Validation of Various Fingerprint Processes in a Medium Municipal Agency

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Abstract

Validation of Various Fingerprint Processes in a Medium Sized Municipal Agency

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According to the National Academy of Sciences Report recommendation 7, laboratory accreditation should be mandatory and follow the standards published by the International Organization for Standardization (ISO). Readers will better understand the strategy employed for validating fingerprint methods for a medium size municipal agency while trying to complete the quality requirements necessary to achieve ISO accreditation. There are many different kinds of methods utilized to visualize latent prints, and they all need to be tested in order to determine which is the best suited for the Huntington Police Department Forensic Investigations Unit (HPD FIU). This study will impact the forensic science community by providing a benefit for the HPD FIU that will lay the foundation for the lab's workflow and the product it generates.

This project includes non-porous, porous, adhesive, and blood processes, but many different methods for each process. Each method must be used in the proper sequence of a series of development techniques, or risk the possibility of destroying certain matrix components that react with subsequent methods. If one method is performed out of order, then the fingerprints could be under developed or even destroyed. The HPD FIU has to be very careful in order to preserve a possible fingerprint and allow it to be detected. By validating these methods, it allows the HPD FIU to know if the method works for its intended use or if there is another one better suited.

Validations of fingerprinting methods will allow for this medium municipal agency to become accredited through ISO 17020 standards. In order to verify that the methods used were fit for purpose, five data sets were generated for each method and results were evaluated based on the methods ability to be visualized. A result of a positive (see ridge detail) or negative was written down for each to tell if any ridge detail was seen. To show proof that these tests function accordingly or produce inadequate results, pictures or possible prints were kept in order to be accredited through ASCLD/LAB by the ISO 17020 for crime scene response.

There were supposed to be three validations produced for each method, but unforeseen circumstances arrived. Unfortunately, the unit lost some employees, so there was a problem getting everything validated two more times in a timely fashion due to casework. Once these two other validations are completed by two people in the unit, those results will create a new decision of whether or not the methods are good to use in this lab.

Additionally, new methods were tested and validated for implementation in the workflow of the medium municipal lab. Some of the new methods, such as 1, 2 -Indanedione and Acid Fuchsin, are now validated for utilization in the lab. The saying "you always get the good with the bad" came in to play here though, since there were four methods that were found to be no longer useful for this lab which will save the laboratory money. These methods include Coomassie Blue, 5-MTN, ThermaNin, and Oil Red O. D.F.O did not produce usable results, but future use is being evaluated by the laboratory.

Almost all of the fingerprint methods produced results that were expected. The few that did not meet expectations were D.F.O., 5-MTN, Oil Red O, and ThermaNin. 5-MTN, Oil Red O, and ThermaNin however, were new products to this lab and did not produce results that the products' manufacturers stated they would. The validation of these methods helped the HPD FIU in the accreditation process as well as discovering which methods produce better results.

These and other details of the study will be discussed.

Keywords: Fingerprints, Validation, Accreditation

Introduction

Every person has a unique arrangement of friction ridges. When a person touches something, there is a potential transference of the contacting area of friction skin in the form of oils and perspiration, or other matrix. One of the primary goals of any investigation deals with identifying the individuals associated with the criminal activities in question. Friction ridge details from prints can be developed and recovered at crime scenes to aid in this effort if they are processed correctly. In order for proper print recovery, a crime scene investigator or technician must be trained in knowing the different types of friction ridge detail that could possibly be deposited at the crime scene. They also need to be aware of which kinds of surfaces would retain any workable amount of friction ridge detail as well as, the procedures used in retrieving the fingerprint so that later, the prints can be closely examined to see if an identification can be made. With all the different materials used today, it becomes critical that "proven" (validated) methods be available for use by trained personnel to prevent loss, contamination, cross contamination and deleterious changes.

According to ILAC G19 section 2.22 Validation, "a validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled." Every fingerprint process that is in use by the Huntington Police Department Forensic Investigations Unit (HPD FIU) will be validated for records of having proven procedures. If during the validation process a method performs undesirably, then the use of that method will likely be discontinued at HPD FIU. All of these methods will be validated by being reproduced by three separate people with five trials per each substrate used in the processes; however, these substrates vary depending on which fingerprint process is to be used at the time. Validations of all these fingerprinting processes will help the HPD FIU become accredited through ISO 17020 standards. While the five trials will be conducted on each substrate used at the time, a notation of a positive or negative result will be kept as well as what time each validation began and ended. Pictures or possible prints will be kept as proof of the process working or failing in order to have good scientific practice and be accredited through ISO 17020 for crime scene response.

The HPD FIU is trying to become accredited because not only does it make them look professional, but it also shows others that they take pride in having their work be the best that it can be. This in turn boosts the HPD FIU's recognition and reputation in the region (Sadikoglu, Esin, and Talha Temur). According to Jill Spriggs, director of the Sacramento County district attorney's crime lab and immediate-past president of the American Society of Crime Lab Directors, "Accreditation is vitally important to the success and quality of the product crime labs put out. But accreditation alone won't do the job. Crime labs must engage in rigorous hiring practices, including detailed background checks on prospective employees, and have strong monitoring and management procedures in place to detect quality control issues early on" (Hansen, Mark p. 3). Having the HPD FIU accredited allows for others to realize that the personnel are competent in performing multiple specific fingerprint and crime scene response tests. Becoming accredited can help not only the HPD FIU, but laboratories all over to produce reliable results by putting forth an outline of a well-recognized quality system (p.222, Sadikoglu, Esin, and Talha Temur). Within the journal *Science and Justice*, Sheila Willis stated, "Accreditation is a very powerful management tool for testing laboratories. It provides a framework to monitor customer needs and non-conforming work. In this way it facilitates continuous improvement." The HPD FIU encourages improvement in their unit and just wants the best for its city and surrounding areas.

Background

On average, each law enforcement agency in the country has twenty to thirty officers. The HPD however, is considered a medium sized municipal agency since it has 112 officers which serves a daytime population of approximately 75,000. The HPD FIU is staffed by two sworn officers and one civilian employee. A medium municipal lab is an agency with one hundred to two hundred total employees (P. 92, Deese). Twenty-four officers are assigned to the Detective Bureau and seven to Administration. The remainder are assigned to Patrol, Traffic, and Training divisions. HPD also employs 10 civilians. The HPD FIU staff fluctuates based on budgetary resources. They are currently operating at minimum staffing of two officers. The HPD FIU is in the process of hiring a civilian investigator. As a result, fewer cases are processed, while the case load remains the same (Lt. David Castle (police officer) in discussion with the author, June 2016).

On average, the HPD FIU receives 220 cases per year. Last year, they worked 213 cases. The department as a whole however, responds to 60,000 cases per year and creates reports on 9,000 of these cases. Thus the unit is a small, but integral part of the operation. Huntington Police Department operates within the jurisdiction of the City of Huntington, but the HPD FIU frequently assists outside agencies upon request. Agencies the FIU assist include, but are not limited to: The West Virginia State Police, Cabell County Sheriff's Office, Barboursville Police Department, Wayne County Sheriff's Office, Lawrence County (OH) Sheriff's Office, Marshall

University Police Department, Milton Police Department, Charleston Police Department, and the local Federal Bureau of Investigation and Bureau of Alcohol, Tobacco, and Firearms field offices (Lt. David Castle (police officer) in discussion with the author, June 2016).

Below are the statistics showing the breakdown of each kind of incidents the HPD FIU works and the quantity of how many there were back in 2015.

Table 1: Incident types that the HPD FIU worked in 2015 with their corresponding quantity as well as how many more or less than from 2014.

Incident Type	Quantity (plus/minus from previous year)
Suspicious death	
Homicide	3(-7)
Suicide	9(+6)
Overdose	22(+14)
Other	8
total	42(+14)
Malicious wounding	
Shooting	17(+10)
Beating	1(-1)
Stabbing	3
total	21(+9)
Robbery	20(+17)
Felon w/Firearm	10(+3)
Drugs	18(+7)
Wanton Endangerment	10(+4)
B&E	23(+12)
Burglary	31(+8)
Traffic Crash	1(-4)
Search Warrant	6(-2)
Assisting Outside Agency	10(+4)
Other	21(+1)
TOTAL	213(+72)

The HPD utilizes an automated fingerprint identification system known as AFIX Tracker® which is linked to a local database. From all of these cases, 143 were put into AFIX Tracker® which was forty-two more than in 2014. Fifty-three of these cases, twenty-four more than 2014, produced a hit meaning they matched a known offender. The hit percentage was 35%, a 7% greater amount than in 2014 (Lt. David Castle (police officer) in discussion with the author, June 2016).

The HPD FIU compares and examines fingerprints found at crime scenes. All other physical evidence is sent to the West Virginia State Police Forensic Laboratory. "Despite the existence of the FBI Laboratory, the United States has no national system of forensic laboratories. Instead, many local law enforcement jurisdictions - city, county, and state - each operate their own independent crime labs (p. 11, Saferstein)." As noted by Saferstein, HPD is one of the local jurisdictions that operate their own and resultantly it is working to address the concerns of recommendation 7 of the NAS report by achieving accreditation. The difference between accreditation for a state laboratory and a medium size municipal agency lab, like Huntington, is the size difference. The state laboratory has more disciplines offered compared to the HPD FIU which is just seeking accreditation in two disciplines, crime scene response and fingerprints.

