy of vibrational levels of the molecule.	Increasing the energy of scattered photons is proportional to the energy of the vibrational levels of the molecule.

ANTI- STOKE POWDER IMAGING

ANTI- STOKE POWDER-

- The **VISAS Magnetic Fingerprint Powder 433060 (by BVDA)** is an anti-Stokes or up-converter powder is used for the development of latent fingermarks on a range of non-porous surfaces.

MECHANISM-

- Anti-Stokes materials can **absorb long-wavelength light and emit light at a shorter wavelength**. This property is **unusual in both natural and artificial materials** and so fingermark detection techniques based on anti-Stokes luminescence **are potentially sensitive and selective**.

APPLICATION-

- Latent fingermarks on **luminescent and non-luminescent substrates** are generally developed.
- Excellent results can be obtained with fingerprints **on 'busy' multi-colored backgrounds and on backgrounds which fluoresce at similar wavelengths to standard fingerprint treatments**.

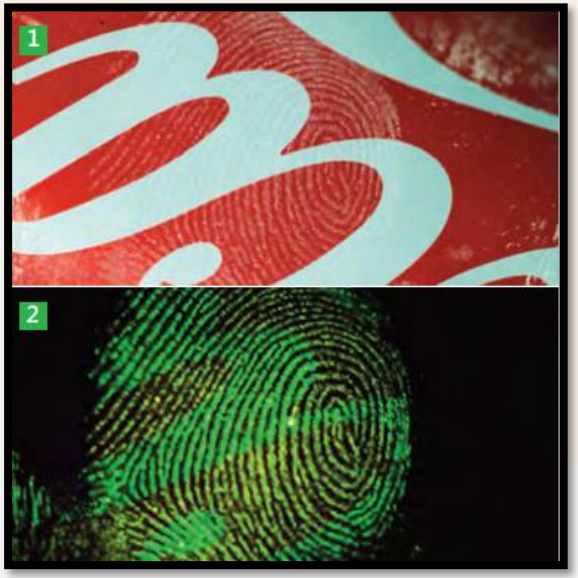
PROCEDURE-

- **A light dusting** of anti-Stokes powder is applied using a **magnetic brush**.
- A fingerprint is **located**.
- Under the illumination of **twin 976nm lasers** the fingerprint **fluoresces brightly** while the **background pattern disappears.**

ANTI- STOKE POWDER IMAGING

CRIME- LITE ASV-

- **Anti-stokes laser viewing enclosure** for the examination of fingerprints.
- The Crime-lite ASV is a **bench-mounted system, with Class 1 viewing enclosure** for the stimulation of **IR laser activated anti-Stokes** fingerprint dusting powders, the Crime-lite ASV renders **high contrast fingerprints** with **no background** interference.



INTRODUCTION TO FINGERPRINT TREATMENT METHODS

- **Why is optical processes used during treatment of fingerprint-**
- The reason why optical processes are given so much importance is because they can be used in the beginning to locate latent fingermarks and also at the end to enhance the developed fingerprint or to visualize it.
- **The visibility of a latent fingerprint depends on-**
- The substrate with which contact is made
- Temperature and climatic factors
- Amount of time passed
- Physical condition of the skin of the criminal
- **The method used for development depends on-**
- The type of surface on which the print is suspected. It can be porous and non porous. Porous surfaces are absorbent. E.g., paper, cardboard, wood, and other forms of cellulose. Whereas non porous surfaces do not absorb. E.g., glass, metal, plastics, lacquered or painted wood, and rubber. Fingerprints present on non porous are more susceptible to damage.
- Condition of the substrate. E.g., clean, dirty, tacky, sticky, greasy, etc.
- Colour of the substrate E.g., densely patterned, multi- colored, etc.
- Subsequent forensic examination to be undertaken and the consequences of the development method used.
- Amount of time elapsed and environmental conditions.

FINGERPRINT TREATMENT METHODS

CHALLENGING SURFACES-

01 MULTI- COLORED SURFACES.

02 DENSELY PATTERNED BACKGROUNDS

03 REFLECTIVE METAL SURFACES.

04 SUBSTRATES THAT FLUORESCE AT SAME WAVELENGTHS AS FINGERPRINT TREATMENTS

FINGERPRINT TREATMENT METHODS

NOVEL IR FLUORESCENT FINGERPRINT POWDER-

Difficulties faced-

- Despite the vast quantity of fingerprint treatments currently available, examiners continue to be frustrated by a **number of 'difficult' substrates.**
- **Multi-colored and densely patterned backgrounds, reflective metal surfaces and substrates that fluoresce at the same wavelengths as common fingerprint treatments**, can prevent the successful imaging of fingerprints.

Solution-

- However, when dusted **with fpNatural 1 and 2 IR fluorescent powder**, **interference** can be **removed to reveal high contrast prints**.
- A preliminary study into the use of fpNatural 1 and 2 as an infrared fluorescent fingerprint treatment shows the effectiveness of fpNatural 1 and 2 at revealing fingerprints on a **wide range of non-porous and semi-porous substrates.**

FINGERPRINT TREATMENT METHODS

NOVEL IR FLUORESCENT FINGERPRINT POWDER-

Application-

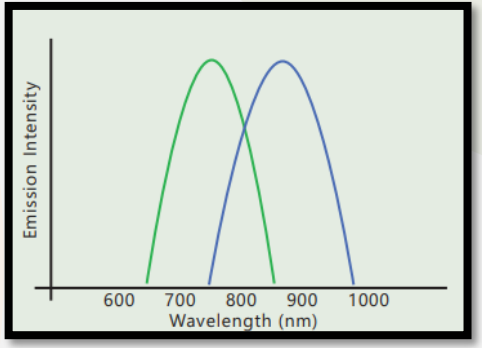
- **Lightly dust surface** to be examined with fpNatural powder using a **standard zephyr brush (fiberglass filaments) with rotational application motion.**

Illumination-

- fpNatural 1 & 2 powders **emit bright fluorescence in the infrared region of the spectrum**; fpNatural 1 is excited by **red or blue illumination**, fpNatural 2 is excited by **near-IR illumination.**

Visualization-

- Visualization of both powders is achieved using an **IR sensitive camera equipped with an IR pass filter** to block out all other wavelengths.



FINGERPRINT TREATMENT METHODS

NOVEL IR FLUORESCENT FINGERPRINT POWDER-

For illumination and visualization-

- **DCS 5-** DCS 5 provides a complete solution to the examination of fingerprints, from **capture, to enhancement to the presentation of court room evidence**. Equipped with a **custom-modified camera** and a **selection of UV-Vis-IR light sources**, DCS 5 is the experts choice of fingerprint system.
- **Crime-lite Imager- Combining advanced imaging and multiwavelength illumination from UV to IR**, the Crime-lite Imager enables operatives with varying degrees of expertise to consistently produce high quality results.
- **Crime-lite Cam-** Designed for **crime scene or laboratory applications**, Crime-lite Cam is a **UV-Vis-IR sensitive digital camera attachment for use with Crime-lite forensic light sources**. Captured images are viewed via a tablet or laptop PC.

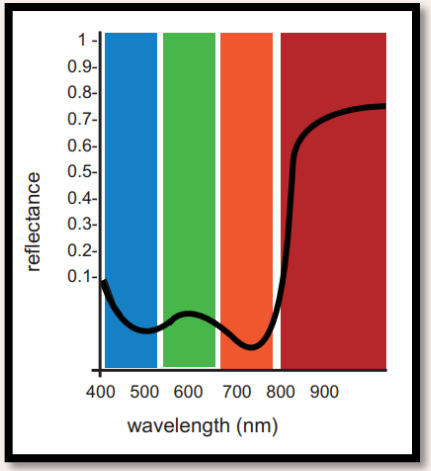



FINGERPRINT TREATMENT METHODS

NOVEL IR FLUORESCENT FINGERPRINT POWDER-

Inspired from-

- Plants **absorb visible light as 'food' reflecting back all IR light** that cannot be absorbed. Under intense illumination, pigments found in plant tissues, namely **chlorophyll and anthocyanin, emit strong Near Infrared fluorescence**.
- Using these facts as starting point, they began **testing plant-based powders** for suitability.
- Excellent results were achieved using a **modified blend of cyanophyta**, a phylum of bacteria that gains its name through its **blue/green colour**.
- Often referred to as blue-green algae, there are approximately **2000 species of cyanophyta**, the **perfect blend** of which meets all the requirements to produce an **ideal IR fingerprint powder**.



Benefits of a plant based fingerprint treatments-

- **Rich** in IR fluorescent **phycocyanin and chlorophyll**.
- **Non-toxic**, safe to use and handle.
- Once modified can be **easily applied with a zephyr brush**.
- Excellent results on many **'difficult' backgrounds**.

FINGERPRINT TREATMENT METHODS

WHY IR REFLECTION IS USED-

01

Absorption/reflection

Near IR (700- 1100 nm) for fingerprint enhancement.

02

IR transparent inks

The organic pigments of inks used for printing.

03

Highly patterned surface

Appears devoid of any patterns present under IR.

04

Multi- colored surface

Appears white and with no colors.

05

Only enhances FP

It does not detect latent FP, onky enhances the developed prints.

06

Doesn’t work always

Many organic reagents and dyes look transparent under the IR. E.g., ninhydrin, cyanacrylate, etc.

FINGERPRINT TREATMENT METHODS

IR REFLECTION MECHANISM-

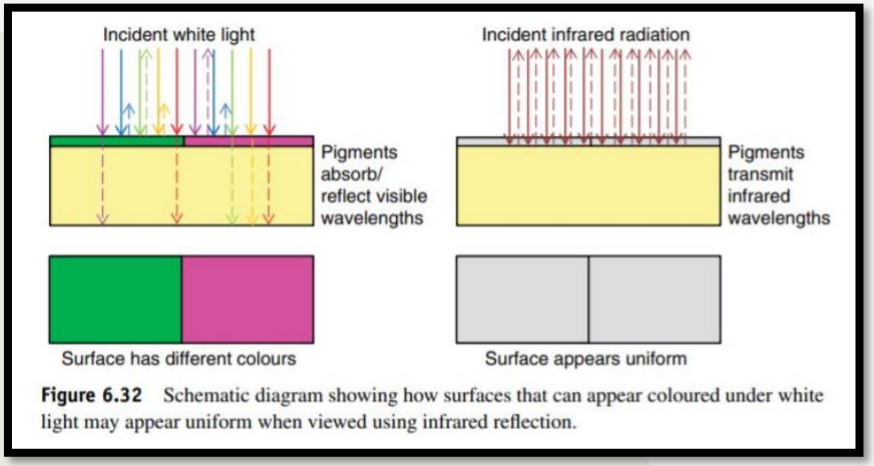


Figure 6.32 Schematic diagram showing how surfaces that can appear coloured under white light may appear uniform when viewed using infrared reflection.

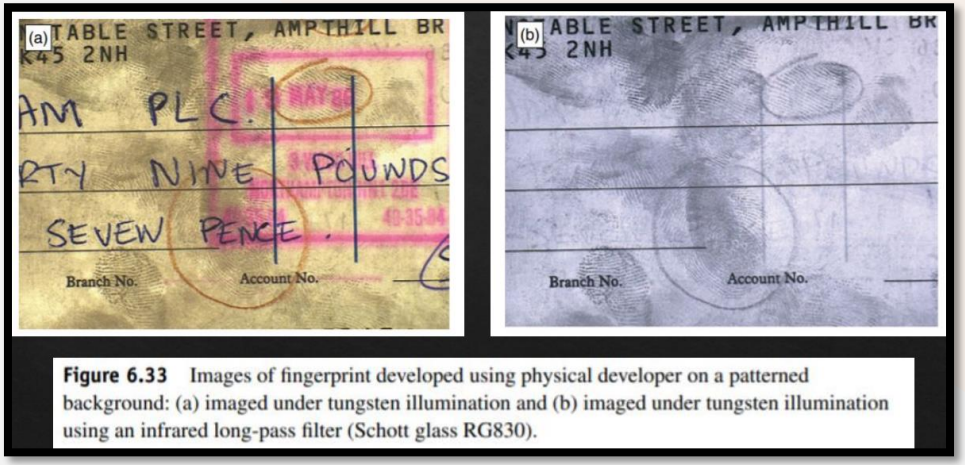
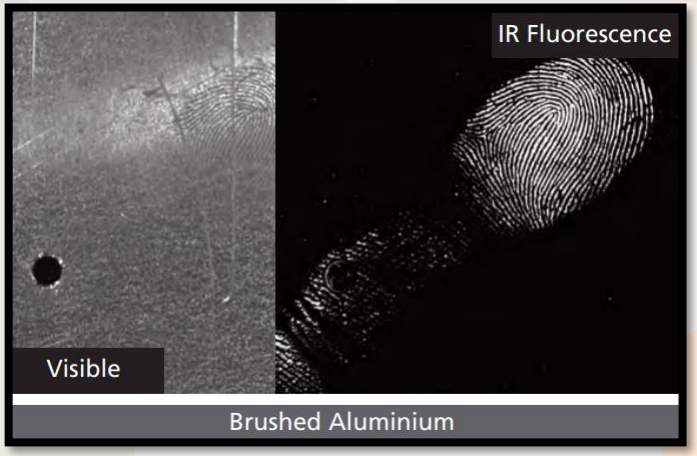


Figure 6.33 Images of fingerprint developed using physical developer on a patterned background: (a) imaged under tungsten illumination and (b) imaged under tungsten illumination using an infrared long-pass filter (Schott glass RG830).

