Deviation Request Form (DRF)

Directions: The Initiator will complete Sections A through C. Additional continuation pages can be included if necessary.

Initiator	Leslie Daugherty	**Date**	9/1/2020

A. Requested deviation applies to (Technical Procedure – include specific section):

Technical Procedure for Physical Developer (PD)- 5.1.4.1

B. Requested deviation:

5.1.4.1:Change 500mL of purified water to 50mL of purified water. Replace 1000mL beaker with appropriate sized beaker.

C. Necessity for the deviation:

Correction to the formulation of the silver nitrate solution (from 500mL to 50mL)

D. Technical review and Authorization (to be completed by the Quality Manager and/or Technical Leader)
Comments(to include merits and impacts):

This change will restore the original reagent composition for the silver nitrate solution.

Approved	☑	Yes	☐	No	Duration	until processing procedure is approved
Signature	Leslie Daugherty Digitally signed by Leslie Daugherty DN: CN=Leslie Daugherty, E=ldaugherty@ncdoj.gov Reason: I am the author of this document Location: Date: 2020-09-01 12:15:23 Foxit PhantomPDF Version: 9.3.0				Date	9/1/2020

E. Quality Assurance Authorization (to be completed by the Quality Manager, Forensic Scientist Manager or designee)

Acceptable within general QA guidelines and good laboratory practice?	☑	Yes	☐	No
Significant negative impact to Crime Laboratory Quality System?	☐	Yes	☑	No

Restrictions/limitations:

☑	Authorized	☐	Rejected	Signature	Karen W. Morrow Digitally signed by Karen W. Morrow Date: 2020.09.01 15:50:54 -04'00'	Date	9.1.2020

Form approved for use by: Timothy G. Suggs Digitally signed by Timothy G. Suggs DN: cn=Timothy G. Suggs, o=North Carolina State Crime Laboratory, ou=Quality Manager, email=tsuggs@ncdoj.gov, c=US Date: 2014.12.19 09:01:52 -05'00'

Technical Procedure for Physical Developer (PD)

1.0 Purpose - This procedure describes how to make the Physical Developer solution and apply it to items of evidence.

2.0 Scope - This procedure applies to porous items of evidence that are to be examined for the presence of latent prints. Physical Developer is a silver-based reagent that reacts with components of sweat in fingerprint residue to form gray deposits.

3.0 Definitions – N/A

4.0 Equipment, Materials and Reagents

4.1 Equipment and Materials

- Laboratory coat and gloves
- Magnetic stir bar and magnetic retriever
- Glass beakers
- Graduated cylinders
- Dark, shatter-proof container
- Forceps (soft tipped)
- Glass trays
- Camera/scanner

4.2 Reagents

- Ammonium Ferrous Sulphate
- Citric Acid
- n-Dodecylamine Acetate
- Ferric Nitrate
- Maleic Acid
- Silver Nitrate
- Synperonic N
- Purified water

5.0 Procedure – Physical Developer consists of a working solution which is made from a stock detergent solution, a redox solution, a maleic acid solution and other chemicals. The purified water used in preparing the solutions must be between 17 °C and 23 °C (or 62.6 °F and 73.4 °F). The glassware used in this technique must be cleaned thoroughly. Wipe all internal surfaces of the beakers with paper towels under cold tap water and rinse 3 times with purified water before use.

5.1 Chemical Preparation

5.1.1 Solution #1 – Maleic Acid

5.1.1.1 Place 1000 mL of purified water into a clean 2000 mL glass beaker with a magnetic stir bar.

5.1.1.2 Add 25 grams of maleic acid to the purified water and stir to ensure the solution is thoroughly mixed. Stir until all the maleic acid is dissolved, which will produce a colorless solution.

5.1.1.3 Transfer the solution to a dark, shatter-proof container.

5.1.1.4 The maleic acid solution may be made in larger quantities and stored for future use (unused maleic acid may be stored indefinitely).

5.1.2 Solution #2 – Redox

5.1.2.1 Place 1000 mL of purified water in a clean 2000 mL glass beaker with a magnetic stir bar.

5.1.2.2 Weigh the following chemicals and add them to the purified water, in the order listed, while stirring. Each must fully dissolve before adding the next.

- Ferric nitrate (30 g)
- Ammonium ferrous sulfate (80 g)
- Citric acid (20 g)

After all contents have dissolved in solution, stir for an additional 5 minutes.

