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Laboratory Division

Processing Guide for Developing Latent Prints

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Introduction

The identification of latent print evidence is often key in solving a crime. A latent print results from the reproduction of friction ridges found on parts of the fingers, hands, and feet. These prints consist of a combination of different chemicals that originate from natural secretions, blood, and contaminants. Natural secretions mainly derive from the eccrine and sebaceous glands and contain known chemical components. Eccrine gland secretions from the fingers, hands, and feet are both organic and inorganic, but only organic materials are secreted from the sebaceous glands. Other contaminants found in prints result from contact with different materials in the environment. Latent prints can be found on all types of surfaces. In general, surfaces can be characterized as porous, nonporous, or semiporous. Understanding these characteristics will aid in processing an item for latent prints.

The beginning of this manual is a list of processes and procedures for different surface types. Also included are processing sequences that specifically involve prints that are left in blood. Following these lists are details for each process that is currently implemented in the Latent Print Unit (LPU) of the Federal Bureau of Investigation (FBI) Laboratory.

Safety

The reader is advised to follow safe work practices when handling the chemicals used in latent print development. Safe work practices include the use of personal protective equipment (e.g., gloves, laboratory coats, eye protection), engineering controls (e.g., ventilation hoods), and hygiene practices (e.g., washing hands, no eating or drinking).

The reader assumes the responsibility of obtaining the necessary knowledge concerning each chemical used, the hazard(s) it may pose, and the procedures and work practices necessary to prevent unhealthful exposure. This information is available from the **Material Safety Data Sheets (MSDS)** and the labels affixed to the chemicals.

The Federal Bureau of Investigation is not responsible for the actions of any personnel outside the FBI using this guide with regard to the handling, use, or improper disposal of the chemicals listed.

Laboratory Chemicals and Equipment

The following **reagent grade** chemicals are used commonly in the latent print processing techniques described in this manual:

Acetone
Ethanol
Ethyl acetate
Glacial acetic acid
Isopropyl alcohol
Methanol
Petroleum ether

Acetonitrile is **HPLC grade**.

Below is a complete list of the laboratory equipment needed for the techniques described in this manual.

Bottles — clear and dark storage bottles; squirt bottles or sprayer
Brushes — air, camel-hair, fiberglass filament, and other brushes
Cotton
Dishes — aluminum, ceramic, and petri or other shallow dishes
Feather duster
Filter paper
Fume hood
Fuming chamber
Glassware — beakers and graduated cylinders of various sizes; glass dishes and trays
Heat gun
Heater or other heat source
Humidity chamber or humidified environment
Laser or alternate light source, including ultraviolet light
Magna brush wand
Magnetic stirrer and stirring rod or other stirring device
Orbital shaker
Oven
Paper towels
Plastic bottles or containers

Refrigerator with freezer
Scales
Steam iron
Tissues
Vacuum metal deposition chamber

Weights, Measures, and Temperature

kiloliter	kL	1 kL = 1000 L
liter	L	1 L = 1000 mL
milliliter	mL	1 mL = 0.001 L
kilogram	kg	1 kg = 1000 g
gram	g	1 g = 1000 mg
milligram	mg	1 mg = 0.001 g
gallon	gal	1 gal = 4 qt = 3.785 L
quart	qt	1 qt = 2 pt = 0.946 L
pint	pt	1 pt = 473.176 mL
atmosphere	atm	1 atm = 760 torr ≅ 14.7 pounds per square inch (psi)
teaspoon	tsp	

Converting from Fahrenheit (°F) to Celsius (°C)

$t_C = 5/9\ (t_F - 32)$

Converting from Celsius (°C) to Fahrenheit (°F)

$t_F = 9/5\ t_C + 32$

Processes and Procedures Used to Develop Latent Prints

Proper Sequences and Types of Processes for Porous, Nonporous, and Some Unique and/or Difficult Surfaces

Adherence to correct processing techniques increases the probability of developing the best quality latent prints. Adherence to the listed sequences ensures the best opportunity to develop all latent prints on an object and minimizes the chance of destroying latent prints.

Surfaces on which latent prints are deposited can be divided into two basic categories—porous and nonporous. Listed below are the suggested sequential processes for porous, nonporous, semiporous, and some unique and/or difficult surfaces.

Depending on the circumstances, all of the suggested processes will not always be performed. This is left to the discretion of the examiner.

Porous Surfaces

1. Visual
2. Inherent fluorescence by laser or alternate light source*
3. Iodine fuming
4. DFO (1,8-Diazafluoren-9-one)
5. Laser or alternate light source
6. Ninhydrin
7. Physical developer

***** Alternate light source includes ultraviolet (UV) light

Nonporous Surfaces

1. Visual
2. Inherent fluorescence by laser or alternate light source
3. Cyanoacrylate fuming
4. Laser or alternate light source
5. Cyanoacrylate dye
6. Laser or alternate light source
7. Vacuum metal deposition (VMD)

8. Powder

Bloodstained Specimens—Porous

1. Visual
2. Inherent fluorescence by laser or alternate light source
3. DFO (1,8-Diazafluoren-9-one)
4. Laser or alternate light source
5. Ninhydrin
6. Diaminobenzidine (DAB); if not available, use amido black
7. Physical developer

Bloodstained Specimens—Nonporous

1. Visual
2. Inherent fluorescence by laser or alternate light source
3. Diaminobenzidine (DAB); if not available, use leucocrystal violet (LCV) or amido black
4. Cyanoacrylate fuming
5. Laser or alternate light source
6. Cyanoacrylate dye
7. Laser or alternate light source
8. Vacuum metal deposition (VMD)
9. Powder

Cardboard

1. Visual
2. Inherent fluorescence by laser or alternate light source
3. DFO (1,8-Diazafluoren-9-one)
4. Laser or alternate light source
5. Ninhydrin
6. Silver nitrate

Rubber Gloves—Semiporous

1. Visual
2. Inherent fluorescence by laser or alternate light source
3. Iodine spray reagent
4. Cyanoacrylate fuming
5. Laser or alternate light source
6. Magnetic powder
7. Cyanoacrylate dye
8. Laser or alternate light source
9. Ninhydrin
10. Distilled water rinse
11. Physical developer

When processing the nonadhesive side of tape, the integrity of the adhesive side should not be compromised by contact with cyanoacrylate dyes or other solvents. Acetate or some other substrate should be used to protect the adhesive side.

Tape—Nonadhesive Side

1. Visual
2. Inherent fluorescence by laser or alternate light source
3. Cyanoacrylate fuming
4. Laser or alternate light source
5. Cyanoacrylate dye
6. Laser or alternate light source
7. Vacuum metal deposition (VMD)
8. Powder

Tape—Adhesive Side

Light-colored adhesive side of tape

1. Visual
2. Inherent fluorescence by laser or alternate light source

3. Sticky-side powder; alternate black powder; ash gray powder; gentian violet

4. Laser or alternate light source

Dark-colored adhesive side of tape

1. Visual

2. Inherent fluorescence by laser or alternate light source

3. Ash gray powder; Liqui-Drox*; gentian violet

4. Laser or alternate light source

* Cyanoacrylate fuming must be done on the nonadhesive side of tape, then both sides can be processed with Liqui-Drox.

Wallpaper

1. Visual

2. Inherent fluorescence by laser or alternate light source

3. Iodine spray reagent

4. Ninhydrin

5. Silver nitrate

Photographs—Emulsion Side

1. Visual

2. Inherent fluorescence by laser or alternate light source

3. Iodine spray reagent

4. Cyanoacrylate fuming

5. Laser or alternate light source

6. Cyanoacrylate dye

7. Laser or alternate light source

8. Vacuum metal deposition (VMD)

9. Powder

Photographs—Paper Side—Semiporous

1. Visual

2. Inherent fluorescence by laser or alternate light source

3. Cyanoacrylate fuming
4. Laser or alternate light source
5. Magnetic powder
6. DFO (1,8-Diazafluoren-9-one)
7. Laser or alternate light source
8. Ninhydrin
9. Cyanoacrylate dye
10. Laser or alternate light source
11. Physical developer

Glossy Paper—Semiporous

1. Visual
2. Inherent fluorescence by laser or alternate light source
3. Cyanoacrylate fuming
4. Laser or alternate light source
5. Magnetic powder
6. DFO (1,8-Diazafluoren-9-one)
7. Laser or alternate light source
8. Ninhydrin
9. Cyanoacrylate dye
10. Laser or alternate light source
11. Physical developer

Selection of Processes

In addition to the type of surface, another determining factor in choosing the proper process is the residue of the latent print, including perspiration, blood, oil or grease, and dust.