FINGERPRINT TREATMENT METHODS

IMAGES UNDER IR REFLECTION-



FINGERPRINT TREATMENT METHODS

IMAGES UNDER IR REFLECTION-

Singapore $10 Polymer Banknote

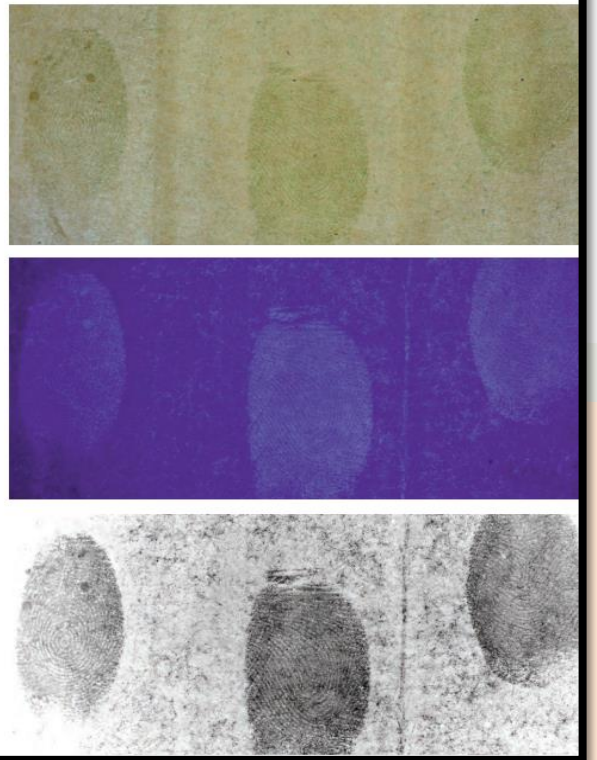
- Vis illumination / Vis Pass Filter (BW)
- Red Illumination / IR Pass Filter (BW)

Nicaragua C$200 Polymer Banknote

- Vis illumination / Vis Pass Filter
- Red Illumination / IR Pass Filter (BW)

Brown Cardboard

- Vis illumination / Vis Pass Filter
- Red illumination / IR Pass Filter
- B&W inversion



CASE STUDY

CONVICTION THROUGH ENHANCED FINGERPRINT IDENTIFICATION

Background of the case-

- In March 1990, an unknown assailant sexually molested and fatally stabbed a young woman.
- The only evidence was a pillowcase, found adjacent to the victim's body, that exhibited several bloodstains. One stain showed some faint fingerprint ridge detail, barely visible even to the trained eye.

Preliminary Investigation-

- The investigator took the pillowcase to the department's forensic unit for bloodstain pattern analysis.
- Technicians photographed and studied the stains and discovered two things. First, they confirmed that several stains were consistent with blood transfer from a knife blade, although no knife was found at the crime scene. Second, analysts determined that the fingerprint presented enough ridge detail to conduct a more extensive investigation.
- Analysts then sent the evidence to another forensic study center where scientists treated the fingerprint with DFO (1,8-Diazafluoren-9-one), a relatively new chemical at that time (similar to Ninhydrin) that becomes fluorescent when exposed to a light source.
- Once processed, the DFO provided an improved ridge detail photo. However, the ridge detail still remained blurred, displaying poor general continuity and visible fabric weave in the background. All traditional photographic techniques failed to erase the distortion.

CASE STUDY

Image Enhancement-

- A short time later, investigators assigned to the case witnessed a demonstration of fingerprint image enhancement at a forensic conference. They decided to try the technique on the unidentifiable pillowcase fingerprint from the crime scene. Investigators took the best DFO photograph and shipped it to a facility with the capability to perform image enhancement.
- Throughout the enhancement process, the accuracy of the print was documented through photographic records of each stage. Within 4 hours, the enhancement yielded an identifiable print.

Supporting Evidence-

- The lead case investigator developed several likely suspects. The primary suspect (the victim's next door neighbor) surfaced early in the investigation. However, the prints on record from a previous arrest did not contain sufficient ridge detail for comparison.
- The investigator then concentrated on the serology report, which noted that examiners recovered seminal fluid from the victim during the postmortem examination. This preliminary serological report proved the seminal fluid matched that of the prime suspect, placing him in less than 5% of the general population.
- Then they initiated the lengthy process of DNA analysis. Using the serology report as probable cause for arrest, the investigators arrested the suspect and obtained a set of inked prints. After weeks of evaluation, comparison, and verification, the examiners achieved a positive identification comparison of the bloody pillow print with the left thumb of the suspect.
- Less than a week later, investigators received the DNA results, which further incriminated the suspect by matching his DNA code with that found in the stain on the pillowcase.

CASE STUDY

Court Proceedings-

- During the suppression hearing, defense attorneys launched an attack on what they believed to be the most potentially vulnerable piece of evidence, the scientific acceptance of fingerprint image processing. To counter, an analyst took the court step by step through the entire procedure using a full complement of image enhancement equipment. An expert in the field of image processing then offered supporting testimony to the court. Ultimately, the court ruled the enhanced print admissible, stating that the process did not alter the actual pattern of the print; it only made it more visible.
- The evidence passed the test, resulting in the first documented case where image enhancement technology withstood the challenges of a Frye hearing.

Trial Results-

- One last piece of evidence emerged during final trial preparation. Maintenance men working in the defendant's vacant apartment discovered a military survival knife hidden in a pipe chase. Serological examination revealed traces of human blood, but no typing was possible.
- However, the shape and size of the sawtooth blade matched several of the blood stains on the pillowcase. Police personnel prepared a large transparent overlay for courtroom display to illustrate how the knife and the stain conformed to a single image.
- Faced with overwhelming physical evidence, such as the image enhanced fingerprint match, the DNA test results, the match between the body fluid found on the victim's body and that of the suspect, and the knife found in the suspect's apartment, defense attorneys entered four guilty pleas.
- On June 18, 1991, the court sentenced the accused to four life sentences for murder and related offenses.

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- article__conviction_through_enhanced_fingerprint_id.pdf

THANK YOU

ANALYSIS OF GLASS FRACTURES

ANALYSIS OF OBLITERATED IDENTIFICATION NUMBERS

Presented by:

Shruti Milind Pawar

MSc II

AY-2019-20

EXP. 1: ANALYSIS OF GLASS FRACTURES

A. AIM, REQUIREMENTS, FORENSIC SIGNIFICANCE
B. THEORY
C. PROCEDURE
D. OBSERVATION, RESULT AND CONCLUSION

A. AIM, REQUIREMENTS AND FORENSIC SIGNIFICANCE

- AIM: Analysis of Glass Fractures
  - Radial fractures
  - Concentric fractures
  - Heckles marks
  - Sequence of impact
- REQUIREMENTS:
  - Glass samples, Travelling Microscope and stationary materials.
- FORENSIC SIGNIFICANCE:
  - The analysis of glass fractures is forensically important for the reconstruction of events in a criminal act. Glass fracture examinations can provide information as to the direction of the breaking force and the sequence of multiple impacts. A physical match of two pieces of glass establishes that they came from the same source to the exclusion of all other sources.

B. THEORY

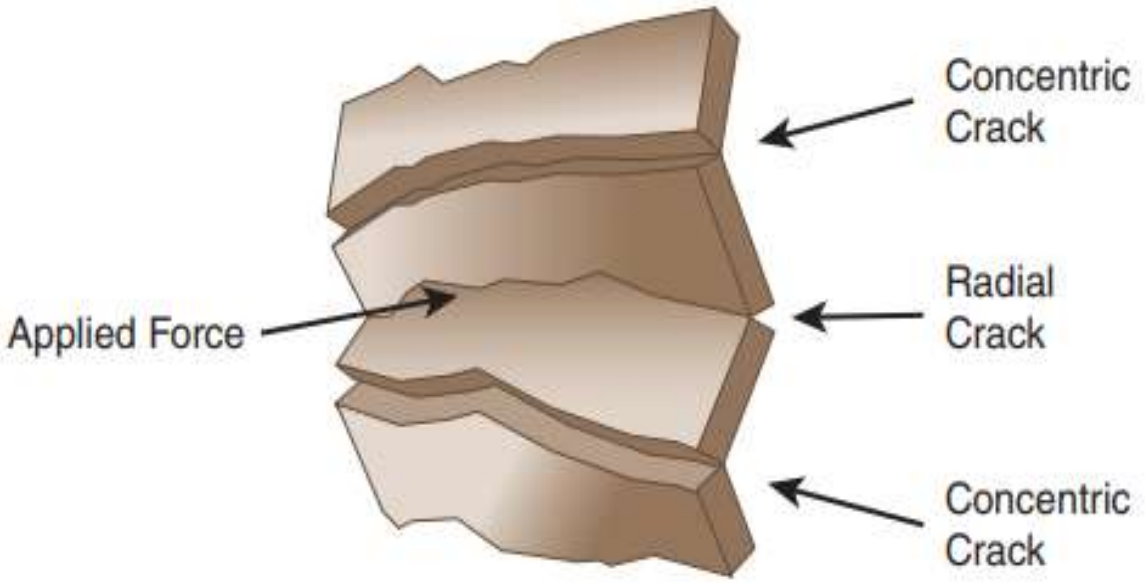
- Elasticity is the ability of a material to return to its previous shape after a force is exerted on it.
- For example, when a force is exerted on a pane of glass, it stretches (this bending may not be visible to the naked eye). If the force is not too high, the glass will then return to its original state and no damage occurs. However, if the force exceeds the glass's elasticity, the glass fractures.

➢ CHARACTERISTICS OF GLASS FRACTURES:

Glass may be subjected to three types of forces (strains):

Compressive force, Tensile force and Shear force.

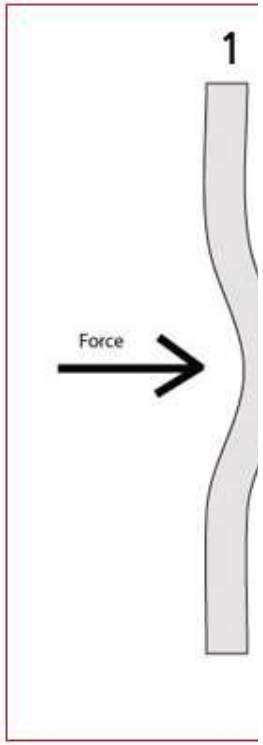
Each of these forces causes a deformation, which resisted by the internal cohesion (stress) of the material. Glass breaks when a tensile strain that is sufficient to overcome the natural tensile stress limit of the material is applied.



B. THEORY

➢ DIRECTION OF

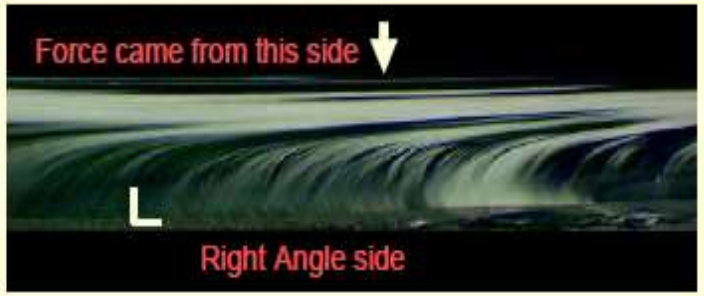
- Radial cracks ar
- Concentric crac around the point of impact. They a adial crack.



Direction of Force

- Small projectiles entry-exit
  - Entry: smaller hole, smooth surface
  - Exit: wider hole, crater shape, rough surface

- Radial fractures indicate direction of force
- 3R Rule:
  - Radial fracture
  - Right angle
  - Reverse side of force

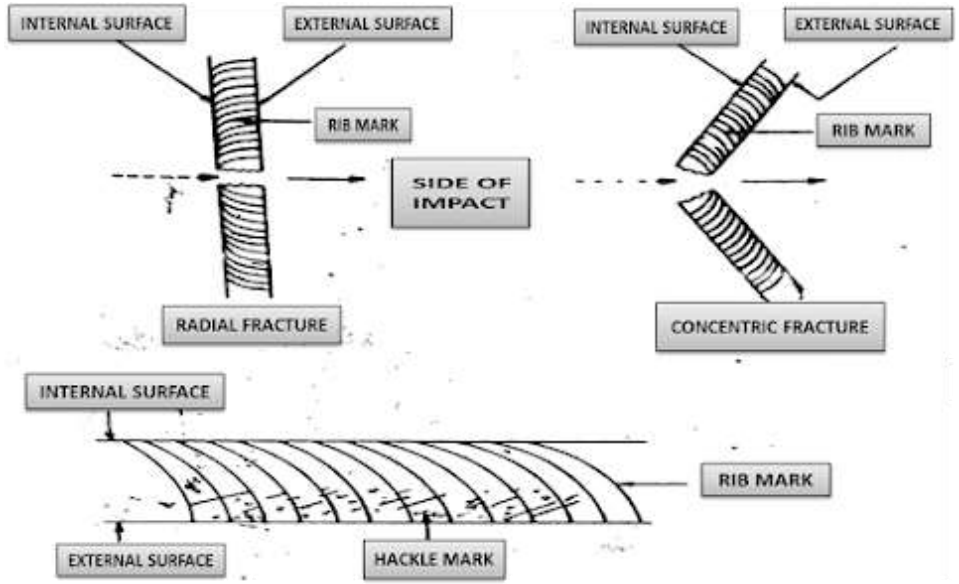


B. THEORY

- Hackle marks are coarse parallel marks lying parallel to the direction of fracture and can be used to match two pieces of glass. The easiest marks to see on the glass edge are the curved shell-like or rib marks. As with hackle mark it may be possible to match fragments of glass.