5.1.2.3 Transfer the solution to a dark, shatter-proof container.

5.1.2.4 The Redox solution may be made in larger quantities and stored for future use (unused Redox solution may be stored indefinitely).

5.1.3 Solution #3 – Stock Detergent

5.1.3.1 Place 1000 mL of purified water in a clean 2000 mL glass beaker with a magnetic stir bar.

5.1.3.2 Add 4 grams of n-Dodecylamine acetate to the purified water while stirring.

5.1.3.3 Add 4 mL of Synperonic N to the solution and continue to stir for at least 30 minutes. A nearly colorless stock solution will be produced.

5.1.3.4 Transfer the solution to a dark, shatter-proof container.

5.1.3.5 The Stock Detergent solution must not be used until the solution is at least 24 hours old, ensuring that all solid matter has been dissolved. The Stock Detergent solution may be made in larger quantities and stored for future use (unused Stock Detergent solution may be stored for 1 year).

5.1.4 Solution #4 – Silver Nitrate

5.1.4.1 Place 500 mL of purified water in a clean 1000 mL glass beaker with a magnetic stir bar.

5.1.4.2 Add 10 grams of silver nitrate to the purified water while stirring. Stir for approximately 10 minutes or until all crystals are dissolved.

5.1.4.3 Transfer the solution to a dark, shatter-proof container.

5.1.4.4 Silver nitrate solutions may be stored for up to 1 year. The solutions must be stored in a dark shatter-proof container away from direct sunlight.

5.1.5 Working Solution

5.1.5.1 The working solution may be mixed and stored in a dark shatter-proof container at room temperature for 2 weeks. It is suggested that the working solution be mixed as needed. White sediment may appear but will not affect performance of the solution.

5.1.5.2 The following solutions must be mixed in the order listed.

5.1.5.3 Place 1000 mL of Solution # 2 (Redox) in a large clean glass beaker with a magnetic stir bar.

5.1.5.4 Add 40 mL of Solution #3 (Stock Detergent) and 50 mL of Solution #4 (silver nitrate) to the solution with continuous stirring.

5.1.5.5 Stir for an additional 3-5 minutes.

5.2 Processing Procedures

5.2.1 When processing items of evidence, 4 glass trays will be needed to complete the procedure. The purified water tray may be used for the initial and final step. The purified water must be replaced if any heavy contamination occurs while processing numerous items.

5.2.2 Forceps without serrated edges shall be used to handle or transfer item(s) from tray to tray.

5.2.3 Care must be taken to avoid any unnecessary creasing or rough edges on the item(s) as this may cause unwanted deposits of silver.

5.2.4 Place enough of each of the following solutions in the appropriate glass tray to completely submerge the item of evidence.

5.2.5 Tray #1 – Purified Water

5.2.5.1 Place the tray on an agitator and agitate the tray during this step.

5.2.5.2 Place the item(s) in tray #1 (purified water) for approximately 5-10 minutes. This will remove the previously applied chemicals and dirt which may be on the item.

5.2.6 Tray #2 – Maleic Acid

5.2.6.1 Place the tray on an agitator and agitate the tray during this step.

5.2.6.2 Place the item(s) in tray #2 (maleic acid) for approximately 5-10 minutes. Ensure that there are no bubbles noted on the item(s) prior to continuing.

5.2.7 Tray #3 – Working Solution

5.2.7.1 Place the tray on an agitator and agitate the tray during this step.

5.2.7.2 Place the item(s) in tray #3 (Working Solution) for approximately 10 minutes. Inspect the item(s) periodically to prevent overdevelopment of the impressions. The amount of time necessary to process items of evidence will vary depending on the number and size of the items.

5.2.8 Tray #4 – Rinse Tray

5.2.8.1 Tap water shall be used in this tray.

5.2.8.2 Allow the item to remain in the water for approximately 3-5 minutes. This will prevent further development of the impressions and remove unnecessary solutions from the item.

5.2.9 Remove the item from the rinse tray and allow the item to dry completely prior to proceeding. A hot-air dryer may be used to expedite the drying process; however, a hot iron should not be used as it may destroy the impressions. The developed impressions may be more visible after the drying process is completed.

5.2.10 Low contrast impressions may be improved by re-treating the item(s) with Physical Developer starting with the working solution. In the re-treatment process, it is not necessary to use the maleic acid solution. Visible impressions shall always be photographed prior to re-treating as there is the possibility they may be destroyed or over-developed.