The condition of the surface also contributes to determining the correct processes. Such surface characteristics include dryness, wetness, dirtiness, and tackiness or stickiness.

Processing Techniques

Visual

Visually examine all specimens for latent prints before using any latent print development technique. Ensure that the surface is well illuminated. Turn small articles or move and adjust light to change the angle of illumination. Some latent prints may be visible only by oblique lighting. Any useful latent prints detected must be photographed before proceeding with any development process. Some friction ridge prints found by this method may not be detected by any other means. Use extreme care when handling articles to avoid damaging other prints that may not yet be apparent.

Fluorescence

Certain properties of perspiration, body oils, and/or foreign substances contained in latent print residue fluoresce when exposed to a laser or an alternate light source. A filter is used to block the incident light of the light source. No pretreatment of the specimen is required; therefore, no alteration of the specimen occurs.

Use on all surfaces

- Nondestructive to specimen and subsequent examinations
- Detects prints on surfaces not suitable for powders or chemicals
- Detects prints not developed by other techniques

Procedures for conducting an examination

- Conduct examination in a dark room
- Aim expanded beam of light at object
- View object through an orange barrier or other appropriate colored filter
- Preserve latent prints by photography

Use fluorescence examination after application of the following chemicals

- Fluorescent dyes
- DFO (1,8-Diazafluoren-9-one)
- Liqui-Drox

Alternate Black Powder

Alternate black powder is used to process the sticky side of adhesive tapes and labels for latent prints.

Equipment

Petri or shallow dish, camel-hair or small brush

Materials and Chemicals

- Lightning® black powder
- Liqui-Nox™ — concentrated liquid detergent

Mixing Procedure

Lightning® black powder .... 1 tsp

Liqui-Nox™ solution (diluted 50:50 with water) .... 40 drops

Combine the Lightning® black powder and Liqui-Nox™ solution in a petri or shallow dish and stir until the solution has the consistency of shaving cream.

Processing Procedure

The solution is painted on the adhesive surface of the tape with a camel-hair or small brush. Allow to set for 30 to 60 seconds, then rinse off the solution with a slow stream of cold tap water. Allow to dry. Repeat the procedure if necessary.

Storage

Not applicable

Shelf Life

Prepare as needed

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

(See page 62 for chart)

Ash Gray Powder

Ash gray powder is used to process the sticky side of adhesive tapes and labels for latent prints. This method is particularly useful on dark-colored and black tape.

Equipment

Petri or shallow dish, camel-hair or small brush

Materials and Chemicals

- Ash gray powder
- Photo-Flo™ 200 or Photo-Flo™ 600 solution

Mixing Procedure

Ash gray powder .... 1 tsp

Photo-Flo™ 200 or Photo-Flo™ 600 solution

Place the ash gray powder in a petri or shallow dish. Add Photo-Flo™ solution to the powder and stir until mixture is the consistency of thin paint.

Processing Procedure

The solution is painted on the adhesive surface of the tape with a camel-hair or small brush. Allow to set for 30 to 60 seconds, then rinse off the solution with a slow stream of cold tap water. Allow to dry. Repeat procedure if necessary.

Storage

Not applicable

Shelf Life

Prepare as needed

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

(See page 63 for chart)

Gentian Violet

Gentian violet is used to develop latent prints on the adhesive side of tape.

Water-soluble, adhesive-type tapes should not be processed by this method.

Equipment

Scales, beakers, magnetic stirrer and stirring bar, glass tray, clear or dark storage bottles

Materials and Chemicals

- Gentian violet

Mixing Procedure

Gentian violet .... 1 g

Distilled water .... 1000 mL

Combine the ingredients and place on a stirring device for approximately 25 minutes.

Processing Procedure

Gentian violet is applied by dipping. When processing, place the specimen(s) in the gentian violet solution for approximately 1 to 2 minutes, then rinse with cold tap water.

The gentian violet solution can be reused.

Storage

Clear or dark bottles

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

(See page 63 for chart)

Sticky-Side Powder

Sticky-side powder is used to process the sticky side of adhesive tapes and labels for latent prints.

Equipment

Petri or shallow dish, camel-hair or small brush

Materials and Chemicals

- Sticky-side powder
- Photo-Flo™ 200 solution

Mixing Procedure

Sticky-side powder .... 1 tsp

Photo-Flo™ 200 solution

Place the sticky-side powder in a petri or shallow dish. Photo-Flo™ 200 must be diluted with distilled water by 50% to make Photo-Flo™ 100. Add Photo-Flo™ 100 solution to the powder and stir until mixture is the consistency of thin paint.

Processing Procedure

The solution is painted on the adhesive surface of the tape with a camel-hair or small brush. Allow to set for 30 to 60 seconds, then rinse off the solution with a slow stream of cold tap water. Allow to dry. Repeat procedure if necessary.

Storage

Not applicable

Shelf Life

Prepare as needed

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

(See page 63 for chart)

Amido Black (Methanol Base)

Amido black is used to develop latent prints and enhance visible prints that have been deposited in blood.

Caution must be exercised when applying the methanol-based formula to painted surfaces. This formula may destroy the latent print(s) as well as the surface beneath the latent print(s). All blood must be dried prior to application. Cyanoacrylate fuming may be detrimental to this process.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar,
squirt bottles or sprayer, clear or dark storage bottles

Materials and Chemicals

- Naphthol blue black (dye content ≥ 85%)
- Glacial acetic acid
- Methanol

Mixing Procedure

The amido black process consists of two solutions—a developer and a rinse—and a final rinse of distilled water.

Developer Solution

Naphthol blue black .... 2 g

Glacial acetic acid .... 100 mL

Methanol .... 900 mL

Combine the ingredients and mix using a stirring device until all the naphthol blue black is dissolved. This should take approximately 30 minutes.

Rinse Solution

Glacial acetic acid .... 100 mL

Methanol .... 900 mL

Combine the ingredients.

Final Rinse

Distilled water is preferred; however, if not available, tap water can be used.

Processing Procedure

Apply the developer to the specimen(s) by dipping, spraying, or using a squirt bottle. Leave the developer on the specimen for approximately 30 seconds to 1 minute, then apply the rinse. These steps can be repeated to improve contrast. Apply the final rinse of distilled or tap water, then dry the specimen(s).

Storage

Clear or dark bottles

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Amido Black (Water Base — Fischer 98)

This amido black water-based formula is a one-step process that includes a blood fixer. The sensitivity and color intensity of the process are similar to that of the amido black methanol-based formula. This process uses a tap water rinse.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar,
squirt bottle or sprayer, clear or dark storage bottles

Materials and Chemicals

- Glacial acetic acid
- Formic acid (concentrated)
- Naphthol blue black (dye content ≥ 85%)
- Kodak Photo-Flo™ 600 solution
- Sodium carbonate
- 5-Sulfosalicylic acid (purity ≥ 99%)

Mixing Procedure

Amido black water-based one-step formula is prepared on a stirring device by combining the ingredients in the order that they are listed.

Distilled water .... 500 mL

5-Sulfosalicylic acid .... 20 g

Naphthol blue black .... 3 g

Sodium carbonate .... 3 g

Formic acid .... 50 mL

Glacial acetic acid............................. 50 mL

Kodak Photo-Flo™ 600 solution .... 12.5 mL

Dilute this mixture to 1 L using distilled water. Although this mixture will be ready to use following dilution, allow the mixture to stand for several days prior to use for best results.

