PROCESSES TO DEVELOP LATENT PRINTS ON POROUS SURFACES

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Introduction:

The word 'latent' means hidden or invisible. However, in today's forensic science industry usage for the term latent print means any chance of accidental impression left by friction ridge skin on a surface. It may or may not be visible at the time of deposition.

Developing latent prints is divided into two categories based on the surface the print is on: porous and nonporous. Porous surfaces are paper (currency, checks, ransom notes, etc.), cardboard, and raw wood. Nonporous surfaces include things like metal, plastic, glass, and ceramic. The processes outlined here apply to latent prints on porous surfaces.

Developing latent fingerprints is as much an art as it is a science. There is no one-size-fits-all process or reagent that provides the best results every time. But by sticking to correct processing techniques the chances of developing good quality latent fingerprints dramatically increases. Many processes physically and /or chemically alter the evidence so adherence to this list of sequential steps ensures the best opportunity to develop all latent prints. Not all steps are performed depending upon circumstances and the examiner's discretion. Age of print, environmental factors, atmospheric conditions, and surface type all affect which processes have the highest potential to yield quality results (Advances in Fingerprint Technology).

Visual Examination: Begin by visually examining all evidence for latent prints. Adjust viewing angle and lighting for best results. Photograph any useful prints.

Flourescence Examination: Expose the latent print to a laser or other light source using a filter to block incident light. The evidence is not altered during this step.

Iodine Funing: Iodine fumes stick to oils in fingerprints. Put iodine crystals and evidence in a fuming chamber. Heat crystals and watch resultant yellow formation. Photograph immediately.

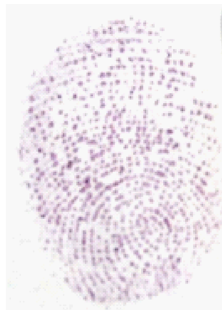
DFO: turns the fingerprints a yellow fluorescence. It uses elevated temperatures of 100°C to develop and takes 20 minutes.

Ninhydrin: is the fastest & most productive method. Conditions of 80°C and 65% RH accelerate latent print development to three minutes and they turn purple.

Physical Developer: is most effective on currency and may cause stains that are not removable. This involves mixing four solutions & submerging the evidence in the solutions.

NINHYDRIN

Ninhydrin (also known as 2,2-Dihydroxyindane-1,3-dione) is a chemical reagent used to detect amino acids. Once treated with a Ninhydrin solution, the amino acid finger ridge patterns form a purple compound, known as Ruhemann's purple, which makes the prints highly visible (Bell). Using Ninhydrin is probably the fastest, most productive, and inexpensive method of developing latent prints on porous surfaces. Ninhydrin has been used since the 1950's to develop finperprints. Prints more than 50 years of age have been developed by this process (Lennard; Ninhydrin).



Print developed with Ninhydrin

Apply Ninydrin: Ninhydrin is flammable and harmful; follow proper safety procedures. Spray, dip or brush Ninhydrin onto the specimen.

Air dry in fume hood: Application of Ninhydrin and air drying is done in a fume hood. Hang up the evidence if practical. Wait until evidence is dry before removing.

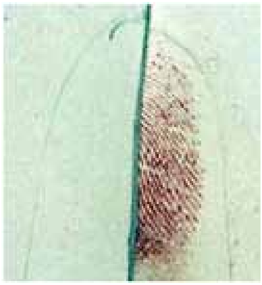
Place evidence in chamber: Ninhydrin prints develop in hours or days in the open air. To accelerate the development process, place inside a chamber at 80°C and 65%RH. Items are hung or placed on a shelf.

Repeat: Ninhydrin prints are a purple color. If the prints are faint, repeat the entire process.

Photograph evidence and individual prints with a measuring device as a scale. Use a 530 nm to 555 nm light source with no filter for enhanced viewing.

DFO PROCESS

1,8-Diazafluoren-9-one (or DFO for short) is a Ninhydrin analogue. DFO reacts with amino acids present in fingerprints on porous surfaces to form highly fluorescent derivatives. DFO is regarded as capable of developing more ridge detail than Ninhydrin. DFO fingerprints glow yellow when they are viewed with blue-green light in the 450 to 550 nm range (Selection & Sequencing of Laten Fingerprint Processing). Unlike Ninhydrin, moisture should not come in contact with the evidence during the development process.