Currently the HPD FIU utilizes many different processes to develop latent prints on various types of substrates. Not only were their most used processes validated, but also some they would like to incorporate in the future.

Materials and Methods

The following methods are separated based on what kind of matrix they can be used on, and they proceed to explain what equipment was used for each process and the substrates being tested. It also explains what procedure needs to be performed which can then be found in the appendix.

Non-porous: The purpose of this section is to visualize latent prints on non-porous surfaces.

1. Cyanoacrylate: First in the sequence of processing non-porous evidence; uses super glue fuming to form a polymerization that encapsulates the moisture from the print under a white shell.

The equipment utilized for superglue fuming include Arrowhead Forensics Cyanoacrylate A-2616, HPD FIU Misonix CA-6000 superglue chamber SN# MYCA601-0001 (top part) and MYCA601-0011 (bottom part), HPD FIU Crane humidifier, Nikon D40 camera, and tin foil cups.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Glass
2. Plastic
3. Aluminum coke cans
4. Metal cans
5. Ceramic mugs
6. Painted wood with 5 of each kind of paint
    a. Classic 99 Interior Satin Latex
    b. Krylon Indoor/Outdoor Gloss Spray Paint
    c. ProMar 200
    d. ColorPlace Fast Dry Spray Paint

Five prints were then intentionally placed on each item for each type of substrate for a total of 25 prints. The items were placed in a HPD FIU Misonix CA-6000 Superglue Chamber at 65%

humidity for eleven minutes (the time it takes for one full cycle before a purge is needed). The purge was allowed to go on as well for another eleven minutes. In order to visualize any friction ridge detail from the latent prints, procedure Non-porous 1 (Appendix A) was used.

2. Basic Black or Grey Powder: Used after cyanoacrylate or by itself; it reacts with the fatty deposits left from a print.

The equipment utilized for this process includes basic black or grey powder, brush, latent print cards, fingerprint tape, eraser, straightedge, and HPD FIU down flow hood SN#108. Follow the Non-porous 2 procedure.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Glass
2. Plastic bottle
3. Plastic CD Case
4. Aluminum coke cans
5. Metal cans
6. Ceramic mugs
7. Painted wood with 5 of each kind of paint
    a. Classic 99 Interior Satin Latex
    b. Krylon Indoor/Outdoor Gloss Spray Paint
    c. ProMar 200
    d. ColorPlace Fast Dry Spray Paint

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 2 (Appendix B) was used.

3. Magnetic Black or Grey Powder: Used after cyanoacrylate or by itself; it reacts with the fatty deposits left from a print.

The equipment utilized for this process includes magnetic black or grey powder, brush, latent print cards, fingerprint tape, eraser, straightedge, and HPD FIU down flow hood SN#108.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Glass
2. Plastic bottle
3. Plastic CD Case
4. Aluminum coke cans
5. Metal cans
6. Ceramic mugs
7. Painted wood with 5 of each kind of paint
    a. Classic 99 Interior Satin Latex
    b. Krylon Indoor/Outdoor Gloss Spray Paint
    c. ProMar 200
    d. ColorPlace Fast Dry Spray Paint

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 2 (Appendix B) was used.

4. M.B.D.: A dye spray that is put over the superglued print to enhance the visualization of the latent print and fluoresces under an alternate light source.

The equipment utilized for this procedure includes premade MBD, Nikon D40 or D5100 camera, measuring tape, alternate light source of 450nm, macro lens, orange safety goggles, and camera stand.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Glass
2. Plastic
3. Aluminum coke cans
4. Metal cans
5. Ceramic mugs
6. Painted wood with 5 of each kind of paint
    a. Classic 99 Interior Satin Latex
    b. Krylon Indoor/Outdoor Gloss Spray Paint
    c. ProMar 200
    d. ColorPlace Fast Dry Spray Paint

Five prints were then intentionally placed on each item for each type of substrate for a total of 25 prints. The items were superglued by following Non-porous 1 procedure. The items were sprayed with MBD and allowed to dry. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 3 (Appendix C) was used.

5. Black Supranano Liquid Powder and Black Small Particle Reagent: Used first when non-porous substrates of any light color become wet and reacts with the fatty deposits left from the print.

The equipment utilized for this procedure includes black supranano liquid powder, black small particle reagent, latent print cards, and fingerprint tape.

The design method used is as follows: two items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Glass
2. Plastic
3. Aluminum coke cans
4. Metal cans
5. White ceramic mugs
6. White grocery bags

Five prints were then intentionally placed on each item for each type of substrate for a total of 10 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 4 (Appendix D) was used.

6. White Small Particle Reagent: Used first when dark colored non-porous substrates become wet and reacts with the fatty deposits left from the print.

The equipment utilized for this procedure includes white small particle reagent, latent print cards, and fingerprint tape.

The design method used is as follows: two items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Glass

2. Plastic

3. Aluminum coke cans

4. Metal cans

5. Black ceramic mugs

6. Black grocery bags

Five prints were then intentionally placed on each item for each type of substrate for a total of 10 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 4 (Appendix D) was used.

7. Yellow Supranano Liquid Powder: Used first when non-porous substrates of any color other than yellow become wet and reacts with the fatty deposits left from the print.

The equipment utilized for this procedure includes Yellow supranano liquid powder, latent print cards, and fingerprint tape.

The design method used is as follows: two items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Glass

2. Plastic

3. Aluminum coke cans

4. Metal cans

5. Ceramic mugs

6. White grocery bags

7. Black grocery bags

Five prints were then intentionally placed on each item for each type of substrate for a total of 10 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 4 (Appendix D) was used.

8. Sudan Black: A dye that reacts with the sebaceous perspiration from latent prints and can be used directly on surfaces or after cyanoacrylate.

A. Post Cyanoacrylate

The equipment utilized for this procedure includes Sudan black, D40 camera, water, glass tray, and macro lens.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. White ceramic mugs

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 5 (Appendix E) was used.

B. Greasy Surfaces

The equipment utilized for this procedure includes Sudan black, D40 camera, water, glass tray, and macro lens.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Glass pan

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 5 (Appendix E) was used.

C. Non-greasy Surface

The equipment utilized for this procedure includes Sudan black, D40 camera, water, glass tray, and macro lens.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Metal can

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 5 (Appendix E) was used.

D. Paint

The equipment utilized for this procedure includes Sudan black, D40 camera, water, glass tray, and macro lens.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous materials that are processed by the HPD FIU.

1. Painted wood with Krylon indoor/outdoor gloss spray paint

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Non-porous 5 (Appendix E) was used.

Porous: The purpose of this section is to visualize latent prints on porous surfaces.

1. Iodine ("Shake and Bake" style): Adheres to the oils left behind from a print and is the first step for a porous substrate.

The equipment utilized for this procedure includes Iodettes, Nikon D40 camera, and macro lens.

The design method used is as follows: five items of each substrate below were gathered because they are the most common porous materials that are processed by the HPD FIU.

1. Plastic bag
2. Receipt paper
3. Plain white printer paper
4. Latent print cards
5. Newspaper
6. Cardboard

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Porous 1 (Appendix F) was used.

2. 1, 8 Diazafluoren 9, 1 (D.F.O.): Reacts with amino acids in fingerprint residues and must be used before ninhydrin or silver nitrate is applied.

The equipment utilized for this procedure HPD FIU Caron Forensics Oven SN#103111-6105-2-194 at 75°C for 15 minutes, ALS, orange safety glasses, camera stand, D40 camera, macro lens, and 1 glass tray.

A formula can be made for this procedure. According to CBDIAI, it entails of mixing certain chemicals in the following order:

DFO Stock Solution-

1. 1 gram D.F.O. crystals
2. 200 ml Methanol
3. 200 ml Ethyl Acetate
4. 40 ml Glacial Acetic acid

Combine and stir with a magnetic stirrer until all the ingredients are dissolved.

DFO Working solution- Add petroleum ether to the stock solution until the total volume is two liters.

The design method used is as follows: five items of each substrate below were gathered because they are the most common porous materials that are processed by the HPD FIU.

1. Newspaper
2. Receipt paper
3. Brown rough cardboard
4. White glossy cardboard
5. Latent print cards

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Porous 2 (Appendix G) was used.

3. Ninhydrin: Reacts with amino acids and can be used instead of iodine or after D.F.O. Must be used before 1, 2- Indanedione though.

The equipment utilized for this procedure includes Iron, up flow hood, spray bottle of pre-made Ninhydrin, Nikon D40 camera, and macro lens.

The design method used is as follows: five items of each substrate below were gathered because they are the most common porous materials that are processed by the HPD FIU.

1. Receipt paper
2. Plain white printer paper
3. Latent print cards

4. Newspaper

5. Cardboard

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Porous 3 (Appendix H) was used.

4. 1, 2- Indanedione: Replaces the use of D.F.O. and can be used after Ninhydrin. This method reacts to the amino acid and will result in the print fluorescing when under an alternate light source.

The equipment utilized for this procedure includes 1, 2- Indanedione, HPD FIU oven SN#103111-6105-2-194, HPD FIU Condensate Recirculator humidifier SN#103111-CRSY102-1-387, Nikon D40 camera, and macro lens.

A formula can be made for this procedure. According to CBDIAI, it entails of mixing certain chemicals in the following order:

1. 2 g of 1,2-Indanedione
2. 70 ml of Ethyl acetate
3. 930 ml of HFE 7100

The design method used is as follows: five items of each substrate below were gathered because they are the most common porous materials that are processed by the HPD FIU.