Processing Procedure

Apply the amido black to the specimen(s) by dipping or using a squirt bottle. Leave the amido black on the specimen(s) for 3 to 5 minutes, then rinse using tap water. These steps can be repeated for the desired contrast.

Storage

Clear or dark bottles

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Cyanoacrylate Fuming (Microburst Method)

Cyanoacrylate fuming is used to develop latent prints on nonporous specimens.

Equipment

Heater, aluminum dish, fuming chamber

Materials and Chemicals

- Cyanoacrylate (premixed)

Processing Procedure

Using the fuming chamber,

1. Place the aluminum dish on a heating surface and turn the heater to the highest setting.

2. When the dish is hot, place enough liquid cyanoacrylate to cover the bottom surface of the dish (approximately 3 g for a small chamber).

3. When the cyanoacrylate begins to fume at a steady pace, place the specimen(s) in the chamber and secure the chamber door.

4. Fume the specimen(s). Fuming time varies depending on the size of the chamber; however, in most instances, fuming times ranging from 30 seconds to 4 minutes are sufficient.

5. After the procedure is complete, remove the specimen(s) from the chamber to view for latent prints. If necessary, the fuming process can be repeated.

If a humidified chamber is available, set the humidity between 70% and 80% for best results.

The accumulation of cyanoacrylate glue fumes on some parts of a firearm could have an unfavorable effect during a subsequent firearms examination. In those instances when a firearms examination is to be done or anticipated, each chamber opening (e.g., the cylinder of a revolver) and each barrel opening should be covered with a small piece of tape (just large enough to cover the opening) before fuming with glue. Ensure that the area to be covered by the tape is processed by other appropriate methods, *prior* to covering. Remove the tape after the cyanoacrylate glue fuming process.

Storage

Original container

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Cyanoacrylate Fluorescent Dye (RAM)

This formula is used to dye cyanoacrylate developed latent prints. These prints can then be better visualized by the use of a laser or alternate light source. This method is effective on all colors of nonporous surfaces. Additional formulas for dyes used to enhance cyanoacrylate developed latent prints can be found in later sections of this guide.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, squirt bottle or sprayer, glass tray, laser or alternate light source, dark storage bottles

Materials and Chemicals

- Rhodamine 6G (dye content 99%)
- MBD
- Ardrox P133D
- Methanol
- Isopropanol
- Acetonitrile
- Petroleum ether
- Acetone

Mixing Procedure

Two stock solutions must be mixed prior to formulating the RAM dye.

Stock Solution 1 (Rhodamine 6G)

Rhodamine 6G .... 1 g

Methanol .... 1000 mL

Combine the ingredients and place on a stirring device until all the rhodamine 6G is thoroughly dissolved.

Stock Solution 2 (MBD)

MBD .... 1 g

Acetone .... 1000 mL

Combine the ingredients and place on a stirring device until all the MBD is thoroughly dissolved.

Ardrox P133D

Ardrox is used undiluted directly from the container.

RAM Working Solution

Stock Solution 1 .... 3 mL

Ardrox P133D .... 2 mL

Stock Solution 2 .... 7 mL

Methanol .... 20 mL

Isopropanol .... 10 mL

Acetonitrile .... 8 mL

Petroleum ether .... 950 mL

Combine the ingredients in the order listed. Do not place on a magnetic stirrer.

Processing Procedure

After a specimen has been processed with cyanoacrylate, RAM can be applied by spraying, dipping, or using a squirt bottle, followed by examination under a laser or alternate light source.

Storage

Dark bottles

Shelf Life

Stock Solution 1 (Rhodamine 6G) — indefinite

Stock Solution 2 (MBD) — indefinite

The RAM solution is stable for approximately 30 days. After 30 days, it should be checked for separation. If the solution has separated, shake the container vigorously, and the solution will usually return to suspension. If this does not occur, discard the solution.

All the ingredients for the RAM working solution, **with the exception of the petroleum ether**, may be mixed and stored. When it is time to mix the RAM working solution, the appropriate amount of petroleum ether can then be added. Once the petroleum ether has been combined with the other ingredients, the 30-day shelf life begins.

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

DAB (Diaminobenzidine)

DAB is used to develop latent prints and enhance visible prints that have been deposited in blood. DAB can be applied by two methods—the submersion method and the tissue method.

Cyanoacrylate fuming can be detrimental to all blood DAB processing. DAB processing must be completed *before* processing with cyanoacrylate.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, 3 squirt bottles or sprayers, refrigerator with freezer, 4 trays, tissues or thin paper towels, heat gun or other heat source, plastic bottle or container, clear or dark storage bottles

Materials and Chemicals

- 5-Sulfosalicylic acid (Purity ≥ 99%)
- 1M Phosphate buffer solution (pH 7.4)
- 3,3'-Diaminobenzidine tetrahydrochloride (Purity ≥ 97%)
- Hydrogen peroxide 30% solution

Mixing Procedure

The DAB process consists of four solutions—A, B, C, and a developer.

Solution A (Fixer)

5-Sulfosalicylic acid .... 20 g

Distilled water .... 1000 mL

Combine the ingredients and place on a stirring device until thoroughly dissolved.

Solution B (Buffer)

1M Phosphate buffer solution (pH 7.4) .... 100 mL

Distilled water .... 800 mL

Combine the ingredients.

Solution C (DAB)

3, 3'-Diaminobenzidine tetrahydrochloride .... 1 g

Distilled water .... 100 mL

Combine the ingredients and mix thoroughly.

Developer Solution

Solution B .... 180 mL

Solution C .... 20 mL

Hydrogen peroxide 30% .... 1 mL

Combine the ingredients and mix thoroughly.

Processing Procedure

Submersion Method

This method consists of four steps using four trays.

Step 1 — Tray 1

This tray contains the **fixer solution** (Solution A). Submerge the specimen(s) in this solution for approximately 3 to 5 minutes.

Step 2 — Tray 2

This tray contains **distilled water** for rinsing the specimen(s). Submerge the specimen(s) in the water for 30 seconds to 1 minute.

Step 3 — Tray 3

This tray contains the **developer solution**. Submerge the specimen(s) in this solution for 5 minutes for maximum development. The specimen(s) may be removed prior to 5 minutes if maximum development or contrast has been achieved.

Step 4 — Tray 4

This tray contains another **distilled water rinse**. Submerge the specimen(s) in the water to stop the developer solution from overdeveloping the print(s).

The specimen(s) can now be air dried or dried with heat (e.g., a heat gun).

Tissue Method

Tissues are placed over the area to be processed and solutions are applied using a squirt bottle or a sprayer. The tissues used for this process must be durable enough to be placed and picked up while wet, without disintegrating. Perfumed tissues should not be used because the chemicals can interfere with the development process. Unscented white facial or hand tissues and thin paper towels are acceptable.

Step 1 — Bottle 1

This bottle contains the **fixer solution** (Solution A). Squirt this solution onto a tissue that has been placed on the area to be examined. The tissue adheres to the area because it is wet from the fixer. The tissue should be kept wet for 3 to 5 minutes.

Step 2 — Bottle 2

This bottle contains **distilled water**. Remove the tissue, then squirt the water on the processed area for 30 seconds to 1 minute.

Step 3 — Bottle 3

This bottle contains the **developer solution.** At this point, it is very important that a *new tissue* is used. After the new tissue is placed on the area to be examined, the developer solution is applied to the tissue. The tissue must be kept wet at all times and maintained on the area for 5 minutes. This time period may be less if maximum development or contrast has been achieved.

Step 4 — Bottle 2

Repeat Step 2.

Storage

Solution A — dark bottle stored at room temperature

Solution B — dark bottle stored at room temperature

Solution C — plastic bottle or container that can withstand extreme cold, stored in a freezer

Hydrogen peroxide (30%) must be stored in a refrigerator.