➢ <u>SEQUENCING</u>

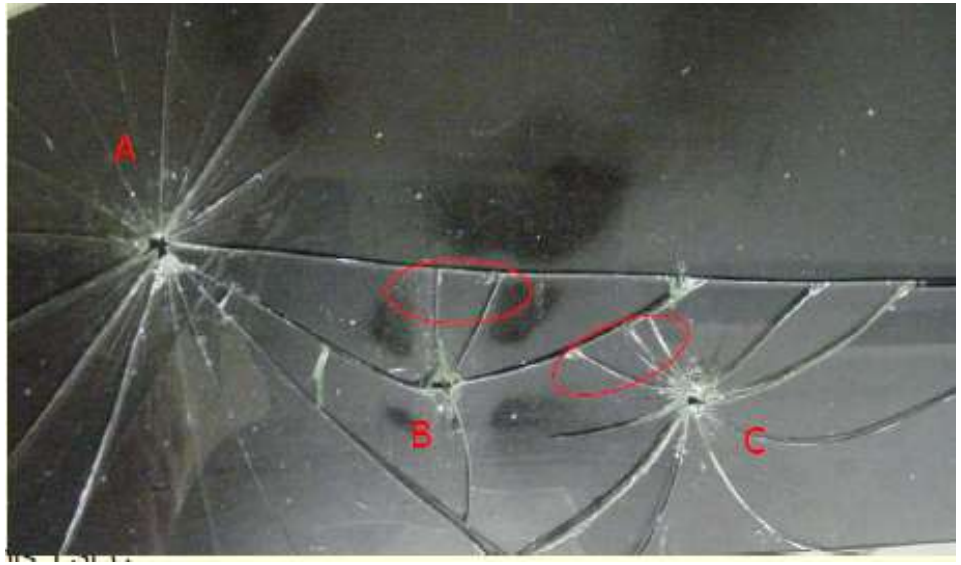
- Radial fracture lines occur first extending outward from the break point, produced when the opposite side of impact fails first.
- Concentric fracture lines form a circle about the break point and are produced by the side of impact failing first.
- Radial fracture lines always end in existing radial lines.

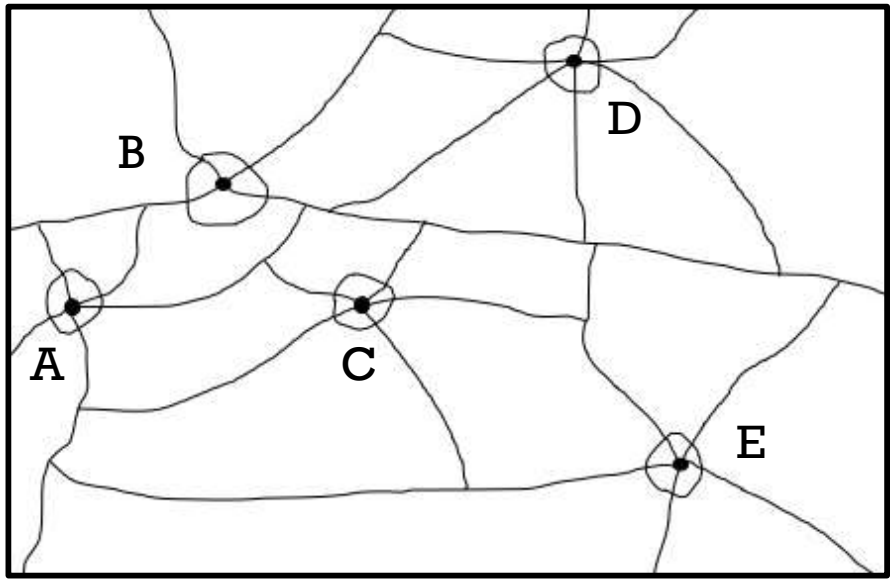


C. PROCEDURE

- SEQUENCE OF IMPACTS
  - Observe the glass fractures and trace the path of fractures on a tracing paper.
  - Examine the point of impacts and the cracks emerging from those points.
  - Number the cracks in clockwise or anti-clockwise direction and determine if the cracks end in existing cracks
  - This will allow the examiner to determine the sequence of impacts. There may be more than one possible sequence of impact.
- HACKLE MARKS
  - The two glass samples were placed under a Traveling microscope and the hackle marks were observed. The direction of impact was determined based on the rib marks.

D. OBSERVATION, RESULT AND CONCLUSION

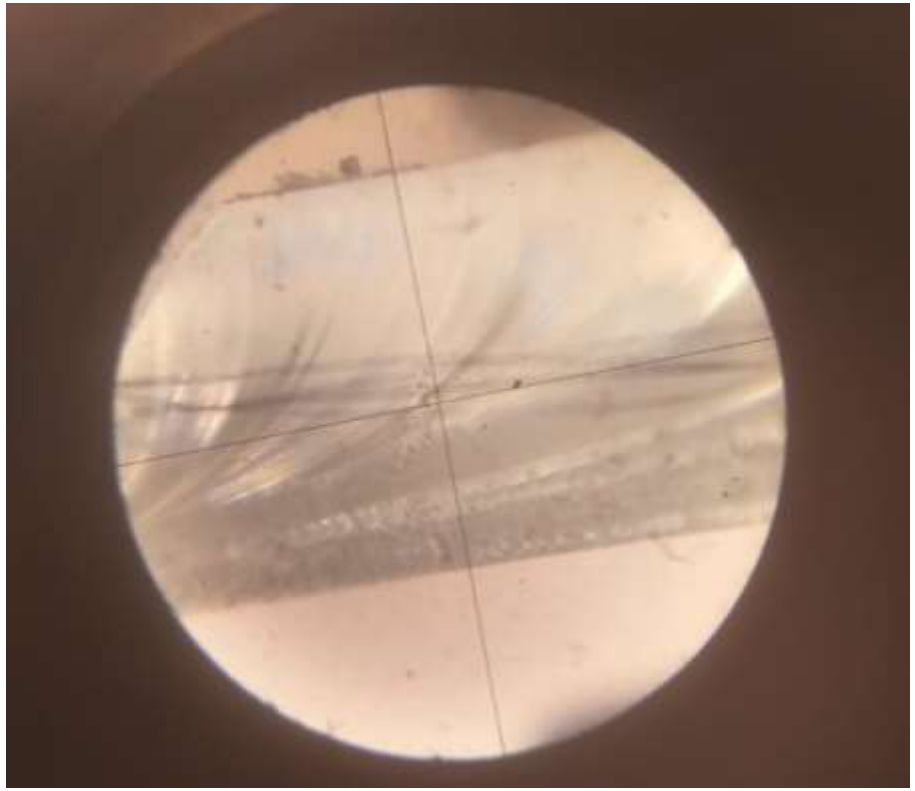


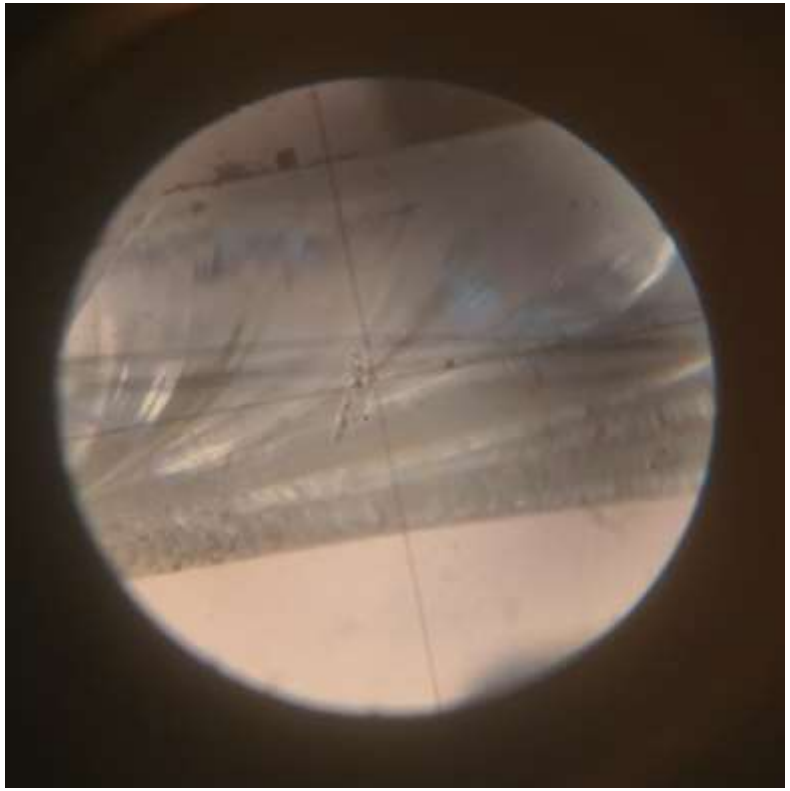


Case 1:
The sequence of impacts here is:
A then B and then C.

Case 2:
The possible sequence of impact are:
B,D,A,E,C
B,A,D,E,C
B,A,E,D,C
B,A,E,C,D

D. OBSERVATION, RESULT AND CONCLUSION





Result and Conclusion:
The sequence of impact for 2 cases were analysed.
The Hackles marks were observed under the microscope.

EXP. 2:
ANALYSIS OF OBLITERATED IDENTIFICATION NUMBERS

A. AIM AND SCOPE
B. INTRODUCTION
C. EXAMINATION
D. CASE STUDIES

A. AIM AND SCOPE

- **AIM:**
  - Analysis of obliterated identification numbers.

- **SCOPE:**

- The investigation of vehicle theft often requires the restoration of erased or altered vehicle identification numbers.
- When vehicles are stolen, it is common place for engine numbers and chassis numbers to be erased and new numbers may be created in order to escape detection.
- Generally the new numbers are punched into the metal in the same location as the original number. When the original engine number or chassis number of a vehicle is erased and a new number is punched on top, it is possible to find the original number using a technique to restore the erased number.

B. INTRODUCTION

- When a metal surface is punched, the metal becomes compressed and deformed; this resulting disturbance of the metal is called "cold working". This increases hardness and decreases malleability and ductility of the metal. The resistance to oxidation and acid is very low.
- The affected part reacts more with acids than the surrounding, unaffected area of the metal. The choice of chemicals used for the restoration of erased numbers depends on the nature of the metal. Mostly we come across stainless steel, mild steel, iron, cast iron, copper, brass, and German silver.
- The restoration of the number is quite time-consuming and as soon as the erased numbers are visualized, immediate photography is required. Otherwise, the numbers may not be seen again due to the action of chemicals on metal.

C. EXAMINATION

There are three types of markings commonly found: a) cast marks, b) engraved marks, and c) stamped or punched marks. There are a number of techniques used to obliterate identification marks that are typically encountered in India:

1. **Filing or grinding**
2. **Peening**
3. **Over-stamping**
4. **Centre-punching**
5. **Substitution**
6. **Drilling**
7. **Welding**
8. Occasionally an original finish will be given to a previously obliterated number surface.

C. EXAMINATION

- Chemical Etching method was employed for restoration of obliterated numbers.

➢ <u>CHEMICAL ETCHING METHOD:</u>

- The chemical etching method is the simplest and most effective method for restoring obliterated numbers. It is simple to apply and it requires no expensive equipment. The techniques involved require considerable skill and great patience. The materials are potentially dangerous and should be used with full awareness of health and safety requirements.

- In the case of motor vehicles, remove the engine from the vehicle if necessary for ease of access to the engine-number surface, and for better-quality photographs of the restoration process. Examine the metal surface after using acetone to clean away oil and dirt.