1. Plain white printer paper

2. Latent print cards

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Porous 4 (Appendix I) was used.

5. 5-Methylthioninhydrin (5-MTN): Reacts with the amino acids in a fingerprint and can be used after D.F.O.

The equipment utilized for this procedure includes 5-MTN, HPD FIU Caron Forensics oven SN#103111-6105-2-194, HPD FIU Condensate Recircuator humidifier SN#103111-CRSY102-1-387, D40 camera, macro lens, glass tray, and ALS at 530nm.

A formula can be made for this procedure. According to CBDIAI, it entails of mixing in the following order:

1. 1.5g of 5-MTN crystals
2. 500 ml of petroleum ether

The design method used is as follows: five items of each substrate below were gathered because they are the most common porous materials that are processed by the HPD FIU.

1. Plain white printer paper

2. Newspaper

3. Receipt paper

4. Cardboard

5. Latent print cards

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Porous 5 (Appendix J) was used.

6. ThermaNin: Reacts with amino acids and is used with Ninhydrin only on thermal paper.

The equipment utilized for this procedure includes HPD FIU up flow hood SN#123, ThermaNin, glass tray, spray bottle of pre-made Ninhydrin, red Nikon D5300 camera, and AF-S Nikkor 18-55mm lens.

A formula can be made for this procedure. The chemicals must be mixed in the following order:

1. 0.4 g of ThermaNin crystals
2. 5 ml of Isopropanol
3. 15 ml of ethyl acetate
4. 98 ml of heptane

Hfe-7100 may be used in lieu of heptane according to Spex Forensics, but it is quite expensive (Ponschke, Michelle, and Mandi Hornickel, p.247).

The design method used is as follows: five thermal receipt papers are gathered because thermal paper is all the process is good for.

Five prints were then intentionally placed on each piece if thermal paper which makes a total of 25 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Porous 6 (Appendix K) was used.

7. Oil Red O: Reacts with lipids from the prints and needs to be used on fresh prints that are believed to have high amounts lipids.

The equipment utilized for this procedure includes Pre-made Oil Red O stain solution, Carbonate ph7 buffer solution, Silver D5300 camera, AF-S Nikkor 18-55mm lens, and 3 glass trays.

A formula can be made for this procedure. It entails of mixing in the following order:

1. 8.83 g Sodium carbonate dissolved in 666ml of distilled water.
2. Add (carefully) 6.1ml of concentrated Nitric acid.
3. Add distilled water to increase the buffer solution volume to 833ml.

The design method used is as follows: five items of each substrate below were gathered because they are the most common porous materials that are processed by the HPD FIU.

1. Newspaper
2. Receipt paper
3. Brown rough cardboard
4. White glossy cardboard
5. Latent print cards
6. Plain white computer paper

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Porous 7 (Appendix L) was used.

8. Silver Nitrate: Reacts with the sodium chloride (salt) present in sweat and is used last out of every method possible.

The equipment utilized for this procedure includes Silver Nitrate solution, Nikon D40 camera, macro lens, and a glass tray.

The design method used is as follows: five items of each substrate below were gathered because they are the most common porous materials that are processed by the HPD FIU.

1. Newspaper
2. Receipt paper

3. Brown rough cardboard
4. White glossy cardboard
5. Latent print cards
6. Plain white computer paper
7. Non-treated wood

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Porous 8 (Appendix M) was used.

Adhesives: The purpose of this section is to visualize latent prints on adhesive surfaces.

1. Black Wetwop: Reacts with the residue on the adhesive side of tape or labels.

The equipment utilized for this procedure includes Wetwop, brush, tweezers, 2 glass pans, squirt bottle of water, Nikon D40 camera, and macro lens.

The design method used is as follows: five items of each substrate below were gathered because they are the most common adhesive materials that are processed by the HPD FIU.

1. Blue duct tape
2. White ruler label
3. Masking tape
4. Large red evidence tape
5. Brown duct tape
6. Clear packing scotch tape
7. Poly fingerprint tape
8. Regular everyday scotch tape
9. Small red evidence tape

10. Blue paint tape
11. Huntington Police Department sticker

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Adhesive 1 (Appendix N) was used.

2. Gentian Violet: Reacts with the residue on the adhesive side of tape or labels.

The equipment utilized for this procedure includes Gentian Violet, tweezers, two glass pans, squirt bottle of water, Nikon D40 camera, and macro lens.

A formula can be made for this procedure. It entails of adding a few drops of gentian violet to a cup of water until the purple solution is translucent.

The design method used is as follows: five items of each substrate below were gathered because they are the most common adhesive materials that are processed by the HPD FIU.

1. Blue duct tape
2. White ruler label
3. Masking tape
4. Large red evidence tape
5. Brown duct tape
6. Clear packing scotch tape
7. Poly fingerprint tape
8. Regular everyday scotch tape
9. Small red evidence tape
10. Blue paint tape
11. Black electrical tape

12. Huntington Police Department sticker

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Adhesive 2 (Appendix O) was used.

Blood: The purpose of this section is to visualize latent prints on bloody surfaces.

1. Amido Black: Reacts with the proteins left behind from a bloody print and can be used first on light colored background surfaces.

The equipment utilized for this procedure includes Amido Black, D40 camera, macro lens, and water.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous and porous materials that are processed with blood reagents by the HPD FIU.

1. Glass
2. Plastic
3. Aluminum coke cans
4. Metal cans
5. White ceramic mugs
6. Painted wood with Class 99 Interior Satin Latex Paint
7. Cardboard
    a. Brown
    b. White
8. Newspaper
9. Receipt paper

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Blood 1 (Appendix P) was used.

2. Acid Fuchsin (Hungarian Red): Reacts with the proteins left behind from a bloody print and can be used first on dark colored background surfaces.

The equipment utilized for this procedure includes Acid Fuchsin (Hungarian Red), D40 camera, macro lens, ALS at 515nm, orange safety goggles, Gel lifts, and water.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous and porous materials that are processed with blood reagents by the HPD FIU.

1. Glass
2. Plastic
3. Aluminum coke cans
4. Metal cans
5. White ceramic mugs
6. Painted wood with Class 99 Interior Satin Latex Paint
7. Cardboard
    a. Brown
    b. White
8. Newspaper
9. Receipt paper

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Blood 2 (Appendix Q) was used.

3. Coomassie Blue: Reacts with the proteins left behind from a bloody print and can be used instead of the other two depending on the surface color.

The equipment utilized for this procedure includes Coomassie blue, D40 camera, macro lens, and water.

The design method used is as follows: five items of each substrate below were gathered because they are the most common non-porous and porous materials that are processed with blood reagents by the HPD FIU.

1. Glass
2. Plastic
3. Aluminum coke cans
4. Metal cans
5. White ceramic mugs
6. Painted wood with Class 99 Interior Satin Latex Paint
7. Cardboard
    a. Brown
    b. White
8. Newspaper
9. Receipt paper

One print was then intentionally placed on each item for each type of substrate for a total of 5 prints. In order to visualize any friction ridge detail from the latent prints, the procedure Blood 5 (Appendix R) was used.

Results

The data for each process was to be collected in a notebook to show results. The data was then evaluated. A positive or negative was established for if it was successful or not. Successful is when there was any level of friction ridge detail with at least three ridges seen. Lastly, the data was summarized in a conclusion after each processed was performed.

✓ = Positive Result X= Negative Result

Table 2: Positive or Negative Results for Cyanoacrylate.

Validation on Cyanoacrylate and Superglue Chamber					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass	✓	✓	✓	✓	✓
Plastics	✓	✓	✓	✓	✓
Metal Cans	✓	✓	✓	✓	✓
Aluminum Coke Cans	✓	✓	✓	✓	✓
Ceramic Mugs	✓	✓	✓	✓	✓
Class 99 Interior Satin Latex Paint on Wood	✓	✓	✓	✓	✓
ColorPlace Interior/Exterior Fast Dry Spray Paint on Wood	X	✓	✓	✓	✓
ProMar 200 Interior Latex Eg-Shel Paint on Wood	✓	✓	✓	✓	✓
Krylon Indoor/Outdoor Gloss Spray Paint on Wood	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/1/16.

Table 3.1 and 3.2: Positive or Negative Results for Basic Black Powder.

Validation on Basic Black Powder					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass Pan	✓	✓	✓	✓	✓
Plastic Bottle	✓	✓	✓	✓	✓
Metal Can	✓	✓	✓	✓	✓
Plastic CD Case	✓	✓	✓	✓	✓
Aluminum Coke Can	✓	✓	✓	✓	✓
Ceramic Mug	✓	✓	✓	✓	✓
Class 99 Interior Satin Latex Paint on Wood	✓	✓	✓	✓	✓
ColorPlace Interior/Exterior Fast Dry Spray Paint on Wood	X	X	X	X	X
ProMar 200 Interior Latex Eg-Shel Paint on Wood	✓	✓	✓	✓	✓
Krylon Indoor/Outdoor Gloss Spray Paint on Wood	✓	✓	✓	✓	✓

Validation on Basic Black Powder					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass Pan	✓	✓	✓	✓	✓
Plastic Bottle	✓	✓	✓	✓	✓
Metal Can	✓	✓	✓	✓	✓
Plastic CD Case	✓	✓	✓	✓	✓
Aluminum Coke Can	✓	✓	✓	✓	✓
Ceramic Mug	✓	✓	✓	✓	✓
Class 99 Interior Satin Latex Paint on Wood	✓	✓	✓	✓	✓
ColorPlace Interior/Exterior Fast Dry Spray Paint on Wood	✓	✓	✓	✓	✓
ProMar 200 Interior Latex Eg-Shel Paint on Wood	✓	✓	✓	✓	✓
Krylon Indoor/Outdoor Gloss Spray Paint on Wood	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 5/25/16 (first table), PO Kyle Quinn on 5/26/16 (first table due to same results), and HPD FIU Civ. Aldo Maldonado on 5/26/16 (second table).