Shelf Life

Solution A — indefinite

Solution B — indefinite

Solution C — more than 6 months after mixing and freezing

Developer — 24 hours if unrefrigerated and 48 hours if refrigerated

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

DFO (1,8-Diazafluoren-9-One)

DFO is used to develop latent prints on porous surfaces. DFO reacts with the amino acids in perspiration. When this reaction is complete, the developed latent prints will fluoresce with the use of a laser or an alternate light source.

Equipment

Scales, graduated cylinder, magnetic stirrer and stirring bar, glass tray, sprayer, laser or alternate light source, oven or iron, dark storage bottles

Materials and Chemicals

- DFO
- Methanol
- Ethyl acetate
- Glacial acetic acid
- Petroleum ether

Mixing Procedure

DFO is mixed in two solutions—stock and working.

DFO Stock Solution

DFO .... 1 g

Methanol .... 200 mL

Ethyl acetate .... 200 mL

Glacial acetic acid .... 40 mL

Combine the ingredients and place on a stirring device for approximately 20 minutes until the DFO is dissolved.

Working Solution

Dilute the stock solution to 2 L with petroleum ether. The working solution should be a clear gold color.

Processing Procedure

DFO can be dipped or sprayed. When a specimen is processed with DFO, it must be dried and placed in an oven at approximately 100 °C (212 °F) for 20 minutes. If an oven is not available, a dry iron may be used (e.g., a steam iron with the steam turned off).

Storage

Dark bottles

Shelf Life

DFO stock solution — more than 6 months

Working solution — more than 6 months

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Fingerprint Powders

Powdering is the application of finely ground, colored powder to a nonporous object to make latent prints visible. Powder clings to moisture, oil, and other residues.

Equipment

Fiberglass filament brush, camel-hair brush, feather duster, cotton, magna brush wand, paper

Materials and Chemicals

- Powders — black, gray, white, magnetic

Mixing Procedure

Premixed

Processing Procedure

Nonmagnetic Powders

1. Pour needed amount of powder into a small pile.
2. Dip tips of bristles of brush into powder.
3. Apply a small amount of powder onto the surface and begin to brush.
4. Brush in the direction of any ridges that begin to appear.
5. Build powder onto ridges and stop when latent print reaches point of sufficient clarity.
6. Clean excess powder from between ridges using brush or cotton.
7. Use cotton to process large areas by dipping cotton into powder and lightly wiping over the surface. When outline of the latent print becomes visible, stop using the cotton and switch to the brush to complete the development.

Magnetic Powders

1. Place magna brush wand with magnet engaged into container of magnetic powder. This will produce a bristle-like effect at the end of the wand when withdrawn.
2. Apply in a circular motion to the surface being examined. Make sure that only the magnetic powder touches the surface, not the wand.
3. After the print has been developed, hold the wand over the container and withdraw the control rod. This will disengage the magnet and release the powder.
4. Re-engage the magnet and pass the clean wand over the developed latent print and the surrounding area to remove excess powder. Do not touch the surface.

Storage

Original container

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Iodine Fuming

Iodine fumes adhere to grease or oils on porous surfaces and appear as a yellow stain.

Latent prints developed with iodine fumes must be photographed immediately.

Equipment

Fuming chamber, ceramic or glass dish, heat source

Materials and Chemicals

- Iodine (ACS reagent grade)

Mixing Procedure

Not applicable

Processing Procedure

Place iodine crystals in the ceramic or glass dish and place the specimen to be processed in the fuming chamber. Apply heat to the crystals and observe development. Remove the specimen(s) from the chamber when sufficient development has occurred.

Storage

Original container

Shelf Life

Iodine crystals — indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Iodine Spray Reagent

Iodine spray reagent or liquid iodine is used to develop latent prints on porous or nonporous specimens.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, refrigerator, air brush, facial tissues or paper towels or filter paper, clear or dark storage bottles

Materials and Chemicals

- Iodine (ACS reagent grade)
- a-Naphthoflavone
- Cyclohexane (reagent grade)
- Methylene chloride (reagent grade)

Mixing Procedure

The iodine spray reagent process consists of two solutions—the iodine and the fixer—from which a working solution is prepared.

Solution A (Iodine)

Iodine crystals .... 1 g

Cyclohexane .... 1000 mL

Mix on a stirring device for approximately 30 minutes.

Solution B (Fixer)

a-Naphthoflavone .... 5 g

Methylene chloride .... 40 mL

Mix manually until all the a-naphthoflavone is dissolved.

Solutions A and B are stock solutions that are combined to make a *working solution*.

Working Solution

Add 2 mL of Solution B for every 100 mL of Solution A.

These ingredients must be placed on a stirring device and mixed thoroughly for 5 minutes.

After mixing the solution, it must be filtered into a beaker or directly into the sprayer. The filters can consist of a facial tissue, paper towel, filter paper, or any other material that will allow liquid to pass freely.

Processing Procedure

When spraying iodine spray reagent, the finest mist possible is the most effective method of application. If the spray is heavy, it will overdevelop the area being processed. An artist-type air brush is very effective in this process.

Storage

Solution A — clear or dark bottles at room temperature

Solution B — clear or dark bottles; must be kept refrigerated

Shelf Life

Solution A— indefinite

Solution B — approximately 30 days

Working solution — 24 hours

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

LCV (Leucocrystal Violet)

LCV is used to enhance visual prints and develop latent prints deposited in blood.

Cyanoacrylate fuming may be detrimental to this process.

Equipment

Scales, beakers, magnetic stirrer and stirring bar, sprayer, tissues or paper towels, dark storage bottles

Materials and Chemicals

- Leucocrystal violet (dye content ≥ 90%)
- 5-Sulfosalicylic acid (purity ≥ 99%)
- Hydrogen peroxide 3% solution
- Sodium acetate

Mixing Procedure

Hydrogen peroxide 3% .... 1000 mL

5-Sulfosalicylic acid .... 20 g

Sodium acetate .... 7.4 g

LCV .... 2 g

Combine ingredients in the order listed and place on a stirring device for approximately 30 minutes.

Processing Procedure

Spraying is the most effective method of application. When spraying, use the finest mist possible because excess application may cause overdevelopment or running of the bloody print. Spray the specimen(s)—the development will occur within 30 seconds—then blot the area with a tissue or paper towel. When the area is dry, the preceding steps can be repeated to possibly improve contrast.

When using the LCV process in direct sunlight, any developed print should be photographed as soon as possible because photoionization may occur, resulting in unwanted background development.

Storage

Dark bottles

Shelf Life

Working solution — up to 30 days

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Ninhydrin (Petroleum Ether Base)

Ninhydrin is used to develop latent prints on porous surfaces. Ninhydrin reacts with the amino acids present in perspiration.

Equipment

Scales, beakers, graduated cylinder, brush, glass tray, magnetic stirrer and stirring bar, humidity chamber, iron, sprayer, dark storage bottles

Materials and Chemicals

- Ninhydrin
- Methanol
- Isopropanol
- Petroleum ether

Mixing Procedure

Ninhydrin .... 5 g

Methanol .... 30 mL

Isopropanol .... 40 mL

Petroleum ether .... 930 mL

The ninhydrin crystals are first dissolved in methanol on a stirring device. Then the isopropanol is added, followed by the petroleum ether.

Processing Procedure

The ninhydrin solution can be applied to a specimen by spraying, dipping, or painting. Once the solution has been applied, it must be dried before any attempt is made to accelerate the development process using a humidified environment (e.g., a humidified chamber or a steam iron). If a humidified chamber is available, set humidity between 60% and 70% for best results.

Storage

Dark bottles

Shelf Life

Up to 1 year

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Physical Developer (PD)

Physical developer (PD) is used to develop latent prints on porous surfaces and on certain nonporous surfaces. Physical developer has also been found to be highly effective in developing latent prints on paper currency. Physical developer is normally applied after the DFO and/or ninhydrin methods.