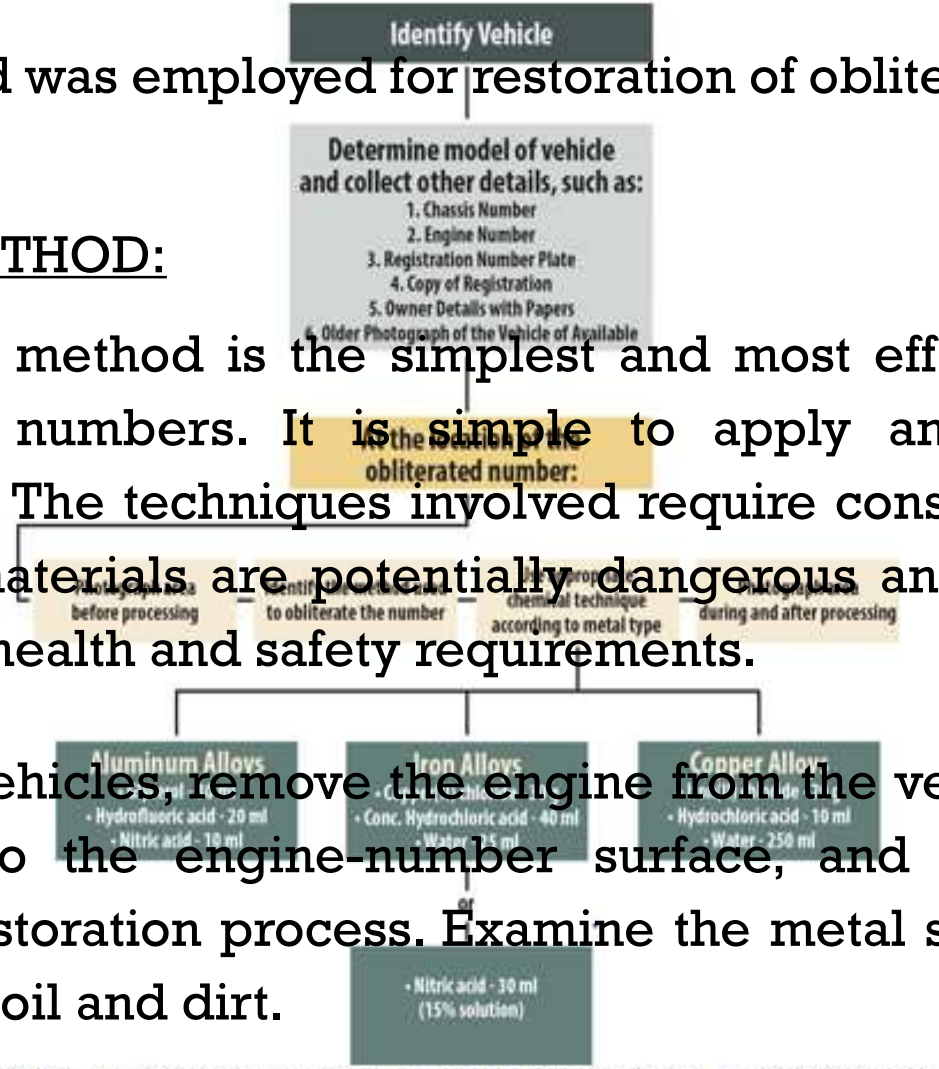


Figure 1—This simple flow chart shows the authors' recommended method for restoration of numbers in metal.

D. CASE STUDIES

Case I – Tata Xenon Truck:

In this case, the driver of a Tata Xenon pickup truck was stopped by the police and subsequently found to be transporting 500 kg of Doda Chura (poppy straw—the dried, upper portion of the opium poppy, minus the seeds). Our team travelled to the district police station and examined the chassis and engine of the truck. It was evident that grinding and rubbing had been performed in the area of the chassis number. The number plate was missing from the engine. We were able to successfully restore the original numbers of the pickup truck.

The following process is utilized when peening is observed (Images 1.1-1.5): First, prepare the surface using a file to polish and clear the damage caused by the pointed punch. Next, treat the surface with the solution shown in the flow chart for the iron-based chassis. The solution can be applied continuously for about 9 to 12 hours, or over the course of 2 to 3 days for 5 hours per day. Photographs should be taken before and after each step to document the process.

Result: The restored number of the chassis of the Tata Xenon pickup truck (Images 1.4-1.5):

* M A T 4 6 4 2 0 3 C S K 0 2 4 1 0 *

D. CASE STUDIES

Case II - Trailer Truck:

- In this case, an individual claimed that his trailer truck was stolen, and that the thief had tempered with the chassis and engine numbers and re-painted the vehicle. The team treated the original position of the chassis number and the newly stamped chassis number. The original chassis number was revealed beneath the newly stamped numbers.

Result: The apparent chassis number prior to treatment

4 4 7 2 0 7 A S Z 3 0 0 5 3 6

The restored chassis number (Images 2.4-2.5):

4 4 7 2 0 7 M T Z 3 0 1 7 2 5

The team was also able to trace the registration number under the re-painted trailer body.


Image 2.3

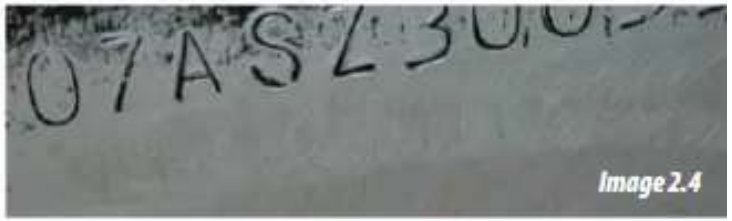


Image 2.4

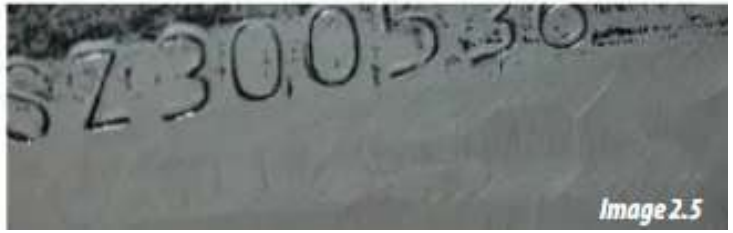


Image 2.5


Image 2.1


Image 2.2

D. CASE STUDIES

Case III - Truck:

- In this case, one truck was found in a jungle by a night surveillance team of the highway police. The number could not be traced by the police at that time, so the police called the team to examine the chassis number. The team treated the newly stamped chassis number that was placed over the position of the original chassis number. The original chassis number under the stamped number was recovered.

Result: The apparent chassis number prior to treatment.

M A T 4 5 7 4 0 3 D 7 H 4 8 9 8 8

The restored chassis number (Images 3.3):

* M A T 4 1 6 4 7 1 A 7 E 2 1 9 9 4 *

The original location of the engine number was found at the rear-accessible location under the engine

D. CASE STUDIES

Case IV - Truck:

- In this case, one truck was detained by the Road Transport office during an inspection that found the registration certificate and other papers related to the truck did not match. The spot examination team treated the original position of the chassis number and the newly stamped chassis number. Experts could recover the original chassis number under the stamped numbers.

Image 4.1—Front view of the Tata truck.
Image 4.2—The location of the original chassis number has been ground away and a new number stamped on top.
Image 4.3-4.4—The restored chassis number.

Result: The apparent chassis number prior to treatment

4 2 6 0 3 1 D R Z 0 0 9 7 4 2

The restored chassis number

4 2 6 0 3 1 G S Z 7 2 9 7 7 0

D. CASE STUDIES

Case V – Motorcycle:

- In this case, a motorcycle was stopped at a checkpoint when official noticed that motorcycle did not display the same number on its chassis as it did on its engine. The team treated the original positions of the chassis and engine numbers. In this case, the location of chassis number had been ground down, had a coating applied, and a new number was stamped over the location of the original number. The original engine number was completely erased then a new number was stamped in the same spot. The team restored both the chassis and engine numbers.

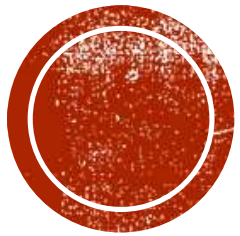
The apparent chassis number:

9 4 M 1 7 F 0 0 6 5 8

The restored chassis number:

0 2 M 2 0 F 3 7 6 4* *May be "4" or "9"

Image 5.1—Front view of the Hero motorcycle.
Image 5.2—The original chassis number has been deeply ground away and a new number is stamped on top.
Image 5.3—The restored chassis number.



THANK YOU!

DESSICATED REMAINS

NAME- ALEFIYA.ATTARWALA

MSc-2

INTRODUCTION–

The skin is both the largest organ and the first line of protection in the human body.

The skin is primarily consistent in nature everywhere except for the areas covering the palmar surfaces of the fingers and hands and the plantar surfaces of the toes and feet.

Obtaining legible recordings of these areas of skin is crucial for subsequent comparisons to latent impressions recovered from crime scenes, for comparison against previous records, or for input into automated fingerprint identification systems (AFIS).

EQUIPMENT–

Ink roller,

An inking plate (constructed of glass or a smooth metal, such as stainless steel),

Fingerprint or palmprint cards for recording the prints,

Quality black ink formulated for this purpose,

Standard cards that are used to record prints (8” x 8”).

Livescan technology replaces the process of using ink to record friction ridge detail. The friction ridge surfaces to be recorded are placed on a scanner that records the detail in a matter of seconds. g of inked impressions on a card, but without the ink.

RECORDING DESICCATED FRICTION RIDGE SKIN(TRADITIONAL METHOD)-

Removing the hands or feet and subjecting the skin to many hours of potentially destructive chemical rehydration soaking and softening techniques. (NOT ALWAYS NECESSARY)

This method involves the use of a silicone product (Mikrosil) to successfully record friction ridge detail that has been subjected to various types of destructive conditions such as desiccation, hardening, or wrinkling.

The friction ridge skin must be cleaned and dried. The fingers should be separated to keep the silicone casts from sticking together.

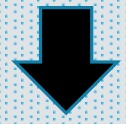
The casting material is then mixed according to the included instructions and applied to each finger or other areas of friction ridge skin.

After approximately 15 minutes, the casts are peeled off one at a time and marked accordingly, thus revealing a “high contrast, highly detailed, three-dimensional mold”.

These silicone casts may then be photographed and preserved. When the casts are examined, the friction ridge details will be black and will be in the same orientation as if they had been recorded on a fingerprint or palmprint

On severely damaged or decomposed friction ridge skin, Greenwop powder, which fluoresces under ultraviolet light, and black casting material may also be used.

The resulting casts are then photographed using ulraviolet light.



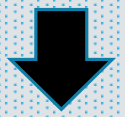
If this method should fail to produce discernible friction ridge detail, the traditional methods of rehydration and softening must be implemented. Once the skin is rehydrated and softened, the Mikrosil method may be used subsequent to the traditional methods to facilitate satisfactory recordings of any restored friction ridge detail.

TRADITIONAL REHYDRATION METHOD-

This method is used primarily when extreme drying and dehydration of the friction ridge skin has caused excessive shriveling and wrinkling of the tissues, thus precluding sufficient recordings using less destructive methods.

METHOD-

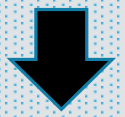
The friction ridge detail is checked periodically until the inner layers of skin are pliable such that the skin will give slightly under pressure. As previously mentioned, sodium and potassium hydroxide solutions are destructive to the tissues and will cause shedding of some of the outer layers of friction ridge skin.



Individual fingers or toes should be placed in separate 75 mL capped bottles, nail-side down. The bottles should be labeled with the subject's name, case number, and the finger or toe number.

Photographs should be taken of any friction ridge detail prior to the rehydration process, because this procedure is potentially destructive to the tissues.

Start with one finger before processing the remaining fingers, in order to determine the degree of destruction caused by the process.



The 75 mL capped bottles are filled with enough 1% to 3% sodium or potassium hydroxide solution to cover the friction ridge detail.

The outer layers of the friction ridge skin may be removed by gently brushing the skin (in the direction of the ridge flow) under warm running water with a soft-bristled toothbrush containing powdered hand cleaner.

If the ridge detail is prominent, and the friction ridge skin is soft and pliable, the skin is then ready to be recorded. At this point, the epidermis should be white and soft.

If, however, the friction ridge skin appears flat and stiff, it may then be soaked in a solution of dishwashing liquid and water in the same manner as with the hydroxide solution. (If this step is needed, one tablespoon of the dishwashing liquid should be placed in the 75 mL jar with enough warm water added to cover the friction ridge detail.)

The friction ridge skin should soak at room temperature for approximately 24 to 48 hours, again being checked every 4 to 6 hours.

This process may also cause further shedding of the tissues, which should be removed using a soft-bristled toothbrush, as described previously.

Once the friction ridge skin is soft and pliable with prominent and discernible friction ridge detail, the friction ridge skin is ready to be recorded.

-->The length of time the skin should soak in these solutions depends on the extent of desiccation. However, if left too long, the friction ridge skin could potentially be destroyed.

RECORDING REHYDRATED FRICTION RIDGE SKIN-

To begin, the fingers should be tied with string around the distal phalangeal joint (first joint) to prevent the material to be injected from escaping.

Enough material is injected into the finger to round out the friction ridge skin, enabling successful recording.

A locking hemostat is then clamped to the finger as an extension of the finger to facilitate the recording process.

The finger must now be completely dry for proper adhesion of the fingerprint ink. To accomplish this, the finger should be gently dried with paper towels and lightly dusted with fingerprint powder. Excess moisture and powder may be removed by rolling the finger on paper towels until the fingers are sufficiently dry.

The friction ridge skin is then coated with a thin layer of fingerprint ink, either by rolling on an inked plate or by rolling ink on the friction ridge skin with an ink roller.

The finger is then recorded in the usual manner by applying light pressure to the nail side of the finger while rolling it on an index card or other suitable recording card.