Table 4.1, 4.2, and 4.3: Positive or Negative Results for Magnetic Black Powder.

Validation on Magnetic Black Powder					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass Pan	✓	✓	✓	✓	✓
Plastic Bottle	✓	✓	✓	✓	✓
Metal Can	✓	✓	✓	✓	✓
Plastic CD Case	✓	✓	✓	✓	✓
Aluminum Coke Can	✓	✓	✓	✓	✓
Ceramic Mug	✓	✓	✓	✓	✓
Class 99 Interior Satin Latex Paint on Wood	✓	✓	✓	✓	✓
ColorPlace Interior/Exterior Fast Dry Spray Paint on Wood	X	X	X	X	X
ProMar 200 Interior Latex Eg-Shel Paint on Wood	✓	✓	✓	✓	✓
Krylon Indoor/Outdoor Gloss Spray Paint on Wood	✓	✓	✓	✓	✓

Validation on Magnetic Black Powder					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass Pan	✓	✓	✓	✓	✓
Plastic Bottle	✓	✓	✓	✓	✓
Metal Can	✓	✓	✓	✓	✓
Plastic CD Case	✓	✓	✓	✓	✓
Aluminum Coke Can	✓	✓	✓	✓	✓
Ceramic Mug	✓	✓	✓	✓	✓
Class 99 Interior Satin Latex Paint on Wood	✓	✓	✓	✓	✓
ColorPlace Interior/Exterior Fast Dry Spray Paint on Wood	✓	✓	X	✓	X
ProMar 200 Interior Latex Eg-Shel Paint on Wood	✓	✓	✓	✓	✓
Krylon Indoor/Outdoor Gloss Spray Paint on Wood	✓	✓	✓	✓	✓

Validation on Magnetic Black Powder					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass Pan	✓	✓	✓	✓	✓
Plastic Bottle	✓	✓	✓	✓	✓
Metal Can	✓	✓	✓	✓	✓
Plastic CD Case	✓	✓	✓	✓	✓
Aluminum Coke Can	✓	✓	✓	✓	✓
Ceramic Mug	✓	✓	✓	✓	✓
Class 99 Interior Satin Latex Paint on Wood	✓	✓	✓	✓	✓
ColorPlace Interior/Exterior Fast Dry Spray Paint on Wood	✓	✓	✓	✓	✓
ProMar 200 Interior Latex Eg-Shel Paint on Wood	✓	✓	✓	✓	✓
Krylon Indoor/Outdoor Gloss Spray Paint on Wood	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 5/26/16 (table one), PO Kyle Quinn on 5/30/16 (table two), and HPD FIU Civ. Aldo Maldonado on 5/31/16 (table 3).

Table 5: Positive or Negative Results for M.B.D.

Validation on M.B.D.					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass	✓	✓	✓	✓	✓
Plastic	✓	✓	✓	✓	✓
Metal Cans	✓	✓	✓	✓	✓
Aluminum Coke Can	✓	✓	✓	✓	✓
Class 99 Interior Satin Latex Paint on Wood	✓	✓	✓	✓	✓
ColorPlace Interior/Exterior Fast Dry Spray Paint on Wood	X	✓	✓	✓	✓
ProMar 200 Interior Latex Eg-Shel Paint on Wood	✓	✓	✓	✓	✓
Krylon Indoor/Outdoor Gloss Spray Paint on Wood	X	X	X	X	X
Ceramic Mugs	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/8/16.

Table 6: Positive or Negative Results for Black Supranano Spray and Black Small Particle Reagent Spray.

Validation on Black Spranano Spray and Black Small Particle Reagent										
	Dry 1	Dry 2	Dry 3	Dry 4	Dry 5	Wet 1	Wet 2	Wet 3	Wet 4	Wet 5
Substrates										
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Metal Cans	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Aluminum Coke Cans	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
White Ceramic Mugs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
White Grocery Bags	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/14/16.

Table 7: Positive or Negative Results for White Small Particle Reagent Spray.

Validation on White Small Particle Reagent Spray										
	Dry 1	Dry 2	Dry 3	Dry 4	Dry 5	Wet 1	Wet 2	Wet 3	Wet 4	Wet 5
Substrates										
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Metal Cans	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Aluminum Coke Cans	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Black Ceramic Mugs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Black Grocery Bags	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/14/16.

Table 8: Positive or Negative Results for Yellow Supranano Spray.

Validation on Yellow Supranano Spray										
	Dry 1	Dry 2	Dry 3	Dry 4	Dry 5	Wet 1	Wet 2	Wet 3	Wet 4	Wet 5
Substrates										
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Metal Cans	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Aluminum Coke Cans	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Blue and White Ceramic Mugs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Black Grocery Bags	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
White Grocery Bags	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/14/16.

Table 9: Positive or Negative Results for Sudan Black.

Validation on Sudan Black						
	Trial	1	2	3	4	5
Substrates						
Ceramic Mugs	After superglue fuming	✓	✓	✓	✓	✓
Painted Wood	Painted surface	✓	✓	✓	✓	✓
Metal Cans	Non-greasy surface	✓	✓	✓	✓	✓
Glass	Greasy surface	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/20/16.

Table 10: Positive or Negative Results for Iodine “Shake and Bake” Style.

Validation on Iodine "Shake and Bake"					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrate					
Receipt Paper	✓	✓	✓	✓	✓
Latent Print Card	✓	✓	✓	✓	✓
Plain White Printer Paper	✓	✓	✓	✓	✓
Newspaper	✓	✓	✓	✓	✓
Cardboard	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/8/16.

Table 11: DFO

Validation on DFO					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Plain White Computer Paper	X	X	X	X	X
Latent Print Card	X	X	X	X	X
Newspaper	X	X	X	X	X
Yellow Cardboard	X	X	X	X	X
Brown Cardboard	X	X	X	X	X
Receipt paper	X	X	X	X	X

The test was performed by Amanda Wilberg on 7/7/16.

Table 12: Positive or Negative Results for Ninhydrin.

Validation on Ninhydrin					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrate					
Receipt Paper	✓	✓	✓	✓	✓
Latent Print Card	✓	✓	✓	✓	✓
Plain White Printer Paper	✓	✓	✓	✓	✓
Newspaper	✓	✓	✓	✓	✓
Cardboard	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/10/16.

Table 13: Positive or Negative Results for 1, 2- Indanedione.

Validation on 1, 2- Indanedione					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrate					
White Computer Paper	✓	✓	✓	✓	✓
Latent Print Card	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/22/16.

Table 14: 5-MTN

Validation on 5-MTN					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Plain White Computer Paper	X	X	X	X	X
Latent Print Card	✓	X	X	X	X
Newspaper	X	X	X	X	X
Yellow Cardboard	X	X	X	X	X
Brown Cardboard	X	X	X	X	X
Receipt paper	X	X	X	X	X

The test was performed by Amanda Wilberg on 7/1/16.

Table 15: ThermaNin

Validation on ThermaNin					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Receipt paper	✓	✓	✓	✓	X

The test was performed by Amanda Wilberg on 7/7/16.

Table 16: Oil Red O

Validation on Oil Red O					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Receipt Paper	✓	✓	✓	✓	✓
Plain White Computer Paper	✓	✓	✓	✓	✓
Newspaper	X	x	x	x	x
Brown Cardboard	X	x	x	x	x
White Cardboard	X	x	x	x	x
Latent Print Cards	X	x	x	x	x

The test was performed by Amanda Wilberg on 7/8/16.

Table 17: Silver Nitrate

Validation on Silver Nitrate					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Receipt Paper	✓	✓	✓	x	x
White Cardboard	✓	✓	✓	✓	✓
Newspaper	✓	✓	✓	✓	✓
Brown Cardboard	✓	x	x	x	x
Plain White Computer Paper	x	x	x	x	x
Latent Print Cards	✓	✓	✓	✓	x
Non-treated Wood	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 7/19/16.

Table 18: Positive or Negative Results for Black Wetwop.

Validation on Black Wetwop					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Blue Duct Tape	✓	✓	✓	✓	✓
White Ruler Label	✓	✓	✓	✓	✓
Masking Tape	✓	✓	✓	✓	✓
Brown Duct Tape	✓	✓	✓	✓	✓
Poly Fingerprint Tape	✓	✓	✓	✓	✓
Blue Paint Tape	✓	✓	✓	✓	✓
Large Red Evidence Tape	✓	✓	✓	✓	✓
Clear Packing Scotch Tape	✓	✓	✓	✓	✓
Regular Everyday Scotch Tape	✓	✓	✓	✓	✓
Small Red Evidence Tape	✓	✓	✓	✓	✓
Huntington Police Department Sticker	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/10/16.

Table 19: Positive or Negative Results for Gentian Violet.