Sodium hypochlorite can also be used in conjunction with physical developer. The sodium hypochlorite solution darkens the latent print(s) developed with physical developer, lightens the background, and removes any ninhydrin stains that may still be present on the specimen(s). This process is especially effective on paper bags and paper currency. Mixing and processing procedures for sodium hypochlorite follow those listed for physical developer.

Stains on blueprints, photographs, or photostats caused by physical developer treatment cannot be removed without defacing the specimens.

This process cannot be used in conjunction with the silver nitrate method. If the PD process is used, it will negate the silver nitrate process.

Physical Developer

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, glass trays, orbital shaker, iron, clear and dark storage bottles

Materials and Chemicals

- Ferric nitrate (purity 100%)
- Ferrous ammonium sulfate (reagent grade)
- Citric acid (reagent grade)
- n-Dodecylamine acetate
- Synperonic-N
- Silver nitrate (reagent grade purity ≥ 99%)
- Maleic acid

Mixing Procedure

Physical developer is mixed in four solutions. Each must be placed on a stirring device until all the chemicals are thoroughly dissolved.

Solution 1 (Maleic acid)

Maleic acid .... 25 g

Distilled water ....1000 mL

Solution 2 (Redox)

Ferric nitrate ....30 g

Ferrous ammonium sulfate ....80 g

Citric acid ....20 g

Distilled water ....1000 mL

Solution 3 (Detergent)

n-Dodecylamine acetate .... 3 g

Synperonic-N .... 4 g

Distilled water .... 1000 mL

Solution 4 (Silver nitrate)

Silver nitrate .... 200 g

Distilled water .... 1000 mL

Processing Procedure

Tray 1 — Solution 1 (Maleic Acid)

Place the specimen(s) in Solution 1 and submerge. All specimens must be left in this solution for 5 minutes. If a specimen begins to emit bubbles, it must be submerged in the solution until the bubbling action ceases.

Tray 2 — Solution 2 (Redox Working Solution)

Solution 2......... 1000 mL

Solution 3............ 40 mL

Solution 4............ 50 mL

The redox working solution **must** be combined in the order listed. Solution 2 is placed in a beaker on a stirring device. Solutions 3 and 4 are then added and mixed for 3 to 5 minutes. Once mixed, it is then placed in Tray 2, which is in turn placed on an orbital shaker. The orbital shaker is set for a gentle rocking motion of the redox working solution to assist the development process. If an orbital shaker is not available, rocking Tray 2 back and forth manually can also be effective. Submerge the specimen(s) for 5 to 15 minutes. The amount of time will depend on the number of specimens in the tray. Generally, the more specimens in the tray, the longer the reaction time will be. Approximately 15 check-sized specimens can normally be processed with 1 L of redox working solution.

Tray 3 — Water Rinse

The specimen(s) removed from the redox working solution, Tray 2, must be rinsed with water to remove the excess solution. If this is not done, when the specimen is dried, it will become brittle and may be easily damaged or destroyed.

The specimen(s) removed from the rinse, Tray 3, must be dried. This can be done by air drying or applying heat (e.g., a dry iron).

Storage

Solution 1 — clear or dark bottles

Solution 2 — clear or dark bottles

Solution 3 — clear or dark bottles

Solution 4 — dark bottles

Shelf Life

Solution 1 — indefinite

Solution 2 — indefinite

Solution 3 — up to 1 year

Solution 4 — up to 1 year

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Sodium Hypochlorite

Equipment

Beaker, glass trays, clear or dark storage bottles

Materials and Chemicals

- Sodium hypochlorite

Mixing Procedure

Sodium hypochlorite is mixed with distilled water in a 1:1 dilution to form a 50% working solution.

Working Solution

Sodium hypochlorite .... 500 mL

Distilled water .... 500 mL

Combine the ingredients.

Processing Procedure

After a specimen has been processed with physical developer and rinsed, it is then dipped in the sodium hypochlorite solution for approximately 15 seconds. The specimen is then placed in a water rinse. **If the specimen is not thoroughly rinsed, deterioration of the specimen may occur.**

Storage

Clear or dark bottles

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Silver Nitrate

Silver nitrate is used to develop latent prints on porous specimens. It reacts with the sodium chloride (salt) content in perspiration. Silver nitrate can be prepared with two different carriers—water or alcohol. An alcohol-based solution can be prepared for processing specimens (e.g., waxed paper, cardboard with a wax finish, or Styrofoam™) that may repel a water-based mixture.

Stains on blueprints, photographs, or photostats caused by silver nitrate treatment cannot be removed without defacing the specimens. Latent prints developed by the silver nitrate method on certain types of glossy paper will often disappear within hours. These latent prints should be photographed as soon as possible.

Equipment

Scales, magnetic stirrer and stirring bar, glass tray, brush,
high-intensity light, dark glass storage bottles

Materials and Chemicals

- Silver nitrate (reagent grade purity ≥ 99%)
- Ethanol

Mixing Procedure

Water Base

Silver nitrate .... 30 g

Distilled water .... 1000 mL

Combine the silver nitrate and distilled water and place on a stirring device for approximately 10 minutes or until all the crystals are dissolved.

Alcohol Base

Silver nitrate .... 30 g

Distilled water .... 100 mL

Ethanol .... 1000 mL

Combine the silver nitrate and distilled water and place on a stirring device until all the crystals are dissolved. Add this solution to the ethanol.

Processing Procedure

When applying the silver nitrate solution to a specimen, it can be dipped or painted. The specimen must be dried and then subjected to high-intensity light or sunlight to develop prints.

Storage

Dark glass bottles

Shelf Life

Up to 1 year

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Sudan Black

Sudan black is a dye that stains sebaceous perspiration to produce a blue-black image. This method is useful on surfaces contaminated with foodstuff, oils, and other greasy substances.

Equipment

Beakers, magnetic stirring device, glass tray, clear or dark storage bottles

Materials and Chemicals

- Sudan black
- Ethanol

Mixing Procedure

Sudan black .... 15 g

Ethanol .... 1000 mL

Distilled water .... 500 mL

Combine the Sudan black and the ethanol and stir. Then add the distilled water and stir to obtain the working solution. Some of the Sudan black will not be dissolved.

Processing Procedure

Shake working solution and pour a sufficient amount into a glass tray. Immerse the specimen(s) in the Sudan black solution for approximately 2 minutes. Remove the specimen(s), rinse with tap water, and let dry.

Storage

Clear or dark bottles

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Vacuum Metal Deposition (VMD)

Vacuum metal deposition is used to develop latent prints on nonporous specimens and some semiporous specimens (e.g., magazine pages and photographs). The vacuum metal deposition technique involves coating or depositing a thin layer of metal onto a surface by thermalizing metals under vacuum.

Vacuum metal deposition developed prints are fragile. Extreme caution should be exercised when handling and photographing these specimens.

These procedures are for a specific vacuum metal deposition chamber size. Various styles and sizes may require different procedures.

Equipment

Vacuum metal deposition chamber, control card or test sample

Materials and Chemicals

- Gold
- Zinc

Processing Procedure

1. Place or suspend the specimen from the interior rack. Secure the specimen to the rack with magnetic clips. A control card or test sample should also be placed on the interior rack. If the specimen needs to be rotated, remove the rotation probe and place in a plastic holder.

2. Place gold in the appropriate boats, using all six boats if the specimen needs to be rotated, but only the second, fourth, and sixth if processing only one side. Check the boats for stress cracks. If damaged, the boats need to be replaced. Contact designated maintenance personnel for appropriate replacement. The total amount of gold to be thermalized for each sequence will be approximately 0.04 g.

3. Check the zinc pots for defects and zinc. Add zinc as needed. If defects are detected in the zinc pots, the pots need to be replaced.

4. Pump the chamber down to the proper operating pressure range of 10^{-4} torr. The vacuum ready light on the instrument display panel will indicate when this is done (approximately 10 minutes).

5. Once the desired vacuum is obtained, set the current switch to gold and adjust the power control knob to 195. The gold should be heated until all gold in the three boats has been thermalized (approximately 10 seconds). This should be observed through one of the viewing ports while wearing welder's goggles.