This process should be repeated until satisfactory results are obtained. The recorded prints are then placed in the appropriate blocks on a standard fingerprint card.

If satisfactory results cannot be obtained using this inkand-roll method, it is possible to obtain satisfactory recordings using powder and lifting tape.

A light dusting of black fingerprint powder is applied to the friction ridge detail. A piece of lifting tape is then placed on the friction ridge detail at one side and lightly pressed over the friction ridge detail to the other side while smoothing. The tape is then removed and placed on a piece of clear Mylar-type plastic. One might also use white opaque lifting sheets with a transparent cover.

Putty can serve as a cushion on which to roll the finger. Putty (i.e., duct seal) is moldable and nondrying. (It is used in plumbing and electrical work and is available in hardware stores.)

A ball of duct seal is placed on the working surface and flattened. A piece of a lifting sheet is placed on top of the duct seal and the powdered finger is rolled onto the lifting sheet). The duct seal allows the lifting sheet to mold into the extreme wrinkles of the finger, creating a fingerprint impression of the entire area of the finger.

Regardless of the tape that is used, the recorded impression is now placed in the appropriate block (adhesive-side up) on the fingerprint card with the correct orientation. (When using transparent fingerprint tape, if the recorded impression were to be placed adhesive-side down on the fingerprint card, the fingerprint impression would be reversed.) The clear lift should then be marked directly on the lift with the correct orientation, finger number, and all other appropriate markings

FINGERPRINT RECORDED ON A SHEET PLACED OVER DUCT SEAL

ILLUMINATING LIGHT SOURCES

INTRODUCTION

A Illuminating Light Source is made up of a powerful lamp containing the ultra-violet,visible and infrared components of light.

It then filters down the light into individual color bands (wavelengths) that enhance the visualization of evidence by light interaction techniques including fluorescence (evidence glows) ,absorption(evidence darkens),and oblique lighting (small particle evidence revealed).

The primary application of a Illuminating Light Source is for enhancing the detection of latent fingerprints.

The use of fluorescent enhancement processes that compliment a light source greatly increases the types of surfaces from which a latent fingerprint can be detected. Consider the difficulties of dusting and lifting a print off of the following surfaces: thin plastic bags, rigid duct tape, thin aluminum foil, heavily grained wood, concrete wall, brick, printed glossy magazine pages, paper products, etc.

Illuminating Light Source techniques have been successfully utilized for revealing latent prints on these and many other types of textured surfaces, backgrounds which mask ridge detail, fragile surfaces, and contaminated surfaces.

In many cases,the background surface will also glow under light source illumination. In these cases it is necessary to tune to a wavelength of light that causes the print to glow and not the background.

WHAT ARE FORENSIC LIGHT SOURCES?

Forensic Light Source, A high intensity, multiple wavelength, bulb based, alternate light source designed specifically for use in Forensic Applications.of all the classes of alternate light sources:

Laboratory lasers are high power but also have the highest price and they lack versatility.LEDs are lowest in price but also lowest in power and they lack versatility.

Forensic Light Sources are high power, moderately priced and are extremely versatile.

Lasers

Traditionally Lasers were used primarily for lab work due to the large footprint and cooling requirements.While lasers have become more portable with higher powers, they are still not versatile since they are only one wavelength.

Bringing a green laser to the crime scene is nice if you are going to use Rhodamine or DFO for every surface. Background rejection is not possible and many fingerprints, body fluids, and trace samples will remain obscured on variously colored backgrounds if you have only one wavelength available.

Forensic Light Sources

An FLS can provide versatility unmatched by any other class of instrument. With multiple integrated wavelengths, an FLS provides the ability to change wavelengths to find the optimal wavelength for causing evidence to fluoresce and backgrounds to fade. This is background rejection. A concept not discussed by other classes of instruments.

Simplest of all, a multiple wavelength FLS provides unparalleled ease of use. No light source offering multiple wavelengths is as easy to use. With integrated, one hand control, changing wavelengths is as easy as “flicking your thumb”. No components to swap, no slides to switch, no separate remote controls.

As with all of our products,we suggest you compare. We can provide a loaner unit of any of our FLS, at no cost, to compare side by side to any other unit on the market. We are confident that when you try our units you will be satisfied it is everything we said it would be.

UV LIGHT

Ultraviolet radiation extends from approximately 180 nm to 400 nm (visible light extends from 400 nm to 700 nm, and infrared radiation from 700 nm to 1200 nm).

The ultraviolet portion of the spectrum has been commonly divided into three regions:

– short wavelength – also known as far ultraviolet and extends from 180 nm to 280 nm

--medium wavelength – extends from 280 nm to 320 nm.

– long wavelength – also known as near ultraviolet and extends from 320 nm to 400 nm.

APPLICATION OF ULTRAVIOLET LIGHT FOR DETECTION OF FINGERPRINTS

From the researchs performed at the laboratory we know that UV itself alone is not an effective tool for detecting untreated prints.

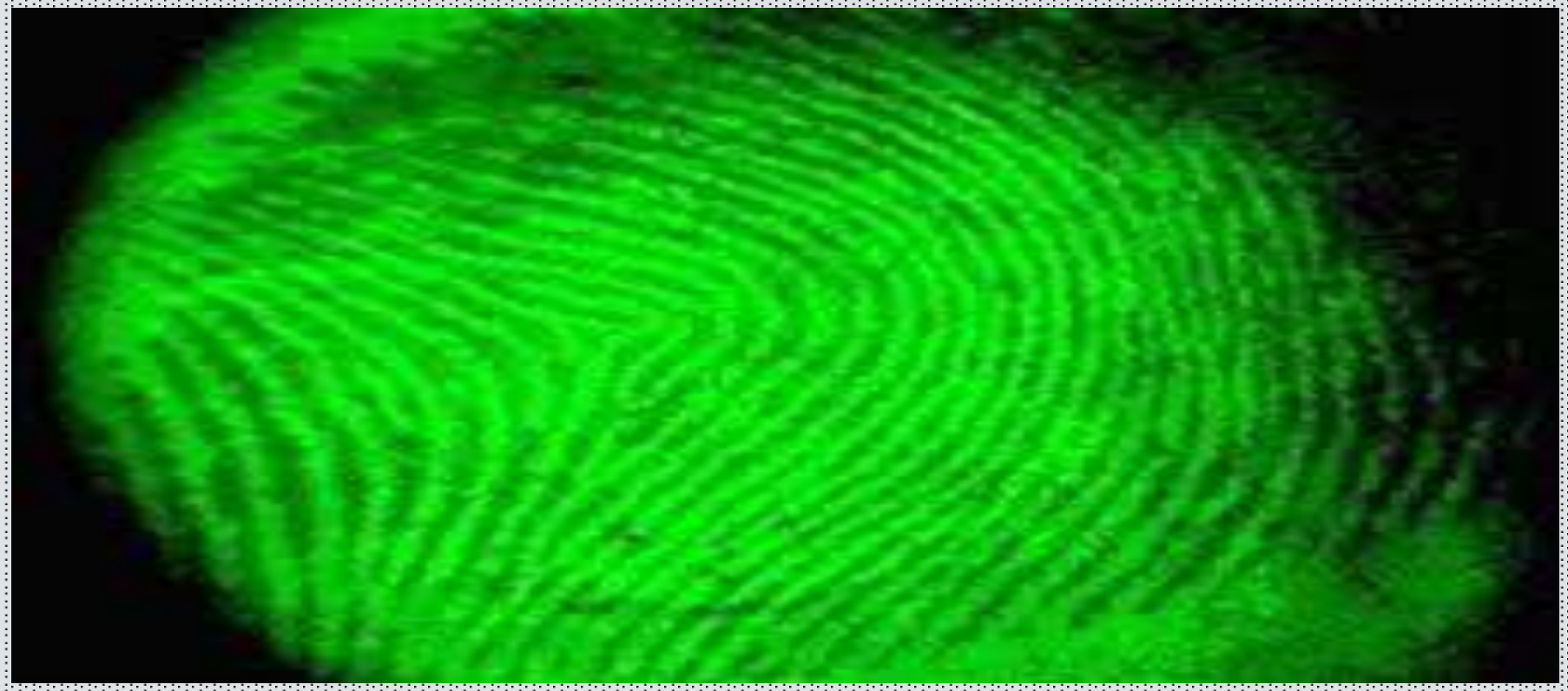
However RUVIS,the acronym used for reflected ultraviolet imaging system, makes the visualisation of untreated or superglue fumed latents possible. Ruvis has been developed by the Japanese National Police and extends forensic examination capabilities into the portion of light spectrum below 360 nm.

A 105 mm ultraviolet lens and an intensifier are the main parts of this device. As the light source we make use of a portable short wavelenght(254nm) UV lamp.

We can observe and detect the untreated prints on smooth and non porous surfaces just by using UV and the main unit of RUVIS.

90% of all untreated prints on smooth and non porous surfaces can be visualised with this technique.If we want to photograph them it is easy to connect a camera to the main unit.

FINGERPRINT ENHANCED USING RUVIS



DIFFERENT LIGHT SOURCES AND THEIR WAVELENGTH

Foster c
differer

Filter	Pale Yellow	Yellow	Orange	Red	UV
Used with...	Violet Crime-lite	Blue Crime-lite	Blue/Green Crime-lite	Green Crime-lite	UV Crime-lite
Wavelength	455nm	495nm	550nm	590nm	420nm
1% transmission	435nm	476nm	529nm	571nm	408nm

DIFFERENT LIGHT SOURCES AND ITS APPLICATIONS ON FINGERPRINTS DEVELOPED WITH DIFFERENT METHOD

Other coloured light sources include green light,blue light,red light,violet light,blue/green light.

All these light sources emit wavelengths of different energy and can be used on untreated as well as on chemically treated fingerprints.

The table in the next slide gives few exaples of chemically treated prints and are classified as whether they illuminate in the given light source or no.

Processing Reagent	Excitation Wavelength; Absorption Maximum*	Excitation Light					Recommended Barrier Filter(s)
		UV (260-400 nm)	Violet (400-450 nm)	Blue (450-490 nm)	Green (490-560 nm)	Yellow (560-590 nm)	
Ardrox	280-365 nm; 435-480 nm	●	●	●	●		Clear, Yellow
Basic Yellow 40	415-485 nm		●	●			Yellow, Orange
DFO	495-550 nm; 514*				●		Orange, Red
1,2-Indanedione	515-570 nm				●	●	Orange, Red
Liqui-Drox	< 400 nm (UV)	●					Clear (none)
M.B.D.	415-470 nm; 415–505 nm; 450 nm*		●	●	●		Yellow, Orange
M.R.M. 10	430-530 nm		●	●			Orange
Nile Red	450-560 nm; 530 nm*			●	●		Orange
R.A.M.	415-485 nm; 460 nm*			●	●		Orange
Rhodamine 6G	495-540 nm; 525 nm*				●		Orange
Safranin O	~500 nm region				●		Orange
TapeGlo	450 nm			●			Orange
Thenoyl Europium	Long-wave UV (~350 nm)	●					Clear (red for photography)
UV-sensitive powders/dyes	< 400 nm (UV)	●					Clear

PRINT TREATED BY DFO ENHANCED UNDER BLUE/GREEN LIGHT

FINGERPRINT ENHANCED UNDER BLUE LIGHT.

FINGERPRINT DEVELOPED UNDER IR LIGHT

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8)Image courtesy: Google.

THANK YOU!

FINGERPRINT FUMING SYSTEMS

DEEPA RAJU

- M.Sc. Part II

CONTENTS

1.CYANOACRYLATE FUMING CHAMBERS

- Cyanoacrylate fuming is one of the most common techniques used to visualize latent prints on non-porous surfaces.
- Developed prints appear white in color, after the cyanoacrylate monomer has polymerized on the latent print residue.
- The amount of time required for development to occur varied from hours to days.
- Items were initially fumed in thin layer chromatography tanks, fish tanks, and petri dishes.

Acceleration Methods

- The glue and sodium hydroxide-soaked cotton
- Mixture of baking soda and sawdust
- Heat- heating metal block , light bulb

Hard Evidence

- Cyanoacrylate gel
- Water vapor - freezing the item
- Mixing of cyanoacrylate with petroleum jelly (1 cc of Vaseline to four drops of cyanoacrylate) spread between acetate sheets .

One-step

- Iodine crystals in conjunction with a cotton pad soaked with sodium hydroxide.

2.FIELD FINGERPRINT FUMING SYSTEMS AND LARGE AREA FUMING SYSTEMS

2.1 Fuming chamber at crime scene.

1. Sandridge fuming cabinet - 80% ± 2% Relative Humidity (RD), temperature of 140 , 3g of cyanoacrylate was placed in an aluminium dish and heated, cleaning of the cyanoacrylate fumes using mechanic extraction.

2. self - scrubbing chamber- dilute coating of sulphuric acid

2.2 Fuming Wands

1. Butane heated torch that vaporized solid cyanoacrylate at high temperatures.

2. Disadvantages:

- melt or damage fragile items
- personal protective equipment
- cartridges would last only 60 s
- dangerous decomposition products like hydrogen cyanide.