Validation on Gentian Violet					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Blue Duct Tape	✓	✓	✓	✓	✓
White Ruler Label	✓	✓	✓	✓	✓
Masking Tape	✓	✓	✓	✓	✓
Brown Duct Tape	✓	✓	✓	✓	✓
Poly Fingerprint Tape	✓	✓	✓	✓	✓
Blue Paint Tape	X	✓	✓	✓	X
Large Red Evidence Tape	X	✓	✓	✓	✓
Clear Packing Scotch Tape	✓	✓	✓	✓	✓
Regular Everyday Scotch Tape	✓	✓	✓	✓	✓
Small Red Evidence Tape	✓	✓	✓	✓	✓
Black Electrical Tape	X	X	X	X	X
Huntington Police Department Sticker	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/13/16.

Table 20: Positive or Negative Results for Amido Black.

Validation on Amido Black					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass	✓	✓	✓	✓	X
Plastics	✓	✓	✓	✓	✓
Metal Cans	✓	✓	X	✓	X
Aluminum Coke Cans	✓	✓	✓	✓	✓
White Ceramic Mugs	✓	✓	✓	✓	✓
Receipt Paper	✓	✓	✓	✓	✓
Painted Wood	✓	✓	✓	✓	✓
Newspaper	X	X	✓	X	X
Brown Cardboard	X	✓	X	X	X
White Cardboard	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/24/16.

Table 21: Positive or Negative Results for Acid Fuchsin.

Validation on Acid Fuchsin (Hungarian Red)					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass	✓	✓	✓	✓	✓
Plastics	✓	✓	✓	✓	✓
Metal Cans	✓	✓	✓	✓	✓
Aluminum Coke Cans	✓	✓	✓	✓	✓
Blue Ceramic Mugs	✓	✓	✓	✓	✓
Receipt Paper	X	X	X	X	X
Painted Wood	✓	✓	✓	✓	✓
Newspaper	✓	✓	✓	✓	✓
Brown Cardboard	X	X	X	X	X
White Cardboard	✓	✓	✓	✓	✓

The test was performed by Amanda Wilberg on 6/27/16.

Table 22: Positive or Negative Results for Coomassie Blue.

	Validation on Coomassie Blue				
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Substrates					
Glass	✓	✓	✓	✓	✓
Plastics	✓	✓	✓	X	X
Metal Cans	✓	✓	✓	✓	✓
Aluminum Coke Cans	✓	✓	✓	✓	✓
White Ceramic Mugs	✓	✓	✓	✓	✓
Receipt Paper	X	X	X	X	X
Painted Wood	✓	✓	✓	✓	✓
Newspaper	X	X	X	X	X
Brown Cardboard	X	X	X	X	X

The test was performed by Amanda Wilberg on 6/24/16.

Discussion

All of the validations were documented in writing. All of the written data as well as the photographs and lifts were kept in the validation notebook. This will be stored in the HPD FIU supervisor's office. Every process was photographed except for both the basic and magnetic powders and all the sprays (both blacks, white, and yellow). For these five validations, the prints were lifted with tape. The variables in all of the validation studies were that latent prints were deposited at random from both hands of multiple people. The challenges encountered in this project include: The lack of stainless steel countertops, shortage of some chemicals, and mixing of chemicals. Another significant challenge was the minimum staffing issue mentioned above. Only two permanent officers were working in the HPD FIU, but they were devoted to actual case work, call outs, and report writing. As a result, they were unable to consistently perform the other two validation processes required by ISO 17020 and ILAC G19.

Technique Results

Cyanoacrylate, Basic Black Powder, Magnetic Black Powder

Latent prints developed on all surfaces except the ColorPlace Fast Dry Spray Paint. That one did not always produce results. The painted wood also did not produce prints if the wood had too many rough spots.

The Arrowhead Forensics cyanoacrylate (A-2616), Misonix CA-6000 superglue chamber SN# MYCA601-0001 (top part) and MYCA601-0011 (bottom part), basic and magnetic black powders, Air Science Technologies down flow hood SN#108, and procedures tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on nonporous surfaces.

M.B.D.

Latent prints developed on all surfaces except the Krylon indoor/outdoor Gloss Spray Paint. Along with the color of the paint being orange, there was not even any superglue residue after applying the MBD and allowing it to dry once rinsed off. Also, latent prints on the

ColorPlace Fast Dry Spray Paint, was not able to be seen until the picture was taken first then magnified on the camera. The first trial of it however, had no results at all.

The M.B.D., alternate light source, and procedure tested developed latent prints, and are therefore valid to be used in the development of latent prints of multiple nonporous surfaces.

Black Supranano Spray and Black Small Particle Reagent Spray

Latent prints developed on all surfaces. The black small particle reagent left more background than the black Supranano liquid powder.

The black Supranano liquid powder, black small particle reagent, and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on wet and dry nonporous surfaces.

White Small Particle Reagent Spray

Latent prints developed on all surfaces.

The white small particle reagent and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on wet and dry nonporous surfaces.

Yellow Supranano Spray

Latent prints developed on all surfaces. The yellow Supranano liquid powder worked better than the black and white solutions due to less background and easier to see on all substrates. ALS only makes the prints fluoresce brighter, so it is not necessary to use unless this is the route one wants to take.

The yellow Supranano liquid powder and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on wet and dry nonporous surfaces.

Sudan Black

Latent prints developed on painted, non-greasy, greasy, and after superglue fuming surfaces.

The Sudan black solution and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on nonporous surfaces.

Iodine "Shake and Bake" Style

Latent prints developed on all surfaces. Cardboard was a difficult substrate to see the prints on if it was brown.

The iodine ("Shake and Bake" style) and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on porous surfaces.

D.F.O.

Latent prints with ridge detail did not develop on surfaces. The prints were lightly visible, but never became bright enough to see enough ridge detail. They only looked like sparkled yellow spots all over the substrates. The brown cardboard and newspaper did not have anything on them.

The D.F.O. solution and procedure tested did not develop latent prints with good enough ridge detail, and is therefore not valid and fit for purpose to be used in the development of latent prints on porous surfaces.

Ninhydrin

Latent prints developed on all surfaces. Cardboard was a difficult substrate to see the prints on if it was brown.

The Ninhydrin, Air Science Technologies up flow hood SN#123, iron, and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on porous surfaces.

1, 2 –Indanedione

Latent prints developed on all surfaces.

The 1, 2-Indanedione, oven, alternate light source, and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on porous surfaces.

5-MTN

Latent prints did not develop on surfaces. The prints were lightly visible, but never became bright enough to see ridge detail. They only looked like purple spots all over the substrates. The brown cardboard did not have any purple, but instead turned a peach color. When viewing the substrates with the ALS at 530nm with no barrier filter, nothing happened.

The 5-MTN, ALS, and procedure tested did not develop latent prints, and is therefore not valid and fit for purpose to be used in the development of latent prints on porous surfaces.

ThermaNin

Latent prints developed on all thermal receipt papers. If prints are on the front side, they will not be clear due to the front side turning black even with no heat. If the print is on the back of the thermal paper, then the print will turn a bright purple.

The ThermaNin, Ninhydrin, Air Science Technologies up flow hood SN#123, and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on thermal receipt paper.

Oil Red O

Fingermarks developed on most surfaces, but without visible ridge detail. The prints were lightly visible, but never became bright enough to see ridge detail. They only looked like peach spots all over the substrates. No prints developed on the brown cardboard or newspaper. Only very faint ridge detail developed on the receipt paper and plain white computer paper. The receipt paper was a little better than the plain white computer paper, but took all the ink off the receipt paper.

The Oil Red O and procedure tested did develop latent prints, and is therefore valid and fit for purpose to be used in the development of latent prints on porous surfaces.

Silver Nitrate

Latent prints did develop on most surfaces. The prints were faint on the latent print card. On the receipt paper, the prints were a little darker than the latent print card. The best prints appeared on the newspaper and wood. The white cardboard showed bright prints, but not as clear as the newspaper and wood. Only one print developed on the brown cardboard. No prints developed on the plain white computer paper. There was a lot of background on everything, but the least was on the wood.

The Silver Nitrate and procedure tested did develop latent prints, and is therefore valid and fit for purpose to be used in the development of latent prints on porous surfaces.

Wetwop

Latent prints developed on all surfaces. The large red evidence tape was difficult to see prints on.

The wetwop and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on adhesive surfaces.

Gentian Violet

Latent prints developed on all surfaces. Latent prints were difficult to see on the large and small red evidence tape. Latent prints did not always develop on the blue paint tape and were difficult to see as well. Gentian violet should not be used on the black electrical tape because the purple is not able to be seen on black. Latent prints developed best on Duct tape. Latent prints developed on the masking tape, but were consistently very faint regardless of the amount of time left in the solution. There was heavy background staining when used on the scotch tape, which provided very little contrast between the friction ridges and the tape.

The Gentian Violet and procedure tested developed latent prints, and are therefore valid and fit for purpose to be used in the development of latent prints on adhesive surfaces.

Amido Black

Enhanced bloody prints, as well as latent bloody prints developed on all surfaces. Newspaper and brown cardboard are not good substrates for this process due to just absorbing the solution. White cardboard, on the other hand, works better. Enhanced bloody prints, as well as latent bloody prints did not always develop on metal and glass. A Hexagon OBTI presumptive test was used before performing tests and it was positive showing it was human blood on the latent prints.

The Amido black and procedure tested developed latent prints from blood, and are therefore valid and fit for purpose to be used in the development of latent prints on porous and nonporous surfaces.