6. Turn the current switch off for approximately 15 seconds.

7. Set the current switch to zinc and adjust the power control knob to 52. Allow 1 minute to 1 minute 45 seconds for the zinc to thermalize. Observe the control sample through the viewing port for the correct zinc development.

8. Repeat steps 5 through 7 after setting the rotate switch, if the specimen needs to be rotated.

9. Wait approximately 30 seconds and vent the chamber.

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Amido Black (Water Base)

The amido black water-based formula is used in place of the methanol-based formula when there is a question about or a problem with a painted surface.

All blood must be thoroughly dried before applying this formula. Cyanoacrylate fuming may be detrimental to the amido black water-based formula.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, glass tray, squirt bottles or sprayer, clear or dark storage bottles

Materials and Chemicals

- Naphthol blue black (dye content ≥ 85%)
- Citric acid (reagent grade)
- Kodak Photo-Flo™ 600 solution

Mixing Procedure

Amido black water-based formula consists of a citric acid stock, a developer, and a final rinse.

Citric Acid Stock Solution

Citric acid .... 38 g

Distilled water .... 2000 mL

Combine the ingredients and place on a stirring device until citric acid is completely dissolved.

Developer Solution

Citric acid stock solution .... 1000 mL

Naphthol blue black .... 2 g

Kodak Photo-Flo™ 600 solution .... 2 mL

Combine the ingredients and place on a stirring device.

Rinse Solution

Citric acid stock solution .... 1000 mL

Final Rinse

Distilled water is preferred; however, if not available, tap water can be used.

Processing Procedure

Apply the developer to the specimen(s) by dipping, spraying, or using a squirt bottle. Leave the developer on the specimen(s) for approximately 30 seconds to 1 minute, then apply the rinse. These steps can be repeated to improve contrast. Apply the final rinse of distilled water or tap water, then dry the specimen.

Storage

Clear or dark bottles

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Ardrox (Fluorescent Dye)

Ardrox is a fluorescent dye used to make cyanoacrylate developed latent prints more visible on various colored surfaces. This dye is used in conjunction with a long-wave ultraviolet light source.

Equipment

Beakers, graduated cylinder, squirt bottle, clear or dark storage bottles

Materials and Chemicals

- Ardrox P133D
- Acetone
- Methanol
- Isopropanol
- Acetonitrile
- Petroleum ether

Mixing Procedure

Ardrox dye stain does not use a stock solution. Ardrox is used undiluted directly from the container.

Working Solution

Ardrox P133D .... 2 mL

Acetone .... 10 mL

Methanol .... 25 mL

Isopropanol .... 10 mL

Acetonitrile .... 8 mL

Petroleum ether .... 945 mL

Combine the ingredients in the order listed. Do not place on a magnetic stirrer.

Processing Procedure

The ardrox working solution can be applied by either dipping or using a squirt bottle.

Storage

Clear or dark bottles

Shelf Life

Working solution — up to 6 months

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Coomassie Brilliant Blue

Coomassie brilliant blue is used to develop latent prints and enhance visible prints deposited in blood.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, glass tray, squirt bottle or sprayer, clear or dark storage bottles

Materials and Chemicals

- Coomassie brilliant blue R (dye content ≥ 60%)
- Glacial acetic acid
- Methanol

Mixing Procedure

Coomassie brilliant blue consists of developer and rinse solutions and a final rinse of distilled water.

Developer Solution

Coomassie brilliant blue R ...... 0.96 g

Glacial acetic acid .... 84 mL

Methanol .... 410 mL

Distilled water .... 410 mL

Combine the ingredients and place on a stirring device until all the Coomassie brilliant blue R is dissolved. This should take approximately 30 minutes.

Rinse Solution

Glacial acetic acid .... 100 mL

Methanol .... 450 mL

Distilled water .... 450 mL

Combine the ingredients.

Final Rinse

Distilled water is preferred; however, if not available, tap water may be used.

Processing Procedure

Apply the developer to the specimen(s) by dipping or using a squirt bottle or sprayer. Leave the developer on the specimen(s) for approximately 30 to 90 seconds, then apply the rinse. These two steps can be repeated until maximum contrast is achieved. When this has occurred, apply the final bath of distilled water.

Storage

Clear or dark bottles

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Crowle's Double Stain

Crowle's double stain is used to develop latent prints and enhance visible prints deposited in blood.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, glass tray, squirt bottle or sprayer, clear or dark storage bottles

Materials and Chemicals

- Crocein scarlet 7B (dye content ≥ 75%)
- Coomassie brilliant blue R (dye content ≥ 60%)
- Glacial acetic acid
- Trichloroacetic acid (6.1 **N**)

Mixing Procedure

Crowle's double stain is prepared in developer and rinse solutions. There is also a final rinse of distilled water.

Developer Solution

Crocein scarlet 7B .... 2.5 g

Coomassie brilliant blue R .... 150 mg

Glacial acetic acid .... 50 mL

Trichloroacetic acid .... 30 mL

Combine the ingredients, then dilute into 1 L of distilled water. Place the solution on a stirring device for approximately 30 minutes until all the Crocein scarlet 7B and Coomassie brilliant blue R are dissolved.

Rinse Solution

Glacial acetic acid .... 30 mL

Distilled water .... 970 mL

Combine the ingredients.

Final Rinse

Distilled water is preferred; however, if not available, tap water may be used.

Processing Procedure

Apply the developer to the specimen(s) by dipping or using a squirt bottle or sprayer. Leave the developer on the specimen(s) for approximately 30 to 90 seconds, then apply the rinse. These two steps can be repeated until the desired contrast is achieved. When this has occurred, apply the final bath.

Storage

Clear or dark bottles

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Liqui-Drox

Liqui-Drox is a fluorescent dye used to develop latent prints on the adhesive and nonadhesive sides of dark-colored tape.

Equipment

Beaker, small brush, long-wave ultraviolet light, dark storage bottles

Materials and Chemicals

- Ardrox P133D
- Liqui-Nox™ — concentrated liquid detergent

Mixing Procedure

Ardrox P133D .... 200 mL

Liqui-Nox™ .... 400 mL

Distilled water .... 400 mL

Combine the ingredients and stir thoroughly. The solution should be thick and have a milky yellow color.

The Liqui-Drox solution will become clear with time and should not be used in this condition. Stir to return the milky color to the solution and use as normal.

Processing Procedure

The Liqui-Drox solution is applied with a small brush to both sides of the tape, provided the nonadhesive side of the tape has been cyanoacrylate fumed. Brush until a lather is produced. Allow the solution to sit on the tape for about 10 seconds. Rinse the tape under a stream of water until Liqui-Drox is no longer visible. Allow the tape to dry. The tape is then viewed under a long-wave ultraviolet light.

Photograph promptly, because the ridge detail begins to fade within 12 hours. Do not leave the specimen under the ultraviolet light for extended periods of time because this will cause the latent print to fade.

Storage

Dark bottles

Shelf Life

Up to 6 months

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

MBD (Fluorescent Dye)

MBD is a fluorescent dye used to make cyanoacrylate developed latent prints more visible on various colored surfaces. A laser or alternate light source is used in conjunction with this process.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, glass tray, squirt bottle, laser or alternate light source, dark storage bottles

Materials and Chemicals

- MBD
- Acetone
- Isopropanol
- Petroleum ether
- Methanol

Mixing Procedure

MBD is mixed in stock and working solutions.

Stock Solution

MBD .... 1 g

Acetone ..... 1000 mL

Combine the ingredients and stir on a stirring device until all the MBD is dissolved.

Working Solution

MBD stock solution .... 10 mL

Methanol .... 30 mL

Isopropanol .... 10 mL

Petroleum ether .... 950 mL

Combine the ingredients in the order listed. Do not place on a magnetic stirrer.

Processing Procedure

The MBD working solution can be applied by dipping or using a squirt bottle. This solution is applied to the specimen(s) after the cyanoacrylate fuming process and then examined under a laser or alternate light source.