2.3 Other Methods

- Custom build system to process development process inside cars was introduced
- Large-scale fuming of crime scenes has also been reported where heavy plastic tent type enclosures were used in residential interiors.
- The size of the spaces fumed ranged from 8,000 to 12,000 ft3 (226–340m). For such a scene, 100mL of cyanoacrylate monomer was split between several hot plates, which were heated to 66°C (150°F).
- The fuming was allowed to continue overnight.

EXAMPLES

1.SIRCHIE'S PORTABLE FUMING CHAMBER KIT	2. ATTESTOR MOBIfume
• Unit is made to disassemble into flat sheets and fit into a tough, nylon carrying case. • Volume of about 12 gallons • Cyano-black reagent is applied to all polycarbonate surface • Defumigator • The fumes inside the chamber are drawn through a >995 efficient filtering system. • Unit is also transparent which allows for easy monitoring.	• Turn tents and garages into instant fuming rooms for large pieces of evidence. • Humidifier, power circulation fans • Carbon filter cartridge • Controls the system via a provided touch screen tablet and connects with the individual components of the mobile fuming unit wirelessly. • A freely adjustable fuming temperature, very large fuming plates and also allows users to use fluorescent and non-fluorescent cyanoacrylate derivatives in liquid or powder form.

SIRCHIE'S PORTABLE FUMING CHAMBER KIT

ATTESTOR MOBIfume

3. VACUUM FUMING SYSTEMS

- The first prototype chamber system operator- 0.4mbar, 20 minutes.
- Bench top desiccator- superior prints appeared as the layer of solid polymer and those develop at atmospheric pressure appeared as a tangled network of fibers.)
- However the U.K. Home Office obtained different result w.r.t. atmospheric pressure / heat technique:

1. Superior visualization technique.
2. The age of the latent print increases.
3. Greater surface area for dye stains to attach.
4. Reduced pressure technique produced higher background reaction.

3.1 One Step Fluorescent Cyanoacrylate Fuming System

- A fuming wand with a special cartridge that contained a magenta-colored dye from the styryl family - early 1980s
- When the cartridge was heated, the dye would copolymerize with the methyl cyanoacrylate to produce pink-colored, fluorescent prints in one step.
- An argon ion laser was used to excite the developed prints and a red-orange filter (approximately 600nm) was used to view the fluorescence.
- PolyCyano UV,* has also shown some promise for developing fluorescent cyanoacrylate prints in one step. Other attempts have been made to chemically alter the structure of the cyanoacrylate to incorporate functional groups that would promote the formation of a fluorescent polymer on latent print residue.
- Recent efforts have once again focused on creating new cyanoacrylate monomers that contain either colored or fluorescent functional groups.
- Unfortunately, the compounds evaluated decomposed before becoming volatile and thus failed to form colored or fluorescent prints.

EXAMPLE: MVC/D Range of Fuming Cabinets:

- Foster and Freeman has developed a line of cabinets accommodating under different situation.

1. They have a cabinet that provides additional 19 litre capacity - cutting fire arms, rifles and other objects up to 1245mm in length.

2. 72 litre and also another up to 2009 litre - all size of evidences.

3. The new MVCD cabinets help to develop detailed fingerprint patterns which is immediately fluorescent under UV illumination and does not require a secondary enhancement treatment.

4.OTHER CHAMBER SYSTEM

4.1 Safedevelop DFO, Ninhyrdrin Fingerprint Developement Chamber

- Control all functions from start to finish, permitting the investigator to initiate an unattended cycle, establish proper development and duration.
- The resulting prints will fluoresce under different light source.
- Wide temperature range, large working area, shelves and rod systems

4.2 Chemical vapour fuming chamber

- Finger print with the range of difficult surfaces including those that have been exposed to heat (bullet casing) and also items that have been washed clean
- Recover prints on metals exposed to extreme heat including improvised explosive device (IED) fragments even if the device has been triggered.
- Fingerprint on metals surfaces that has been washed or wiped clean using detergent or cleaning chemical even if it was submerged in bleach for seven days, can be recovered using the chemical vapour fuming chamber.

4.3 Osmium/Ruthenium Tetroxide

- Ruthenium tetroxide or other volatile ruthenium salts would also be effective latent print reagents
- RTX vapor was produced by mixing aqueous solution of ruthenium chloride with an aqueous solution of ammonium cerium nitrate in equal volumes (in a closed chamber).
- Upon reaction with sebaceous material in the latent print residue, a black-colored product, ruthenium dioxide, was reported to form.
- RTX fuming was also reported to not inhibit development if used prior to 1,8-diazafluoren-9-one (DFO) (fluorescence) or ninhydrin treatments
- New method - ruthenium tetroxide dissolved in a saturated halogenide (e.g., tetradecafluorohexane) - produced a yellow, nonflammable reagent - simple spraying device.- gave brownish-black prints could be developed on a variety of surfaces, including regular and thermal paper, leather, vinyl, wood, and human skin.
- In the latter case, RTX was found to work better on dead bodies than with live skin samples.

4.4 Iodine Fuming System

- Physical absorption and fugitive nature of the developed print
- The use of iodine vapors was first reported by Coulier in 1863. Prints were developed at room temperature without any other catalyst.
- The vapor method was in use at the Federal Bureau of Investigation’s Technical Laboratory as early as the mid-1930s
- Fuming method was typically conducted at room temperature in a fuming box with a clear glass front for observation
- A small amount of iodine crystals (~1.0g) was placed into an evaporating dish and placed in the bottom center of the cabinet. Items to be processed were suspended above the evaporating dish. Heat (~50°C) could be applied to speed up the process.

- **Fuming “gun”** - packing of a glass tube with iodine (~0.5g) and calcium chloride crystals separated by glass wool.
- A device with separate tubes for each component can also be used. A rubber tube was used to supply warm breath, which was first dried by the calcium chloride and then passed through the glass wool to the iodine crystals. The temperature of the air is sufficient to sublimate the iodine crystals and produce violet fumes, which were then expelled from the device.
- Variation of the traditional fuming gun - used an electric lamp to heat the iodine crystals and pressurized, heated air (generated from squeezing a rubber bulb) to expel the vapors. A power source was required for the lamp.
- Another interesting variation of this fuming method was introduced and was called the porous glass iodine fuming technique. Dry iodine powder (called Driodine) was mixed with porous glass (96% silica, 4nm pore diameter).

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THANK YOU

FINGERPRINT DETECTION/TREATMENT METHODS ON CHALLENGING BACKGROUNDS

NAME: SHRUTI PAWAR
CLASS: MSc II

❖INTRODUCTION

- Fingerprints act as a direct evidence in identifying criminals.
- Latent fingerprints is the most common evidence found at crime scenes.
- The method used for the development and enhancement of these prints is based on the nature, the texture, condition and color of the surface on which they are present.
- The conventional methods such as powder dusting, ninhydrin spraying, iodine fuming, and silver nitrate produce results on normal surfaces but remain ineffective on challenging surfaces such as densely patterned and multi colored backgrounds, highly reflective surfaces, substrates that fluoresce at the same wavelength as other fingerprint treatment methods, etc.

❖ Fingerprint development methods for challenging surfaces

1) **Luminescent powders**

- Introduced in the late 1970's
- They contain natural/synthetic dyes that fluoresce on exposure to UV or other light sources
- Many luminescent dyes and pigments are useful as luminescent dusting powders for laser examination such as Rhodamine 6G, Rhodamine B, Acridine yelllow, etc.
- The use of phosphorescent powders was also suggested due to better emission lifetimes.
- Advantageous on multicolored or patterned backgrounds.
- Limitations: the dyes used pose health risks and they fluoresce in the same area of the spectrum as the background.

2) Anti- Stokes Powder

- Contains specialized materials that exhibit upconversion.
- Most materials rarely exhibit Anti–Stokes luminescence.
- A number of rare–earth metal complexes exhibit Anti–Stokes luminescence.
- Research suggested the use of Sodium yttrium tetrafluoride doped with erbium and ytterbium ($NaYF_4$: Er, Yb) as a fingerprint powder.
- Principle: attaches to the grease and sweat residue of fingerprint impression. On excitation of the powder at 980 nm (NIR), it emits green light revealing the fingerprint.
- It successfully developed fingerprints on glass, plastics, aluminum foil, ceramic plates, beer cans, glossy paper and electrical tape (PVC).

- Latent fingermarks were developed by dry powder, wet powder, and cyanoacrylate staining techniques.

- Using as dry powder:
- Good affinity on glass, plastic and aluminium surfaces
- Background staining evident on polyster cards
- Successful development on glass, Australian polymer bank notes, glossy papers, beer cans, etc.
- Gives remarkably clear ridge details.

- Using as wet powder:
- One of the three methods were used for development
- 1. Powder suspension using surfactants
- 2. Homogenized suspension
- 3. Sticky–side wet powder
- The dry powdering method revealed fingermark detail with higher clarity than either of the wet powdering techniques

- Using as post–treatment after Superglue fuming:
  - latent fingermarks developed on the glass microscope slides, ceramic plates, playing cards and plastic containers.
  - Then treated with $NaYF_4$: Er, Yb dry powder.

- Conclusion: Dry powder gave satisfactory results on all surfaces. Wet powder dispersed in hexane showed background staining.

Figure 1: Latent fingermark (<24 h old) on a soft drink label

Figure 2: Fresh fingermarks (<5 h old) on polymer banknote developed

Figure 3:Fresh fingermarks (<12 h old) on glass developed with: (left) aluminum powder and (right)

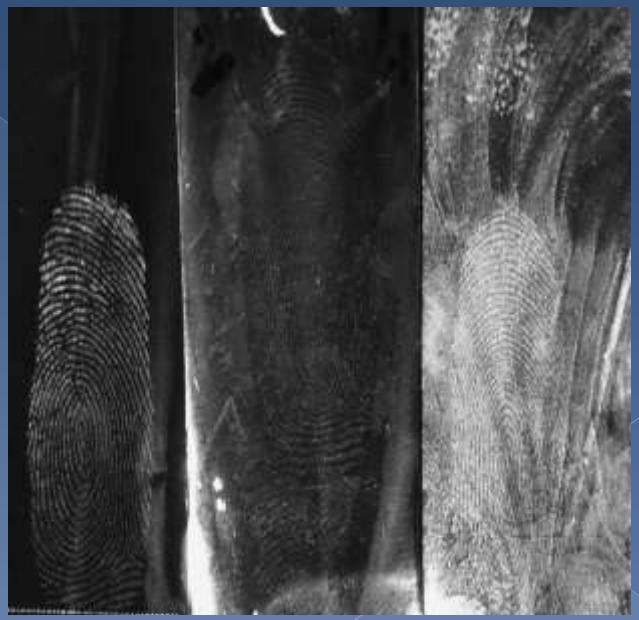

Figure 4: Fresh fingermarks (<12 h old) on aluminum foil developed by different methods.
(Left) dry powdering, (middle) CTAB suspension, and (right) homogenized suspension

3) NIR Chemical Imaging

- Chemical imaging is used for the detection of treated and untreated latent fingermarks in visible absorption and luminescence modes.
- Combines digital imaging and molecular spectroscopy.
- The use of chemical imaging for both treated and untreated samples gave good results.
- The use of NIR Chemical imaging shows more benefits as most dyes absorb or luminesce strongly in the visible region and are reflective in the NIR.
- The study by Maynard et al. developed fingermarks on porous, non–porous and semi–porous surfaces which were patterned and colored.
- The NIR dyes that were used as post treatment were Styryl 8 and Styryl 9M.

- The nanoparticles powder used were ZnO_2, Al_2O_3 and TiO_2which were coated with NIR dyes.
- Other techniques used were DFO, Ninhydrin, Genipin, Physical developer and other conventional methods.
- The developed images were observed for luminescence, absorbance and luminescence quenching in the NIR region.
- Out of all the methods only the dye coated nanoparticles showed good results without any background interference.