Acid Fuchsin

Enhanced bloody prints, as well as latent bloody prints developed on most surfaces. Receipt paper and brown cardboard are not good substrates for this process. The newspaper needs to dry overnight before prints will appear. This process is better than Amido black and Coomassie blue due to overstaining on nonporous substrates. When compared to just Coomassie blue on plastic, the Acid Fuchsin (Hungarian Red) kept the prints on the plastic and did not wash them off or smudge the prints. One black and one white gel lift was used to lift the prints and then examined with the ALS and an orange filter. The prints did not fluoresce on the black gel lift. Enhanced bloody prints, as well as latent bloody prints did fluoresce on the white gel lift. The color of the prints turned peach instead of fuchsia under the ALS.

The Acid Fuchsin (Hungarian Red), ALS, and procedure tested developed latent prints from blood, and is therefore valid and fit for purpose to be used in the development of latent prints on porous and nonporous surfaces.

Coomassie Blue

Enhanced bloody prints, as well as latent bloody prints developed on most surfaces. Newspaper, receipt paper, and brown cardboard are not good substrates for this process. Although Coomassie Blue does not call for a fixative prior to use, bloody prints were washed away and disappeared on plastic. However, some frictional ridge detail was seen on some of the plastic. Clarity was poor with Coomassie Blue on all surfaces, but some friction ridge detail developed on all the other nonporous substrates. Coomassie Blue is ineffective on porous surfaces.

The Coomassie blue and procedure tested developed latent prints from blood, and is therefore valid and fit for purpose to be used in the development of latent prints on non-porous surfaces.

Some of these are newer methods and will be getting used more now in the lab such as 1, 2 -Indanedione and Acid Fuschin. They worked so well that the HPD FIU was amazed by the outcome and even used the 1, 2- Indanedione for processing an actual case item. Good outcomes like this are always nice to see, but there were some methods that will not be used again. These methods include Coomassie Blue, 5-MTN, ThermaNin, and Oil Red O. These processes also new to the laboratory, but were not favored by the HPD FIU once they were put to the test due to not producing a desirable result. The HPD FIU will always have the old and true methods to keep using which seem to be their favorite go to processes. These include both powders of course, cyanoacrylate, M.B.D., and Amido black. However, the 1, 2 –Indanedione might be taking over Ninhydrin except for processing receipts and the Acid Fuchsin could get used as much as the Amido black.

Conclusions and Future Needs

Most of the fingerprint methods worked as expected, except for the D.F.O., 5-MTN, Oil Red O, and ThermaNin. D.F.O. should be tested in the future with a different mixture to determine its validity for use. The other three were new products to the lab and just did not produce the results advertised by the manufacturers. When the other two tests eventually get completed by two more people, maybe their results will allow for a new determination of whether or not the products are any good in this lab. Unfortunately, these two tests will be put on hold for a while due to the current staffing shortage in the HPD FIU.

As for future needs into this accreditation process besides them needing to reproduce the results two more times, the HPD FIU needs to also get their lab completely moved up to the fourth floor. According to ISO 17020, results just need to be reliable and reproducible in order to be validated, so the HPD FIU chose to test all methods three times. Their evidence room also needs to be completed which seems to look like it will be done very soon. This new space will allow for more evidence to be housed with an easier access for the unit. The HPD FIU will also need to prepare for budgetary allocations The reasonable amount of time for the HPD FIU to become accredited in is hopefully to be about a year as of right now.

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Appendix

A. Cyanoacrylate Fuming – N1 (superglue – non-porous)

Cyanoacrylate fuming is the first step in processing latent prints on non-porous surfaces. Cyanoacrylate is an active ingredient in superglue. In an enclosed chamber, superglue fumes create a polymerized shell over the substrate and cause latent print residue to turn a whitish color. Powder and fluorescent dye stains may be used after superglue to enhance visualization. Latent prints developed with superglue should be photographed prior to subsequent processes.

Equipment Used

Cyanoacrylate fuming and humidity chamber, liquid superglue, aluminum dish, hot plate, water humidifier or cup of hot water, gloves

Materials

Cyanoacrylate (superglue)

Processing Procedure

Suspend articles (if possible) to be processed inside the chamber and place a quarter size amount of superglue in an aluminum dish. Place the aluminum dish on the provided hot plate and close and seal the chamber. Press the start button on the chamber and turn on the attached humidifier. Recommended humidity level is 70% – 80%. When proper humidity level is achieved, turn off the humidifier. Allow 10 – 12 minutes for adequate fuming time and remove articles.

Storage

Store the superglue in a refrigerator.

Shelf Life

Indefinite

Disposal

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

B. Powder – N2 (black and grey – non-porous)

Powders are used on non-porous surfaces. Powders adhere to the moisture content, or other residue, in the matrix of a latent print. The color of powder used should contrast with the background of the substrate. Powder may be used after cyanoacrylate fuming or as a stand-alone process. Developed latent prints may be photographed and/or lifted with fingerprint lifting tape and placed on a suitable contrasting background card.

Equipment Used

Jar or shallow dish, fiberglass or camel hair brush, down-flow vent hood, gloves, lab coat

Materials

- Lightning powder
- Supranano powder

Mixing Procedure

No mixing required. Powders used by the HPD FIU are commercially manufactured and sold pre-mixed.

Procedure

Basic Powder – Dip the tip of the fiberglass or camel hair brush in the powder and gently apply to substrate in a spinning or sweeping motion. If friction ridge detail begins to appear, sweep or spin the bristles in the direction of flow of the ridges. Use a clean brush to "clean" the developed latent print by gently sweeping or spinning against the substrate to brush away any excess powder. When satisfied, photograph and/or lift the print.

Magnetic Powder – Dip the applicator into the magnetic powder with the magnetic rod in the down position. With a sufficient amount of powder adhering to the applicator, gently apply to the substrate in a gently sweeping motion. If friction ridge detail begins to appear, sweep the applicator in the direction of ridge flow. When satisfied, photograph and/or lift the print. Be careful not to touch the substrate with the tip of the applicator, as this could damage the print. Also, be careful not over develop the latent print, as this could destroy the print.

Storage

Powders should be stored at room temperature in the appropriate container. Avoid subjecting powders and brushes to moisture.

Shelf Life

Indefinite

Disposal

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

C. Fluorescent Dye Stain – N3 (MBD, – non-porous)

Fluorescent dye stains are used to stain cyanoacrylate developed latent prints on non-porous surfaces. Prints developed with a dye stain must be visualized with an alternate light source and photographed. Dye stains are effective on all non-porous surfaces. Dye stains may be used prior to powdering techniques.

Equipment

Plastic squirt bottles with nozzle, glass dish, sink, ALS, gloves, lab coat, safety glasses

Materials

- MBD (premixed)

Processing Procedures

After processing with superglue, an article may be washed with a fluorescent dye stain by dipping, spraying, or with a squirt bottle (preferred). A light rinse with distilled water may be used after the wash. Allow the item to air dry and examine with an ALS and appropriate filter. Photograph any developed latent prints. Fluorescent dye stains may be recaptured after processing and poured back into the original container.

Shelf Life

1 year.

Disposal

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

D. Small Particle Reagent, Supranano Liquid – N4 (aka SPR – non-porous)

Small particle reagent and Supranano liquid are reagents for developing latent prints on non-porous surfaces and are of particular use on wet or previously wet surfaces. It can also work on articles which have been contaminated with liquid accelerants and on surfaces where latent print powders are ineffective. It can also be used as a post-cyanoacrylate process. It is sensitive to fats and lipids. SPR and Supranano liquid are available in black, white, and various fluorescent colors for contrast purposes.

Equipment

Magnetic stirrer, glass tray or sink.

Materials and Chemicals

- Small particle reagent or Supranano liquid
- Choline chloride
- Tergitol 7
- Molybdenum disulfide
- Distilled water

Mixing Procedures

SPR and Supranano liquid are generally sold pre-mixed (preferred), but may be mixed in house. If mixed in-house, follow the mixing instructions below.

Combine .4 mL of Tergitol 7 with 5 g of molybdenum disulfide and 50 mL of distilled water in a magnetic stirrer to create a suspension.

Processing Procedures

Articles may be are sprayed onto or immersed in the solution for approximately 1 minute. When satisfied the article is rinsed with tap water and allowed to air dry. Any developed latent prints should be photographed and may be lifted with standard fingerprint lifting tape. This is a very messy process so consider using outdoors or in a large sink.

Storage

Store in the original packaging in a dry location.

Shelf Life

Indefinite

Disposal

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

E. Sudan Black – N4 (dye stain – non-porous)

Sudan Black is a dye that stains the sebaceous components of perspiration on non-porous surfaces. It is also useful in developing latent prints deposited in contaminants such as grease and other sticky foodstuffs. It may be used as a post-cyanoacrylate stain or as a single process on non-porous items. Success has also been achieved in developing latent prints on latex gloves after superglue development.

Equipment

Plastic squirt bottle with nozzle, glass dish, sink, magnetic stirrer, amber jar, chemical fume hood, gloves, lab coat, safety glasses

Materials and Chemicals

- Sudan Black powder
- Ethanol (or methanol)

Mixing Procedure

15 g Sudan Black powder mixed with,

1000 mL ethanol

500 mL distilled water

Mix Sudan Black powder with ethanol and stir, then add the distilled water and stir for create the working solution. Some of the powder may not dissolve.