Storage

Dark bottles

Shelf Life

Stock solution — indefinite

Working solution — up to 6 months

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

MRM 10 (Fluorescent Dye)

MRM 10 is a fluorescent dye used to enhance cyanoacrylate developed latent prints on various colored nonporous surfaces. A laser or alternate light source is used in conjunction with this process.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, glass tray, squirt bottle or sprayer, laser or alternate light source, dark storage bottles

Materials and Chemicals

- Rhodamine 6G (dye content ≥ 99%)
- Maxillon flavine 10GFF
- MBD
- Methanol
- Isopropanol
- Acetonitrile
- Petroleum ether
- Acetone

Mixing Procedures

Prior to mixing the MRM 10 cyanoacrylate dye solution, stock solutions A, B, and C must be prepared.

Stock Solution A

Rhodamine 6G .... 1 g

Methanol .... 1000 mL

Combine the ingredients and place on a stirring device until all the rhodamine 6G is dissolved.

Stock Solution B

Maxillon flavine 10GFF .... 2 g

Methanol .... 1000 mL

Combine the ingredients and place on a stirring device to dissolve the maxillon flavine 10GFF.

Not all the maxillon flavine 10GFF will dissolve. There will be a settlement in the bottom of the storage bottle, but this will not affect the working solution.

Stock Solution C

MBD ....1 g

Acetone ... 1000 mL

Combine the ingredients and place on a stirring device to dissolve the MBD.

MRM 10 Working Solution

Stock solution A .... 3 mL

Stock solution B .... 3 mL

Stock solution C .... 7 mL

Methanol .... 20 mL

Isopropanol .... 10 mL

Acetonitrile .... 8 mL

Petroleum ether .... 950 mL

Combine the ingredients in the order listed. Do not place on a stirring device.

Processing Procedure

MRM 10 working solution can be applied by dipping or using a sprayer or squirt bottle. This solution is applied to the specimen(s) after the cyanoacrylate fuming process and followed by examination under a laser or alternate light source.

Storage

Dark bottles

Shelf Life

Stock solutions A, B, C — indefinite

Working solution — up to 6 months

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Ninhydrin (Acetone Base)

Ninhydrin is used to develop latent prints on porous surfaces. Ninhydrin reacts with the amino acids in perspiration.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, glass tray, sprayer, small brush, humidity chamber or iron, dark storage bottles

Materials and Chemicals

- Ninhydrin
- Acetone

Mixing Procedure

Ninhydrin............... 6 g

Acetone .... 1000 mL

The ninhydrin crystals will readily dissolve in acetone. Minimal stirring is required.

Processing Procedure

Ninhydrin can be applied to a specimen by spraying, dipping, or painting. Ninhydrin must be dried before any attempt is made to accelerate the development process. Ninhydrin must be subjected to a humidified environment (e.g., a humidified chamber or an iron on the steam setting). If a humidified chamber is available, set humidity between 60% and 70% for best results.

Storage

Dark bottles

Shelf Life

Up to 1 year

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Rhodamine 6G (Fluorescent Dye)

Rhodamine 6G is a fluorescent dye used to make cyanoacrylate developed latent prints more visible on various colored surfaces. A laser or alternate light source is used in conjunction with this process.

Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar, glass tray, squirt bottle or sprayer, laser or alternate light source, dark storage bottles

Materials and Chemicals

- Rhodamine 6G (dye content ≥ 99%)
- Methanol
- Isopropanol
- Acetone
- Acetonitrile
- Petroleum ether

Mixing Procedure

The rhodamine 6G process uses stock and working solutions.

Stock Solution

Rhodamine 6G .... 1 g

Methanol .... 1000 mL

Combine the ingredients and place on a stirring device until all the rhodamine 6G is dissolved.

Working Solution

Rhodamine 6G stock solution .... 3 mL

Acetone .... 15 mL

Acetonitrile .... 10 mL

Methanol .... 15 mL

Isopropanol .... 32 mL

Petroleum ether .... 925 mL

Combine the ingredients in the order listed. Do not place on a magnetic stirrer.

Processing Procedure

The rhodamine 6G working solution can be applied by either dipping or using a sprayer or squirt bottle. This solution is applied to the specimen(s) after the cyanoacrylate process and followed by examination under a laser or alternate light source.

Storage

Dark bottles

Shelf Life

Stock solution — indefinite

Working solution — up to 6 months

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Safranin O (Fluorescent Dye)

Safranin O is a fluorescent dye used to develop or enhance cyanoacrylate developed latent prints. This dye is very effective at the low 500 nm region.

Equipment

Scales, beakers, magnetic stirrer and stirring bar, glass tray, squirt bottle or sprayer, heat gun, laser or alternate light source, clear or dark storage bottles

Materials and Chemicals

- Safranin O (dye content ≥ 90%)
- Methanol

Mixing Procedure

Safranin O .... 1 g

Methanol ....1000 mL

Combine the ingredients and place on a stirring device for approximately 15 minutes.

Processing Procedure

Apply the safranin O solution to the specimen(s) by dipping or using a sprayer or squirt bottle. Let the specimen(s) air dry or use a heat gun; then examine under a laser or alternate light source. An optional rinse of straight methanol can be used to remove any excess safranin O.

Storage

Clear or dark bottles

Shelf Life

Indefinite

Disposal

Observe all federal, state, and local environmental disposal regulations.
State and local disposal regulations may differ from federal disposal regulations.

Thenoyl Europium Chelate (Fluorescent Dye)

Thenoyl europium chelate is a fluorescent dye used to stain cyanoacrylate developed latent prints.

The dye can be viewed only under ultraviolet light.

Equipment

Scales, beakers, magnetic stirrer and stirring bar, glass tray, long-wave ultraviolet light source, squirt bottle, dark storage bottles with tight lids

Materials and Chemicals

- Europium chloride hexahydrate (purity ≥ 99%)
- Thenoyltrifluoroacetone (purity ≥ 97%)
- Methyl ethyl ketone (HPLC grade)
- Methanol

Mixing Procedure

The thenoyl europium chelate process consists of stock and working solutions. The stock solution is prepared from parts A and B.

Stock Solution—Part A

Thenoyltrifluoroacetone .... 1 g

Methyl ethyl ketone .... 200 mL

Stock Solution—Part B

Europium chloride hexahydrate .... 0.5 g

Distilled water .... 800 mL

Combine solutions A and B and place on a magnetic stirrer in a sealed container for 15 to 30 minutes. **The sealed container is necessary due to evaporation of the methyl ethyl ketone.**

Working Solution

Stock solution .... 100 mL

Methyl ethyl ketone .... 180 mL

Distilled water .... 720 mL

Combine the ingredients and place on a stirring device in a sealed container for 15 minutes.

Processing Procedure

Processing with this solution can be done by submerging the specimen(s) or using a squirt bottle.

Submersion Method

Submerge the specimen in the working solution for approximately 2 minutes. Let the specimen dry, then subject it to long-wave ultraviolet light.

Squirt Bottle Method

While viewing the specimen under long-wave ultraviolet light, apply the working solution with a squirt bottle. Keep applying the working solution until maximum development occurs.

If the working solution dye adheres to the background, a rinse consisting of 800 mL methanol and 200 mL distilled water can be applied. The rinse does not have to be mixed on a magnetic stirrer. The rinse can be applied by either submerging the specimen or using a squirt bottle.

Storage

Dark bottles with tight lids

Shelf Life

Up to 90 days

Disposal

Observe all federal, state, and local environmental disposal regulations. State and local disposal regulations may differ from federal disposal regulations.