5.2.11 Preservation of Developed Impressions – Preserve the developed impressions through photography (see Photographic Equipment/Procedures) and/or by electronic recording (see Image Processing).

5.2.11.1 In some cases, the photographic contrast of developed impressions may be improved when viewed with an alternate light source. The background material may fluoresce and the developed impressions will remain dark, which will assist in photographing the impression.

5.2.11.2 Physical Developer may be followed by sodium hypochlorite (bleach solution) to lighten the background and darken the developed impression (see Technical Procedure for Sodium Hypochlorite).

5.3 Standards and Controls – Forensic Scientists shall produce a self-made test print to be processed concurrently with items of evidence.

5.4 Calibration – N/A

5.5 Sampling – N/A

5.6 Calculations – N/A

5.7 Uncertainty of Measurement – N/A

6.0 Limitations

6.1 Physical Developer shall be used only after ninhydrin (and ninhydrin analogs) and zinc chloride.

6.2 The glassware used in this process shall be cleaned thoroughly.

6.3 After completion of all processes, wash beakers and trays with tap water and dry with a clean cloth or paper tissue. Stubborn stains shall be removed with a mild detergent (never use an abrasive cleaner) and rinsed with cold tap water for 10 minutes to remove detergent.

6.4 Long development times will indicate that the silver nitrate concentration has weakened and the solution(s) shall be discarded and new solutions mixed. If new solutions are mixed, be sure to thoroughly clean the trays and beakers prior to using the new solutions.

6.5 Solutions used in this technique shall not be reused.

6.6 Shelf Life

6.6.1 Ammonium ferrous sulphate, citric acid, n-Dodecylamine acetate, ferric nitrate, maleic acid, silver nitrate and Synperonic N - indefinite if stored properly.

6.6.2 Solution #1 (maleic acid) and Solution #2 (Redox) - indefinite.

6.6.3 Solution #3 (Stock /detergent) and Solution #4 (silver nitrate) - up to 1 year.

6.6.4 Working solutions - 2 weeks (it is recommended solutions be mixed when needed).

7.0 Safety

7.1 Silver nitrate and the solutions containing this chemical are corrosive and toxic and must be handled with extreme care.

7.2 Protective gloves, eyewear and clothing shall be worn. Avoid ingestion and inhalation.

7.3 The solutions will stain clothing and skin black; the stain will remain on skin for several hours after contact.

8.0 References

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Kent, T., ed. *Manual of Fingerprint Development Techniques: A Guide to the Selection and Use of Processing for the Development of Latent Fingerprints.* Police Scientific Development Branch, London (July 1992).

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Phillips, Clarence E., Douglass O. Cole and Gary W. Jones. "Physical Developer: A Practical and Productive Latent Print Develop." *Journal of Forensic Identification.* Vol. 40, 3: 135-147 (1990).

Trozzi, T.A., R.L. Schwartz and M.L. Hollars. *Processing Guide for Developing Latent Prints.* (2000): 1-64.

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Wertheim, P. A. "Physical Developer Processing." *Minutiae.* Issue 50 (2007).

Wilson, J.D., et al. "Examination of the Steps Leading up to the Physical Developer Process for Developing Fingerprints." *Journal of Forensic Science.* Vol. 52, 2: 320-329 (March 2007).

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9.0 Records – N/A

10.0 Attachments – N/A

Revision History		
Effective Date	Version Number	Reason
09/17/2012	1	Original Document
10/31/2013	2	Added issuing authority to header
08/29/2014	3	Correct reagent amounts and mL to g in 4.2 (n-Dodecylamine Acetate) and 5.1.4.2 (Silver Nitrate – 10 g) and correct wording in 5.1.3.5/6.6.3, 5.1.5.1/6.6.4, and 5.2.10/5.2.9
03/30/2017	4	Header Update – Removed Digital reference.
01/19/2018	5	Updated issuing authority in header 5.2.1 & 5.3 - Moved requirement for test print to "Standards and Controls." Changed magnetic follower to magnetic stir bar throughout.
02/01/2019	6	Changed number references to be numerals only instead of spelled out throughout document Changed "distilled" to "purified" throughout document 4.2: capitalization of chemical names; removed chemical amounts 5.2.11.2: corrected reference to technical procedure