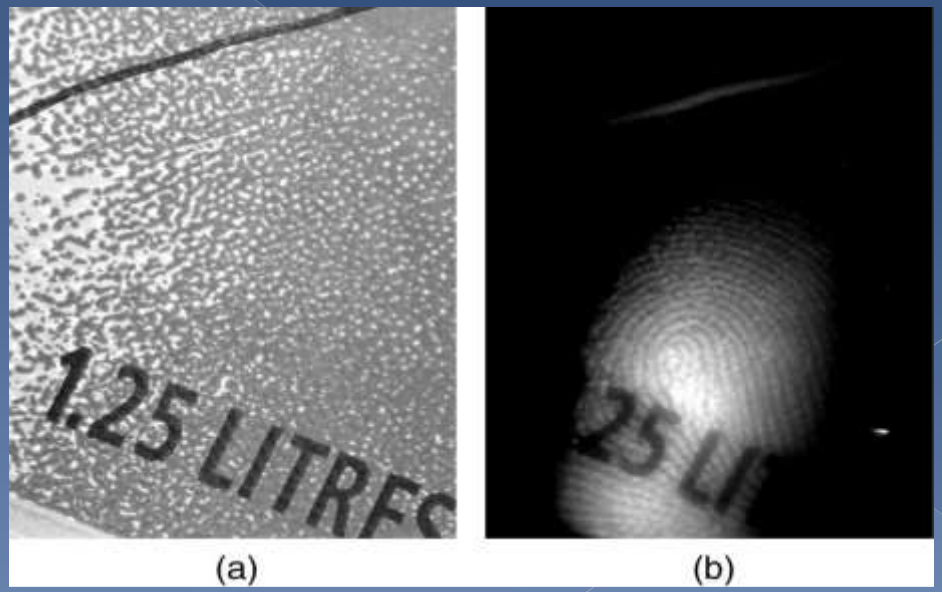

***Figure 5**: VSC image of fresh marks on soft drink label developed with TiO2–Styryl 9M powder, viewed under (a) white light and (b) in the luminescence mode with excitation at 590 nm and detection at 735 nm*

4) Spirulina Platensis Powder

- A study by King et al. showed the use of a finely divided powder of Spirulina Platensis on semi-porous and non-porous surfaces.
- Spirulina Platensis is a non-toxic algae widely used in food industry.
- It is a IR fluorescent powder developed by Foster Freeman. It is named *fpNatural 1*^{TM}.
- Spirulina contains chlorophyll and phycocyanins.
- The powder produces fluorescence at 650 nm on excitation in orange-red light (620-640 nm).
- The optical viewing filter required is 780 nm and above.
- Crime Lite Kit can be used for illumination.

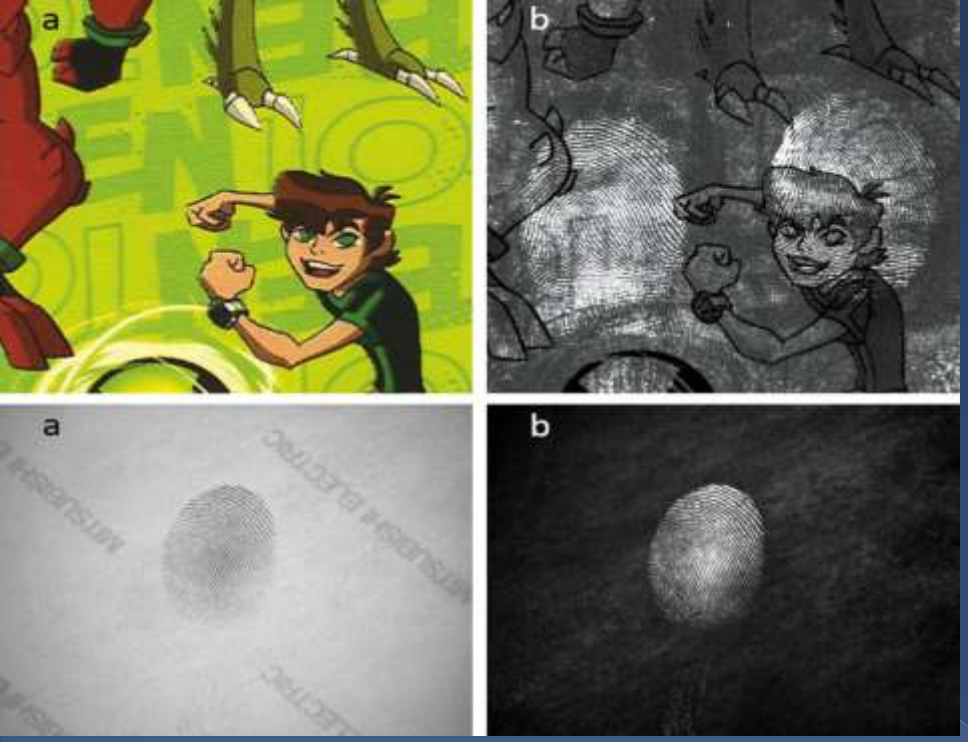

Figure 6: *Fingerprints developed using spirulina on (top) patterned wrapping paper and (bottom) white photographic paper as viewed under (a) white light and (b) 640 nm illumination with 850 nm long-pass filter*

Figure 7: *Fingerprints developed using spirulina on two different polymer bank notes viewed under white light (left) and under 640 nm illumination with an 850 nm long-pass filter.*

5) Egyptian Blue Pigment

- also known as cuprorivaite, it is the earliest known synthetic pigment.
- first prepared in ancient Egypt around 3600 BCE and used extensively until the 4th century CE.
- It is blue in color and its primary composition is calcium copper silicate ($CaCuSi_4O_{10}$).
- It is also one of the IR powders developed by Foster Freeman named *fpNatural 2™*
- shows high stability to light, oxygen, pH, temperatures upto 1000 ° C and long luminescence lifetime.
- The powder size 5–25 μm gave much better results than larger sized particles.
- The excitation wavelength used is 780nm.
- Its fluorescence surpasses the fluorescence of Spirulina Platensis.

Figure 8: Seven-day-old latent fingermarks on polymer banknotes

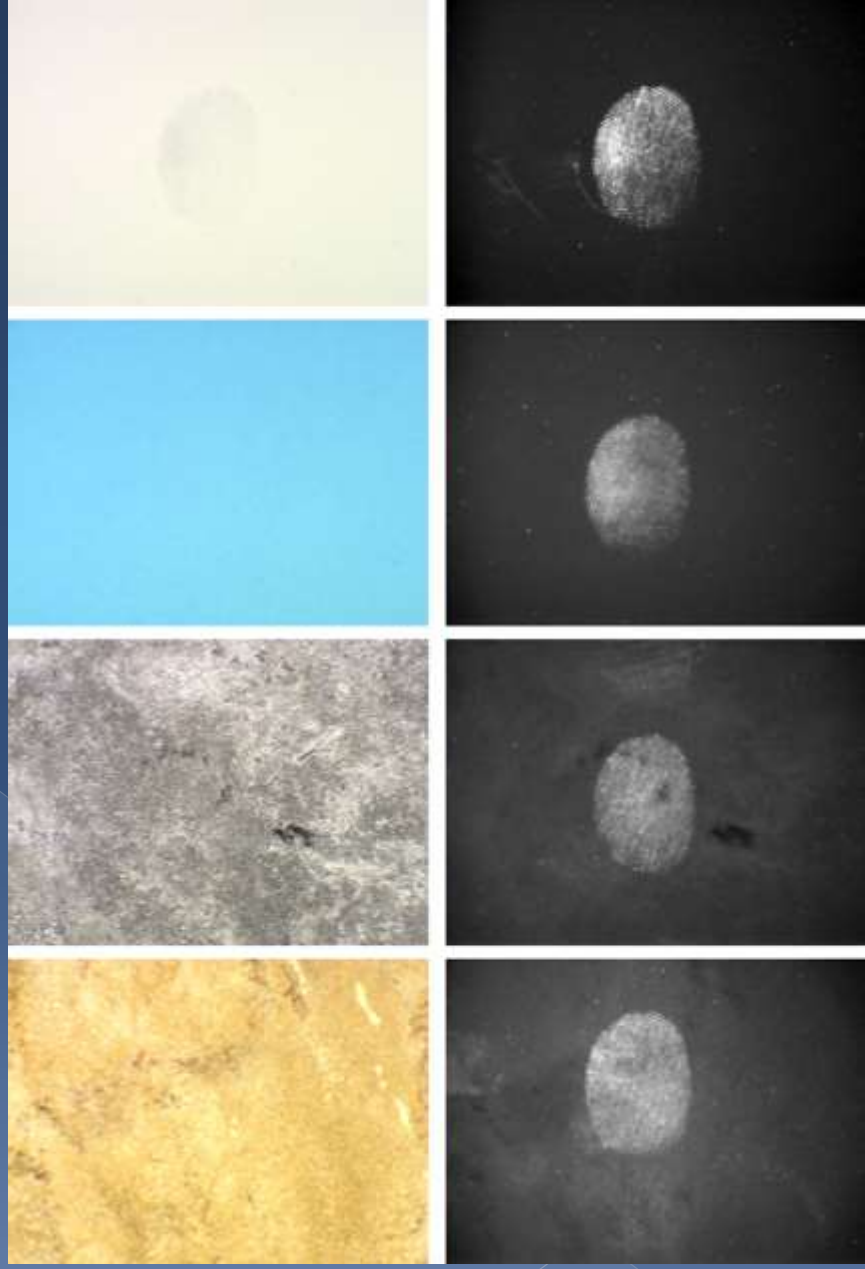

Figure 9: One day aged latent fingermarks developed

❖CONCLUSION

- The Anti–Stokes powder showed good potential to be used on various difficult surfaces.
- Spirulina Platensis powder and Egyptian Blue Pigment showed good results on all the challenging surfaces such as multicolored and densely patterned backgrounds, reflective metal surfaces and when the substrates fluoresce at same wavelengths.
- They are non–toxic methods. Moreover, they are easily available, low in cost with the ability to give better results and an easy method of application.
- Thus, these methods seem more amenable as a practical tool for the development of latent fingerprints.

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THANK YOU!

Fingerprint Enhancement Techniques: Thermal Fingerprint Developer, Anti-Stoke Powder Imaging

SUBJECT :

PSFSQ302-Advanced Fingerprint Technology-I

PRESENTED BY :

Prashant Kumar Panda

INSTITUTE OF FORENSIC SCIENCE, MUMBAI

Topic
Introduction
Thermal Fingerprint Developer
• Introduction
• Modern day development of Thermal Fingerprint Developer
• Principle
• Effectiveness
• Procedure
• Advantages
• Disadvantages
Anti Stoke Powder Imaging
• Introduction
• Anti-Stokes Visualization
• Crime-lite® ASV
• Application
• Advantages
• Disadvantages
Conclusion
References

Introduction

- Fingerprints are a result of an anatomical manifestation of a pattern of ridges and furrows of the epidemic layer at the anterior aspect of the fingertips. This pattern is determined during the fetal development, and is believed to provide a unique signature for every individual and for each finger.
- In spite of the scientific developments done in the field of DNA profiling, fingerprints remains the best and a crucial form of evidence needed for personal identification in the arena of crime scene investigations.
- The best results are generally obtained if a logical sequence of techniques is applied.
- The choice for the best detection techniques invariably depends on the circumstances from where the latent prints have been recovered and thus depends on a variety of factors
- The type of surface
- Probable age of the fingerprints
- Occurrence of any specific contaminant
- Environmental factors

Thermal Fingerprint Developer

Introduction

- Thermal development of fingermarks is a phenomena that was first observed as an fortuitous consequence of the exposure of paper items to heat, with the paper selectively darkening in the region where fingermark ridges were present.

- This effect was most commonly observed close to the charred edges of burnt paper, where the mark had been exposed to high temperature but had not become highly discolored.

- In the market there are many thermal fingerprint developer but the Foster & Freeman TFD-2 and the Consolite Forensics Hot Print System (HPS) are widely in use.

Modern day development of Thermal Fingerprint Developer

- The Southern California Association of Fingerprint Officers conference in Burbank, California in October 2009, there were two speakers on the platform Adam G. Brown and Daniel Sommerville.
- In their review of the literature for their research, Brown, Sommerville, et al., found a section in the seminal text, Scott's Fingerprint Mechanics, that discusses the thermal development of latent prints and cites research done in the 1940s.

- Brown, Sommerville, et al., decided to revisit this discounted thermal development technique and determine whether they could develop more reliable and consistent outcomes. The research team discovered that with the application of heat for short durations—before the paper becomes charred—the (still invisible) sebaceous or eccrine latent prints would fluoresce.
- Foster + Freeman became interested in the work of these researchers and began the commercial research and development of a thermal latent print developer for paper- or cellulose-based substrates.

Principle

- There is no particular theory regarding fingerprint development due to heat. The theory associated with thermal development on conventional paper substrates has not been conclusively established.
- Song et al. attribute thermal development to the presence of the fingermark locally changing the thermal properties of the paper.
- An alternative theory is proposed by Dominick et al., who ascribe the fluorescence and subsequent visual discoloration observed to the degradation of the amino acid constituents of the fingermarks.
- The formation of fluorescent degradation products under the conditions used for thermal development has not been conclusively proven. It is known that amino acids can bind to the cellulose molecules in paper; it may be the degradation products of these more complex structures that are ultimately responsible for the fluorescence observed.

Effectiveness

- Thermal Fingerprint Developer is suitable on porous surface.
- It’s efficiency varies and sometimes decreases according to the substrate under investigation.
- The method is not much useful for older prints which are more than a week old.

Procedure

Procedure here mentioned is for TFD-2 but all other commercially available instruments also have almost the process based on their instrument functioning.

- Evidence is placed on the motor-driven conveyor tray and passed under an intense heating element.
- The heating element raises the temperature of the document and causes a chemical reaction between the latent fingerprint and the paper’s surface.
- This produces a fluorescent byproduct that is visible with the use of a forensic light source in the range of 495 nm (blue) and 530 nm (blue/green).
- The user has complete control over the progress of development through variation of conveyor speed and heat-source intensity.

Advantages

- Latent prints can be detected in seconds.
- There is no requirement of chemical processes.
- The virtually contact less system reduces risk of cross-contamination.
- High throughput reduces search times.
- Visible prints feature excellent ridge detail and contrast.
- Can be used sequentially with chemical treatments, including Ninhydrin and DFO.
- For use at crime scenes or in the laboratory.