Tape Chart by Method

Alternate Black Powder + 50/50 Liqui-Nox™

Color	Brand and Description	Width	Alternate Method
Clear	Ordinary scotch tape	1"	Gentian Violet
Clear	3M™ Transpore™—Textured tape	1"	
Off white	3M™ Tartan—Masking tape	1"	
Off white	Manco—Masking tape	1 1/2"	
White	Johnson & Johnson—Cloth tape	1"	
White	3M™—Decorative and repair tape	1 1/2"	Sticky-Side
White	Manco—Duct tape (Duck™)	2"	
Light brown	Packing tape	3"	Sticky-Side
Dark brown	Manco—Duct tape (Duck™)	2"	
Dark brown	American Tape™—Packing tape	2 3/4"	
Yellow	3M™ Scotch—Transparent packing tape	2"	Sticky-Side
Yellow	3M™ Scotch—Transparent packing tape	2 3/4"	
Yellow	3M™ Scotch—Heavy-duty tape	3"	Sticky-Side
Red	3M™ Scotch—Transparent packing tape	2"	Sticky-Side
Green	3M™ Scotch—Heavy-duty tape	1"	Sticky-Side
Green	3M™ Scotch—Transparent packing tape	2"	
Blue	3M™ Scotch—Transparent packing tape	2"	Sticky-Side
Gray	3M™ Highland—Duct tape	2"	
Black	Manco—Duct tape (Duck™)	2"	

Ash Gray Powder + Photo-Flo™ 200

Color	Brand and Description	Width	Alternate Method
Clear	Packing tape	2"	
Clear	Strapping tape with white stripes	3/4"	
Black	3M™ Scotch—Heavy-duty tape	2"	
Black	3M™—Decorative and repair tape	1 1/2"	
Black	Vinyl electrical tape	3/4"	

Gentian Violet

Color	Brand and Description	Width	Alternate Method
Cloudy	Ordinary scotch tape	3/4"	
Cloudy	3M™ Scotch—Ordinary scotch tape	1"	

Sticky-Side Powder + Photo-Flo™ 100

Color	Brand and Description	Width	Alternate Method
White	3M™ Scotch—Transparent packing tape	2"	
Orange	3M™ Scotch—Transparent packing tape	2"	

Chemical Synonyms

Acetone

dimethylformaldehyde—dimethylketal—dimethylketone—b-ketopropane—propanone—2-propanone—pyronacetic ether

Acetonitrile

cyanomethane—ethanenitrile—ethyl nitrile—methanecarbonitrile— methyl cyanide

Ardrox P133D

tracer tech P133D

Citric acid

citric acid monohydrate—2-hydroxy-1,2,3-propanetricarboxylic acid—b-hydroxytricarballylic acid

Coomassie brilliant blue R

acid blue 83

Cyanoacrylate

ethyl-2-cyanoacrylate—methyl-2-cyanoacrylate

Cyclohexane

hexahydrobenzene—hexamethylene—hexanaphthene

DAB

diaminobenzidine

3,3'-Diaminobenzidine tetrahydrochloride

3,3',4,4'-tetraaminobiphenyl tetrahydrochloride

DFO

1,8-diazafluoren-9-one

n-Dodecylamine acetate

laurylamine acetate

Ethanol

Ethyl alcohol

Ethyl acetate

acetic acid ethyl ester—acetic ether—vinegar naphtha

Europium chloride hexahydrate

europic chloride

Ferrous ammonium sulfate

ammonium ferrous sulfate—ammonium iron (II) sulfate—ferrous ammonium sulfate hexahydrate—mohr's salt

Formic acid

acide formique—acido formico—ameisensaeure—aminic acid—bilorin—formylic acid—hydrogen carboxylic acid—kwas metaniowy—kyselina mravenci—methanioc acid—mierenzuur

Gentian violet

aniline violet—basic violet 3—crystal violet—crystal violet chloride—gentiaverim hexamethyl pararosaniline chloride—hexamethyl-p-rosaniline chloride—hexamethyl-p-rosaniline hydrochloride—hexamethyl violet—methyl-rosaniline chloride—oxiuran—vermicid bismuth violet

Glacial acetic acid

acetic acid—ethanoic acid—ethylic acid—methanecarboxylic acid—pyroligneous acid—vinegar acid

Gold

Au—burnish gold—colloidal gold—gold flake—gold leaf—gold powder—shell gold

Hydrogen peroxide 3%

hydrogen dioxide solution—oxydol

Hydrogen peroxide 30% solution

albone 35, 50, 70, 35cg, 50cg, or 70cg—hydrogen peroxide solution, 30%—interox—kastone—perone 30, 35 or 50

Iodine

iodine crystals—iodine sublimed

Isopropanol

isopropyl alcohol—2-propanol

LCV

leucocrystal violet

Maleic acid

2-butenedioic acid—*cis*-butenedioic acid—CID-1,2-ethylenedicarboxylic acid—maleinic acid—malenic acid—toxilic acid

Maxillon flavine 10GFF

basic yellow 40—yellow 40

MBD

7-P-methoxybenzylamino-4-nitrobenz-2-oxa-1-3-diazole

Methanol

carbinol—methyl alcohol—wood alcohol—wood spirit

Methylene chloride

aerothene MM—dichloromethane—methane dichloride—methylene bichloride—methylene chloride—methylene dichloride

Methyl ethyl ketone

2-butanone—ethyl methyl ketone

a-Naphthoflavone

7,8-benzoflavone—benzo(h)flavone—a-naphthoflavone—a-naphthylflavone—2-phenyl-4h-naphtho(1,2-B)pyran-4-one

Naphthol blue black

acidal black 10B—acidal navy blue 3BR—acid black 10A, 10B, 12B, 10BA, base M, 4BN, 4BNU, 10BN, BRX, BX, H, 1, or JVS—acid blue black B, 10B, BG, or double 600—acid leather blue IGW, dark blue G, or fast blue black G—airedale black 2BG—amacid black 10BR—atulacid black 10BX or BX—azanol fast acid black 10B—AZO dark blue C 2B, HR, S or SH—blue black 12B or SX—boruta black A—brasilan black BS—bucacid blue black—calcocid blue black—calcocid blue black 2R—C.I. 20470—C.I. acid black 1 (7CI)—C.I. acid black 1, disodium salt (8CI)—colacid black 10A—comacid blue black B—diacid blue black 10B—eniacid black IVS or SH—eriosin blue black B—fast sulon black BN—fenazo blue black

Ninhydrin

2,2-dihydroxy-1,3-indandione—2,2-dihydroxy-1H-indene-1,3(2H)-dione—1,2,3-indantrione,2-hydrate—1,2,3-indantrione monohydrate—ninhydrin hydrate—triketohydrindene hydrate

Petroleum ether

benzine—petroleum naptha—petroleum spirits

Rhodamine 6G

C.I. basic red I—9-(2-(ethoxycarbonyl)phenyl)-3,6-bis(ethyl amino)-2,7-dimethyllxanthylium chloride

Safranin O

basic red 2—brilliant safranin BR—brilliant safranin G—brilliant safranin GR—calcozine red Y—C. I. 50240—C. I. basic red 2—2,8-dimethylphenosafranine—gossypimine—hidaco safranin—leather red HT—mitsui safranin—safranin A, B, G, GF, J, O, OK, T, TH, TN, Y, YN, or ZH—safranin superfine G—safrin T—tolusafranine

Sodium acetate

anhydrous sodium acetate—sodium acetate trihydrate

Sodium carbonate

ash—bisodium carbonate—calcined soda—carbonic acid sodium salt—crystal carbonate—disodium carbonate—disodium salt—Na-X—soda—soda ash

Sodium hypochlorite

bleach

Sudan black

C.I. solvent black 3—2,3-dihydro-2,2-dimethyl-6-((4-(phenylazo)-1-naphthyl)azo)perimidine—Sudan black B

5-Sulfosalicylic acid

3-carboxy-4-hydroxybenzenesulfonic acid—2-hydroxybenzoic-5-sulfonic acid—salicylsulfonic acid—sulfosalicylic acid

Synperonic-N

ethoxylated alkyphenol non-ionic surfactant

Trichloroacetic acid

aceto-caustin—trichloracetic acid—trichloroethanoic acid

Zinc

blue powder—emaray zinc dust—granular zinc—jasad—lead refinery vacuum zinc—merrillite—pasco Zn—zinc dust—zinc powder