Processing Procedure

Shake the working solution and pour into a glass tray. Immerse the article in the solution for approximately two minutes. Allow to air dry and examine. Recapture the solution and store in the original container. Any developed latent prints should be photographed.

Storage

Store in a clear or amber jar (preferred), inside fire proof cabinet.

Shelf Life

Indefinite

Disposal

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

F. Iodine – P1 (fats, lipids – porous)

Iodine is a chemical that reacts with fats and lipids found in fingerprint residue on porous surfaces. When subjected to iodine fumes a latent print turns a brownish color, but the development is only temporary as the print will fade quickly when removed from the iodine fume. Iodine is the first step in the sequence when processing non-porous surfaces.

Equipment

Plastic bag, chemical fume hood, gloves, lab coat, and safety glasses.

Materials

Iodine crystals

Mixing Procedures

No mixing required

Processing Procedures

"Shake-n-bake" – Select a zip-lock style plastic bag large enough to contain the item to be processed. Place approximately 2 grams of iodine crystals in the plastic bag with the item to be processed. Seal the bag and allow the heat from your hand to activate the crystals. Shake the bag and allow the crystals to slide over the surface of the substrate on both sides while watching for any developing latent prints. The longer the substrate is left in the bag, the darker the ridges will appear. Remove the article from the bag and immediately photograph any developed latent prints. When the prints fade, the article may be re-processed. If no other chemical processes will be performed after iodine, then the developed latent prints may be made permanent by the application of magnetic powder.

Storage

Maintain at room temperature in sealed container.

Shelf Life

Indefinite

Disposal

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

G. DFO – P2 (1, 8-Diazafluoren-9-one [amino acid – porous])

DFO is an amino acid reagent to be used on porous surfaces. DFO is one of many options that may be used after iodine and prior to ninhydrin. Any latent prints developed will fluoresce under certain wavelengths. An alternate light source must be used to visualize developed latent prints between 500 – 590 nanometers and viewed with an orange or red filter.

Equipment

Oven/hair dryer/or iron, spray bottle, glass dish, scales, magnetic stirrer, ALS, amber jar, chemical fume hood, gloves, lab coat, and safety glasses.

Materials and Chemicals

- DFO
- HFE-7100
- Glacial acetic acid
- Methanol
- Ethyl acetate
- Petroleum ether

Mixing Procedures

Stock solution – 1 g DFO powder

200 mL methanol

200 mL ethyl acetate

40 mL glacial acetic acid

Mix with magnetic stirrer for at least 20 minutes. Add 2 L to stock solution and mix to create a working solution.

Processing Procedure

Spray, brush, or submerge article in the working solution until saturated and allow to air dry in hood. Once dry, process a second time and again, allow the article to dry in hood. Bake the article in an oven at approximately 200 degrees Fahrenheit for 20 minutes. Examine the article with an ALS at 500 – 590 nanometers with an orange or red filter. Photograph any developed latent prints.

Storage

Amber bottle in fire proof cabinet

Shelf Life

6 months

Disposal

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

H. Ninhydrin – P3 (amino acid – porous)

Ninhydrin is an excellent amino acid reagent used on porous surfaces. It may be used after iodine and DFO. Ninhydrin caused latent prints to turn a purple color, known as Ruhemann's Purple.

Equipment

Magnetic stirrer, chemical fume hood, oven/humidity chamber or steam iron, amber bottle or jar, graduated cylinder/beaker, gloves, lab coat, and safety glasses.

Materials and Chemicals

- Ninhydrin crystals
- Isopropanol
- Methanol
- Petroleum ether
- HFE-7100
- Glacial acetic acid
- Ethyl acetate
- Acetone

Mixing Procedures

Purchase pre-mixed

Processing Procedures

Brush, spray, or immerse the article in a glass tray until saturated and allow to air dry in a chemical fume hood. Once dry, repeat the process and allow it to dry. Place the item in a sealed plastic bag and leave in a dry, dark place for 24-48 hours and examine. Alternatively, subject the article to moist heat using a steam iron or heat/humidity chamber at 60% humidity for 10 minutes and examine. Moist heat accelerates the process from a day or two to only a few minutes. If an accelerated method is selected, be sure that the substrate is completely dry before attempting the process. Photograph any latent prints with a green filter (or no filter).

Storage

Store ninhydrin in an amber jar or bottle in a fire proof cabinet.

Shelf Life

Ninhydrin crystals – indefinite, mixed – 1 year

Disposal

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

I. 1, 2-Indanedione – P4 (amino acid – porous)

1, 2 Indanedione is an amino acid reagent similar to DFO in that it will fluoresce yellow when viewed with an ALS between 455 – 570 nanometers with an orange or red filter. Reports suggest that the fluorescence is improved by post-treatment with Zinc Chloride and cooling with liquid nitrogen. 1, 2 Indanedione may also be followed by treatment with ninhydrin.

Equipment

Magnetic stirrer, chemical fume hood, oven/humidity chamber or steam iron, amber bottle or jar, graduated cylinder/beaker, gloves, lab coat, and safety glasses.

Materials and Chemicals

- 1, 2-Indanedione
- Ethyl acetate
- HFE-7100

Mixing Procedure

2 g 1, 2-Indanedione

70 mL ethyl acetate

930 mL HFE-7100

Mix the above chemicals in amber jar with a magnetic stirrer until dissolved.

Processing Procedure

Brush, spray, or immerse the article in the reagent and allow it to dry in a chemical fume hood, and repeat. Store in a sealed plastic bag for 24-48 hours and examine. A steam iron or heat/humidity oven may be used to accelerate the process. If using an oven, bake at 100 degrees Celsius (212 Fahrenheit) for 10 – 15 minutes at 60% humidity (no humidity is also acceptable). Examine the article with an ALS at 455 – 570nm and orange filter. For brown paper bags, manila envelopes, and cardboard use a red filter. Zinc Chloride and liquid nitrogen may be used after processing to enhance fluorescence. Photograph any latent prints with the appropriate filter.

Storage

Store in an amber jar or bottle in a fire proof cabinet.

Shelf Life

3 months

Disposal

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

J. 5-MTN – P5 (5-methylthioninhydrin – amino acid - porous)

5-MTN is an amino acid reagent used on porous items. It may be used as a substitute for ninhydrin. Reports have indicated that its reaction to amino acids results in a stronger purple coloration than that of ninhydrin.

Equipment

Magnetic stirrer, chemical fume hood, oven/humidity chamber or steam iron, amber bottle or jar, graduated cylinder/beaker, gloves, lab coat, and safety glasses.

Materials and Chemicals

- 5-MTN crystals
- Petroleum ether or other alcohol solvent (acetone, methanol etc.)

Mixing Procedure

Mix 3 g of 5-MTN crystals with 1000 mL of petroleum ether or other alcohol solvent using a magnetic stirrer in a well ventilated area or in a chemical fume hood.

Processing Procedure

Brush, spray, or immerse the article in the solution until saturated and allow it to dry in a chemical fume hood, and repeat. Seal the item in a plastic bag for 24-48 hours and examine. A steam iron or heat/humidity oven may be used to accelerate the process. If using an oven, bake the item at 80 degrees Celsius (176 degrees Fahrenheit) at 65% humidity and monitor for development. Photograph any latent prints using a green filter (or no filter). Zinc Chloride may be used post-treatment to create fluorescence.

Storage

Store in an amber jar or bottle in a fire proof cabinet.

Shelf Life

1 year

Disposal

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

K. ThermaNin – P6 (amino acid – thermal paper)

ThermaNin is a ninhydrin derivative specifically formulated to develop latent prints on thermal paper. Typical ninhydrin and DFO is mixed using polar solvents (acetone, methanol), which turns the top layer of the substrate black or dark grey - obliterating any latent prints. ThermaNin is formulated with a polar solvent (pentane, heptane etc.), which does not discolor or darken thermal paper.

Equipment

Magnetic stirrer, chemical fume hood, amber bottle or jar, graduated cylinder/beaker, gloves, lab coat, and safety glasses.

Materials and Chemicals

- ThermaNin crystals
- Isopropanol (isopropyl alcohol)
- Ethyl Acetate
- HFE-7100

Mixing Procedure

5 g ThermaNin crystals

5 mL isopropanol (isopropyl alcohol)

15 mL ethyl acetate

980 mL heptane

Mix in an amber jar or bottle with a magnetic stirrer. Due to the brief shelf life of the working solution, it is necessary to mix fresh prior to use.

Processing Procedure

Brush, spray, or immerse the item in the solution until saturated in a chemical fume hood, and repeat. Leave to air dry and seal in a plastic bag for 24-48 hours and examine. Photograph any developed latent prints with a green filter (or no filter).

Storage

Store in an amber bottle or jar in a fire proof cabinet.

Shelf Life

ThermaNin crystals – indefinite.

Working solution is 1 – 3 weeks.

Disposal

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

L. Oil Red O – P7 (lipids – porous)

Oil Red O is a lipid-specific dye stain technique for use on porous items which have become wet. Research has shown that Oil Red O can be superior to Physical Developer to develop latent fingerprints on thermal paper and standard white paper. Fewer immersion steps and less need to avoid chloride contamination are benefits using the Oil Red O reagent. Developed latent prints will turn red.

Equipment

Magnetic stirrer, chemical fume hood, amber bottles or jars, glass trays, graduated cylinder/beaker, gloves, lab coat, and safety glasses.