Fingerprint cut in half then treated: DFO (left) compared to ninhydrin (right) in daylight (BVDA International).

Fluorescence of DFO (left) vs ninhydrin (right) with green light & red filter (BVDA International).

Apply DFO: DFO is flammable and harmful; follow proper safety procedures. Spray or dip DFO onto the specimen for five seconds.

Air dry in fume hood: Application of DFO and air drying is done in a fume hood. Hang up the evidence if practical. Wait until evidence is dry before removing.

Re-Apply a second iteration of DFO to the evidence. Spray or dip DFO onto the specimen for five seconds.

Air dry in a fume hood. Hang up the evidence if practical. Wait until evidence is dry before removing.

Place evidence in chamber: Heat accelerates the development process. Place inside a chamber at 100°C. Do not let the evidence get wet or contact moisture. Items are hung or placed on a shelf.

Photograph evidence and individual prints with a measuring device as a scale. View with 495 nm to 550 nm light source. Photograph with an orange colored filter.

NICKEL NITRATE

Nickel nitrate is applied after the evidence has been treated with Ninhydrin. It improves the contrast of the ridge detail of the developed latent print. This enhances the fingerprint for viewing and photography. When viewing of photographing, the background is made to fluoresce or the treated fingerprint may be made to absorb green-colored light around 530 nm (Selection & Sequencing of Latent Fingerprint Processing).

Apply Nickel Nitrate: Nickel Nitrate is toxic and a known carcinogenic; follow proper safety procedures. Spray Nickel Nitrate onto the evidence.

Air dry in fume hood: Apply Nickel Nitrate and air dry in a fume hood. Hang up the evidence if practical. Wait until evidence is dry before removing.

Re-apply: Keeping the evidence in the fume hood, re-apply Nickel Nitrate by spraying on a second coat.

Air Dry in fume hood: Apply Nickel Nitrate and air dry in a fume hood. Hang up the evidence if practical. Wait until evidence is dry before removing.

Place the evidence in chamber: Place the Nickel Nitrate treated prints in a chamber at 80°C and 65%RH. Items are hung or placed on a shelf. Remove after 20 minutes.

Photograph evidence and individual prints with a measuring device as a scale. Use a 530 nm light source. A fluorescent color is not produced, but ridge detail is enhanced.

5-MTN PROCESS

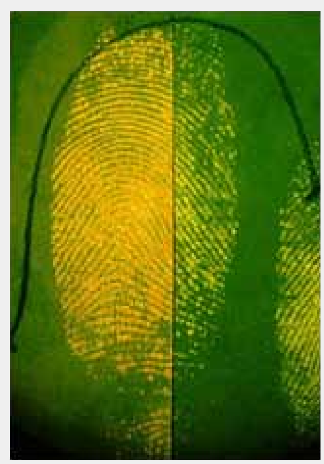
5-Methylthioninhydrin (better known as 5-MTN) reacts with amino acids in fingerprints. It combines the favorable characteristics of ninhydrin (strong color) and those of DFO and 1,2-Indanedione (strong fluorescence).

Very similar to Ninhydrin, 5-MTN develops print's ridge detail into a purple color although it's color is stronger than Ninhydrin's. If the latent print is treated with 5-MTN and then Zinc chloride, the fluorescent becomes more luminescence than DFO's. This makes it useful for developing fingerprints that are hardly visible. The developed detail is viewed through a green-colored filter or with 530nm light and no filter (Selection & Sequencing of Latent Fingerprint Processing).

Fingerprint cut in half then treated: 5-MTN (left) compared to ninhydrin (right) in daylight (BVDA International).

Fluorescence of 5-MTN (left) after treatment with zinc chloride (green light & dark orange filter) (BVDA International).

Fingerprint cut in half then treated: 5-MTN (left) compared to DFO (right) in daylight (BVDA International).