Disadvanatges

- As a single process they are less effective than the alternative chemical treatments that are available for paper/thermal paper.

Anti Stoke Powder Imaging

Introduction

- The Stokes shift is the term used to describe the difference in the wavelength at which a molecule emits light is relative to the wavelength at which the molecule was excited.

- In simpler word when a system (be it a molecule or atom) absorbs a photon, it gains energy and enters an excited state.

- When the emitted photon has less energy than the absorbed photon, this energy difference is the Stokes shift.

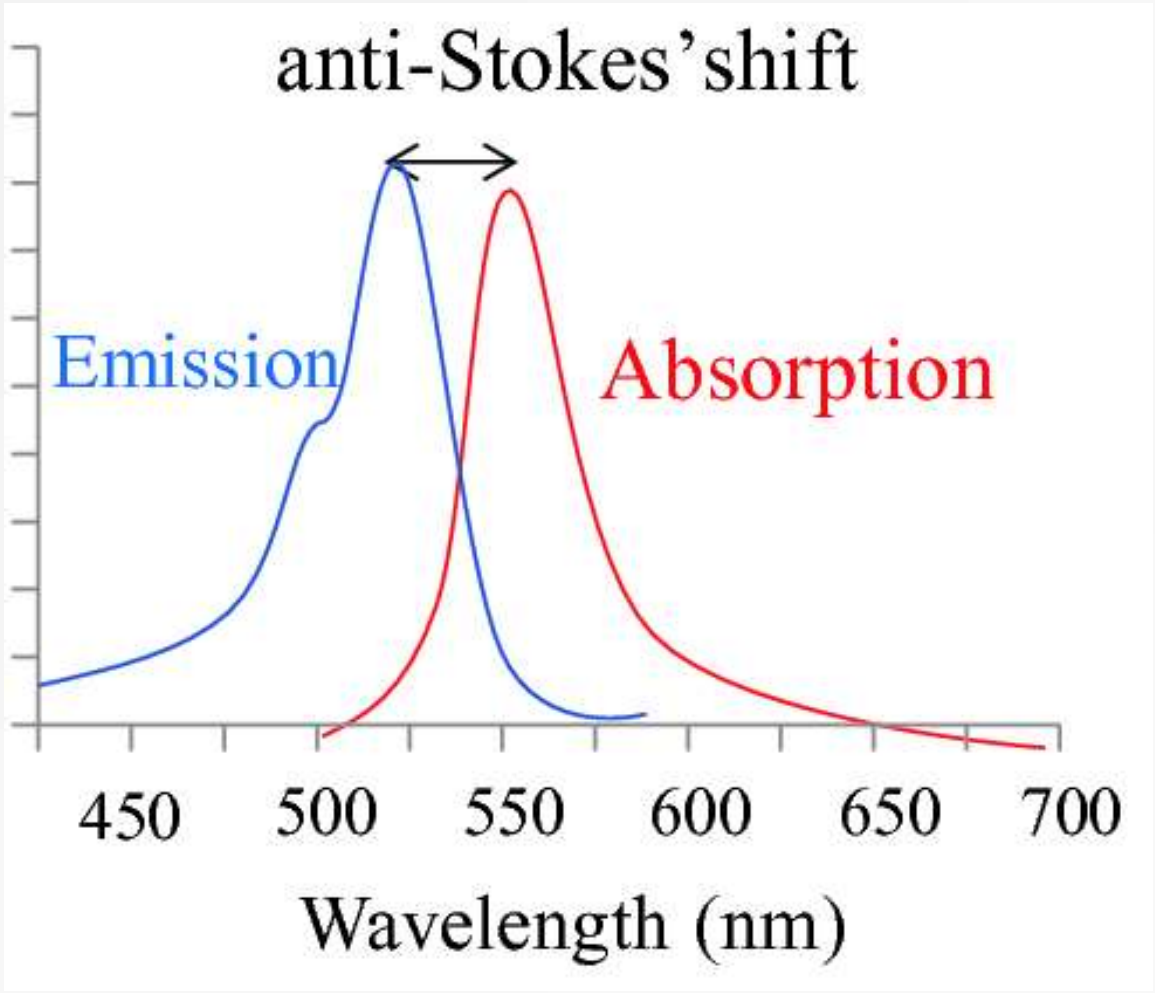
- In the conventional fluorescence emission process, lower wavelength (higher energy) radiation is used to convert a material to its excited state. The material returns to its ground state by emitting a photon at a longer wavelength (lower energy). The difference in excitation and emission wavelengths is referred to as the Stokes shift. Ex. - 514.5 nm line of an argon ion laser to excite Rhodamine 6G dye, which would emit at a maximum wavelength of approximately 555 nm.

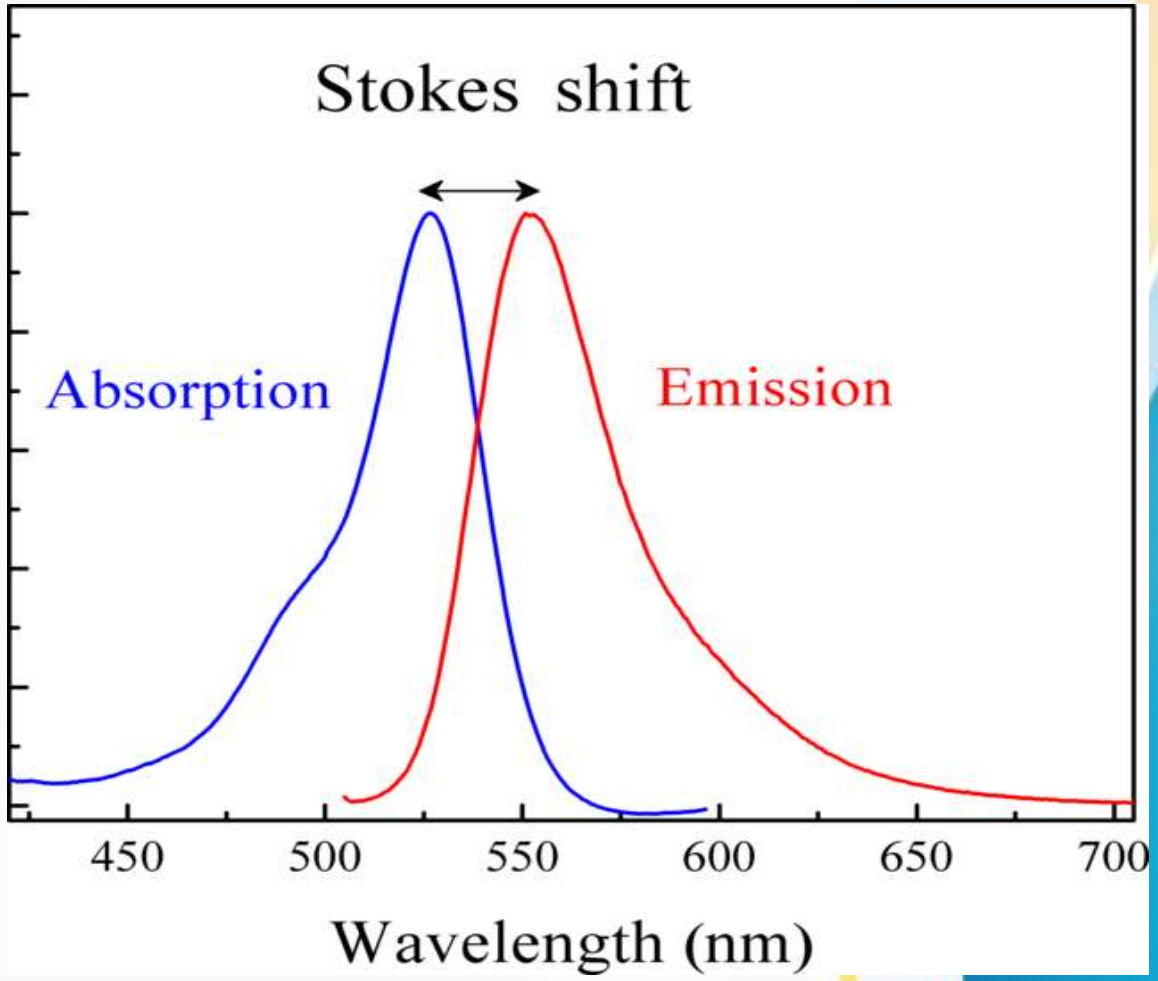
- When upconversion or anti stoke materials are excited with longer wavelength (lower energy) radiation sources like high-powered, near-infrared lasers, multiple photons can be absorbed. The emission of a single photon occurs at a shorter wavelength (higher energy). The difference in wavelengths is referred to as the anti-Stokes shift.

- Anti-Stokes Powders are comprised of specialized materials that exhibit upconversion or anti-Stokes emissions.

- An example of this was reported by Ma et al. who excited NaYF4 doped with erbium and ytterbium at 980 nm and observed an emission in the green portion of the spectrum (495–570 nm) .

- The primary advantage of using near-infrared excitation sources is that very few substrates absorb in that region of the spectrum. Thus, the excited substrates do not emit visible fluorescence that could compete with that emanating from the anti-Stokes-powdered print. Example coca cola can.


anti-Stokes'shift
Emission
Absorption
450
500
550
600
650
700
Wavelength (nm)


Stokes shift
Absorption
Emission
450
500
550
600
650
700
Wavelength (nm)

Anti-Stokes Visualization

- When latent fingerprints are located on material with multi-coloured backgrounds, standard treatments may not produce clear prints because of background interference.

- Even standard fluorescent powders and stains may fail if the background itself fluoresces. Treatment with the new anti-Stokes powders can overcome this problem.

- As these powders produce visible fluorescence when illuminated with invisible near infrared light, latent prints that have adsorbed the powder can be seen while the background, reflecting only infrared light remains invisible - rendering the latent prints clear of background interference.

Crime-lite® ASV

- Crime-lite ASV bench-mounted system for the examination of latent fingerprints treated with anti-Stokes fingerprint powders stimulated by IR laser.

- A bench-mounted Class 1 laser viewing enclosure for the stimulation of infrared activated anti-Stokes fingerprint dusting powders, the Crime-lite ASV renders high contrast fingerprints with no background interference.

- It uses an anti stoke magnetic powder for visualization applied using a magnetic applicator.

- It has Safety-interlocked Class 1 laser viewing enclosure two 6 Watt lasers, laser illumination area and laser blocking fingerprint viewing/imaging window.

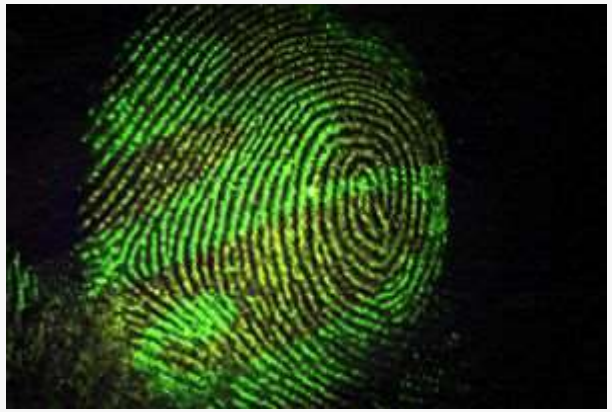
Application

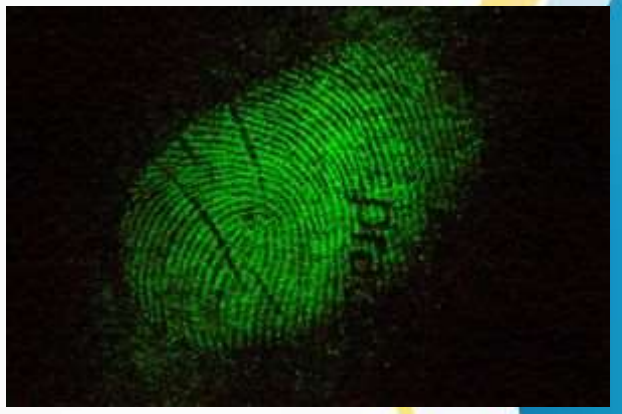
- Paper and card including banknotes, passports, magazines etc.
- Smooth metal surfaces including drinks cans.
- Electronics items such as mobile phones, laptop tablets etc.
- Firearms, that require test firing following treatment.

Drinks can

Postcard

Glossy magazine





Advantages

- Bright visualization of fingerprints under infrared illumination.
- Minimize the impact of background fluorescence.
- It’s safe to use no harmful effect is observed.

Disadvantages

- The method would not work on substrate that absorbs light of longer wavelength.
- It’s a new field that has open up for fingerprint detection and hence requires a lot more research.
- It’s an expensive technique and require elaborate instruments and different expensive powder for visualization.

Conclusion

Fingerprint enhancement techniques are a requirement of the new age where courts are giving so much importance on evidences. The developed fingerprint if can be enhanced gives law enforcement extra teeth for investigation and helps courts to make an informed decision. There are many methods for fingerprint enhancement but thermal fingerprint development and anti stoke powder imaging are coming up avenues in this field.

Reference

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THANK YOU!!