Materials and Chemicals

- Oil Red O powder
- Methanol
- Sodium hydroxide
- Sodium phosphate monobasic monohydrate
- Sodium phosphate dibasic heptahydrate
- Distilled water
- Sodium carbonate
- Nitric acid

Mixing Procedures

Stain Solution

- Purchase pre-mixed

Alternative – Carbonate ph7 Buffer Solution

- 26.5 g Sodium carbonate dissolved in 2 L distilled water

- Add (carefully) 18.3 ml concentrated Nitric acid – shaking constantly.
- Add distilled water to increase the buffer solution volume to 2.5 L.

Processing Procedure

- Immerse the item in stain solution and soak completely. It is optional to agitate the solution on a shaker platform.

- Ridge detail should begin to develop in 5 min. Weak fingerprints (poor lipidic content) may require 60 to 90 minutes of development time.

- Remove & drain item - immerse in one of the buffer solutions.

- Remove item from buffer solution - rinse in distilled water.

- Dry the item at room temperature – or heat in an oven at 50 degrees C (122 degrees Fahrenheit).

Photograph and developed latent prints.

Storage

Amber bottles or jars in a fire proof cabinet at room temperature.

Shelf Life

Stain Solution - indefinite, providing its methanol does not dissolve.

Carbonate Buffer solution – 3 to 4 months.

Disposal

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

M. Silver Nitrate – P8 (salts – porous)

Silver nitrate is used to develop prints on porous surfaces. It reacts with the salt (sodium chloride - NaCl) content of perspiration and when subjected to light, turns it into silver chloride (AgCl). Developed latent prints will turn a brownish-grey color. Two different carriers may be used to formulate a working solution – water or alcohol. An alcohol-based solution may be used on surfaces that could repel water such as: Waxed paper, cardboard with a wax finish, or Styrofoam™. Silver nitrate is always the last procedure in the sequence of latent print development techniques on porous surfaces.

Equipment

Spray bottle, glass tray, magnetic stirrer, gloves, lab coat, safety glasses.

Materials and Chemicals

- Silver nitrate crystals
- Distilled water
- Ethanol

Mixing Procedures

Purchase pre-mixed.

Processing Procedure

Spray, brush, or immerse the article in the solution until saturated and expose to sunlight or other high-intensity light. Be careful not to over-expose to light or the substrate will become dark and cause any developed latent prints to lose contrast with the background. Photograph any developed latent prints.

Storage

Store in an amber jar or bottle in a fire proof cabinet.

Shelf Life

Silver nitrate crystals – indefinite.

Mixed solution – up to 1 year.

Disposal

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

N. **Wetwop – A1 (adhesives – tapes)**

Wetwop is a liquid solution that is an extremely useful method for developing latent prints on the adhesive side of tape and labels. However, consideration should be given to the use of an amino acid reagent if the substrate is particularly porous. Wetwop is formulated in black and white for contrast depending on the color of the substrate. It has also been proven to provide good results on latex and rubber gloves.

Equipment

Glass tray, squirt bottle, forceps or tweezers, gloves, lab coat, and safety glasses.

Materials and Chemicals

- Wetwop
- Camel hair (or similar) small brush
- Squirt bottle with water

Mixing Procedure

This is a pre-mixed solution and requires no chemicals.

Processing Procedure

Vigorously shake the container prior to use. Apply the solution to the adhesive side using a small camel hair brush and allow it to set for approximately 20-30 seconds. Rinse the tape with water using a squirt bottle or directly from the tap. Ridges will develop black or white, depending on the color of the solution. Allow the tape to air dry and photograph any developed latent prints.

Storage

Store at room temperature in the original packaging.

Shelf Life

Indefinite

Disposal

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

O. **Gentian Violet – A2 (aka crystal violet – adhesives – tapes)**

Gentian violet is commonly sold as an antiseptic dye used to treat fungal infections of the skin and to heal minor cuts or abrasions. It is also useful to develop latent prints on adhesives. Gentian violet is a water-based solution that stains the fatty constituents of sebaceous sweat and shed skin cells a purple color.

Equipment

Scales, graduated cylinder, clear glass or amber bottle, magnetic stirrer, glass tray, gloves, lab coat, and safety glasses.

Materials and Chemicals

- Gentian violet
- Distilled water

Processing Procedure

Immerse the article to be processed in the gentian violet solution in a glass tray for approximately 2 minutes and rinse with tap water. Photograph any developed latent prints.

Storage

Store in a clear or amber bottle.

Shelf Life

Indefinite

Disposal

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

P. Amido Black – B1 (blood protein stain – porous and non-porous)

Amido Black is a blood protein stain that may be used on both porous and non-porous surfaces. It is used to develop latent prints and enhance visible prints that have been deposited in blood. Prints are stained a light to dark blue color. Amido Black may be mixed as methanol and water-based solutions. The blood must be dried prior to application of Amido Black. 5-Sulfosalycilic acid acts as a blood fixative in the water-based solution.

Equipment

Clear or amber jars or bottles, glass tray, paper towels, squirt bottle, gloves, lab coat, and safety glasses.

Materials and Chemicals

- Glacial acetic acid
- Formic acid
- Kodak Photo-Flo™ 600 solution
- Sodium carbonate
- 5-Sulfosalicylic acid
- Distilled water

Mixing Procedures

Formula has only a distilled or tap water rinse.

Water base solution

Developer – Mix the following ingredients in the order listed below using a magnetic stirrer.

- 500 mL distilled water
- 20 g 5-Sulfosalicylic acid

- 3 g Amido Black powder (Naphthol blue black)
- 3 g sodium carbonate
- 50 mL formic acid
- 50 mL glacial acetic acid
- 12.5 mL Kodak Photo-Flo™ 600 solution

Dilute this mixture to 1 L using distilled water. This mixture is ready to use following dilution, but it is recommended to allow the formula to sit for several days prior to use to achieve the best results.

Processing Procedure

Apply the developer by submersing or using a squirt bottle to the article for 3 – 5 minutes and rinse with distilled water. Repeat these steps to improve contrast, if desired. Photograph any developed latent prints.

Alternative Process

Vertical surfaces at crime scenes can present a problem. A paper towel without much texture can be soaked in the solution and held against the surface for several minutes. The solution can be reapplied to the paper towel while being held against the surface using a squirt bottle. Use the appropriate rinsing procedure.

Storage

Store in amber or clear jars or bottles inside a fire proof cabinet.

Shelf Life

Indefinite

Disposal

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

Q. **Hungarian Red – B2 (aka Acid Fuchsin – blood protein stain – porous and non-porous)**

Hungarian Red (also known as Acid Fuchsin) is a water-based blood protein stain used to develop latent fingerprints and footwear impressions that have been deposited in blood, on both porous and non-porous surfaces. Developed prints turn fuchsia to red in color. It is recognized as being more sensitive than Amido Black. Another advantage to Hungarian Red is that any developed prints will fluoresce between 520 – 560nm and may be lifted with a gel lifter. Hungarian Red contains a blood fixative in the working solution.

Equipment

Glass tray, spray bottle, squirt bottle, gloves, lab coat, and safety glasses.

Materials

Hungarian Red

Mixing Procedure

Currently, Hungarian Red is only available in a pre-mixed solution and does not require mixing.

Processing Procedure

At a crime scene, spray the surface with the solution and allow about 1 minute for the dye to set. Then, rinse with water or water/acetic acid mixture. Remove any remaining water droplets with compressed air or a hair dryer on low heat. Make sure the surface is completely dry before attempting to lift any prints with a gel lifter. Photograph any developed latent prints.

Storage

Store in a plastic or glass bottle in a fire proof cabinet.

Shelf Life

Indefinite

Disposal

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

R. Coomassie Brilliant Blue – B5 (aka Coomassie blue & CBB – blood protein)

Coomassie brilliant blue is a blood protein solution used to develop latent prints and enhance visible prints deposited in blood. Developed prints turn blue in color. Coomassie blue is similar to Amido Black, but not quite as strong as it does not achieve the same level of contrast. Prints developed with CBB are somewhat light and there is more background staining than that of Amido Black developed prints. It can be used on porous and non-porous surfaces.

Equipment

Scales, amber jar or bottle, graduated cylinder, magnetic stirrer, glass tray, spray or squirt bottle, gloves, lab coat, and safety glasses.

Materials and Chemicals

- Coomassie brilliant blue R powder
- Glacial acetic acid
- Methanol
- Distilled water

Mixing Procedure

Coomassie blue is available pre-mixed (preferred), but it can also be mixed in-house.

Coomassie blue is a three-step process, which includes a developer, rinse, and final rinse. It is not necessary to fix the stain(s), but that is the technician's discretion.

Developer

- .96 g of Coomassie brilliant blue R
- 84 mL of glacial acetic acid
- 410 mL of methanol
- 410 mL of distilled water

Mix the above ingredients using a magnetic stirrer for 30 minutes or until completely dissolved.

Rinse

- 100 mL of glacial acetic acid
- 450 mL of methanol
- 450 mL of distilled water

Swirl jar or mix with a magnetic stirrer.

Final Rinse

- Distilled or tap water

Processing Procedure

Apply the developer by immersion, spraying, or using a squirt bottle. Leave the developer on the substrate for at least one minute, then rinse and repeat, if necessary. When satisfied, apply the final rinse. Prints will turn a light blue color. Photograph any developed prints.

Storage

Store in clear or amber jar or bottle.

Shelf Life

Indefinite

Disposal

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