Fluorescence of 5-MTN (left) vs DFO (right) with green light & dark orange filter (BVDA International).

Apply 5-MTN: 5-MTN is flammable and harmful; follow proper safety procedures. Spray, dip or brush 5-MTN onto the specimen. (5 seconds for dip; until coated for spray and brush.)

Air dry in fume hood: Application of 5-MTN and air drying is done in a fume hood. Hang up the evidence if practical. Wait until evidence is dry before removing.

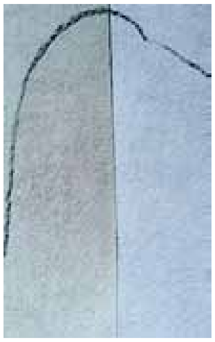
Place evidence in chamber: Set chamber to 80°C & 65%RH to accelerate the latent print development process. Items are hung or placed on a shelf.

Repeat: 5-MTN prints are a strong purple color. If the prints are faint, repeat the entire process.

Photograph evidence and individual prints with a measuring device as a scale. Use a green colored filter.

1,2-INDANEDIONE PROCESS

1,2-Indanedione is considered a potential substitute for DFO. Like DFO, 1,2-indanedine produces a weak initial print (pale pink color) but has strong fluorescent detail when view under green light. One drawback to 1,2-indanedione is the relatively short life it has as a working solution and should be made up only when needed. 1,2-indanedione is less likely to develop prints on low quality paper (newspapers, recycled, etc.) than DFO.



Fingerprint cut in half then treated: DFO (left) compared to 1,2-IND (right) in daylight (BVDA International).

Fluorescence of DFO (left) vs 1,2-IND (right) with green light & dark orange filter (BVDA International).

Apply 1,2-Indanedione: 1,2-Indanedione is flammable and harmful; follow proper safety procedures. Spray, dip or wash 1,2-Indanedione onto the specimen.

Air dry in fume hood: Application of 1,2-Indanedione and air drying is done in a fume hood. Hang up the evidence if practical. Wait until evidence is dry before removing, usually in three minutes.

Place evidence in chamber: Set at 100°C for 10 minutes. Humidity is not needed to develop the prints. Items are hung or placed on a shelf.

Repeat: 1,2-Indanedione prints are a weak pink color. If the prints are too faint, repeat the entire process.

Photograph: View with a 515 nm light and orange filter. Photograph evidence and individual prints with a measuring device as a scale.

ZINC CHLORIDE PROCESS

Zinc chloride is a chemical used to enhance latent prints by improving the visibility of ridge detail, fluorescence. Zinc chloride is applied after Ninhydrin ,1,2-Indandione and 5-MTN treatments. For prints already treated with Ninhydrin, the zinc chloride makes them fluorescent and shifts their color from purple to orange. If the print already is fluorescent, then the fluorescence becomes stronger. Zinc chloride treated 5-MTN ridge detail changes to a reddish-purple color. Application of zinc chloride is usually done by spraying because dipping has the potential to run inks, especially from ballpoint pens.

Treatment with ninhydrin only (left).

Treated with zinc chloride following ninhydrin (right)

Fingerprint cut in half then treated: 5-MTN (left) compared to ninhydrin (right) in daylight (BVDA International).

Fluorescence of 5-MTN (left) after treatment with zinc chloride (green light & dark orange filter) (BVDA International).

ZINC CHLORIDE PROCESS

Apply Zinc Chloride: Zinc Chloride is flammable and toxic; follow proper safety procedures. Lightly spray Zinc Chloride onto the specimen.

Air dry in a fume hood: Application of Zinc Chloride and air drying is done in a fume hood. Hang up the evidence if practical. Wait until evidence is dry before removing.

Place inside a chamber at 80°C and 65%RH. Leave in chamber for 20 to 40 minutes. Items are hung or placed on a shelf.

Repeat: Zinc Chloride treated prints turn an orange (post Ninhydrin) or reddish (post 5-MTN) color. If the prints are faint, repeat the entire process.

Photograph evidence and individual prints with a measuring device as a scale. Photograph with an orange colored filter.

Works Cited

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