Physical Developer

Table of Contents

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1 INTRODUCTION/SCOPE

Physical Developer is used by FBI Laboratory Friction Ridge Discipline personnel to develop latent prints on porous and semi-porous surfaces.

2 STANDARDS AND CONTROLS

See *Processing Overview* (FRD-300).

3 LIMITATIONS

A. All metal items, such as staples and paper clips, must be removed from item(s) prior to Physical Developer processing.
B. Metal tweezers cannot be used during processing.

4 EQUIPMENT

- Distilled water
- Citric Acid
- Maleic Acid
- Silver Nitrate
- Tween 20
- Decaethylene Glycol Monododecyl Ether (DGME)
- Ferrous Ammonium Sulfate
- n-Dodecylamine Acetate
- Ferric Nitrate

5 PROCEDURE

5.1 Solution Preparation

Personnel will prepare the solutions as follows. Alternative amounts may be prepared, provided the same ratio of chemicals mixed is retained.

5.1.1 Maleic Acid solution

A. Combine:
    - Maleic Acid - 25 g
    - Distilled water - 1000 mL
B. Stir until solid dissolves.

5.1.2 Tween 20 Solutions

5.1.2.1 Tween 20 Redox solution

In the order listed below, stir until each solid is dissolved before adding the next solid:

- Distilled water - 1000 mL
- Citric Acid - 20 g
- Ferric Nitrate - 30 g

- Ferrous Ammonium Sulfate - 80 g

5.1.2.2 Tween 20 Detergent solution

A. Combine:
   - n-Dodecylamine Acetate – 3 g
   - Synperonic N or Tween 20 – 4 g
   - Distilled water - 1000 mL

B. Stir until all chemicals dissolve.

5.1.2.3 Silver Nitrate solution

A. Combine:
   - Silver Nitrate - 200 g
   - Distilled water - 1000 mL

B. Stir until solid dissolves.

5.1.2.4 Tween 20 Physical Developer working solution

A. While stirring, combine in the order listed:
   - Redox solution - 1000 mL
   - Detergent solution - 40 mL
   - Silver Nitrate solution - 50 mL

B. Stir for at least three minutes.

5.1.3 DGME Solutions

5.1.3.1 DGME Redox solution

Stir until each solid is dissolved before adding the next solid:

- Distilled water - 900 mL
- Citric Acid - 20 g
- Ferric Nitrate - 30 g
- Ferrous Ammonium Sulfate - 80 g

5.1.3.2 DGME Detergent solution

A. Combine:
   - n-Dodecylamine Acetate – 1.5 g
   - DGME – 1.25 g
   - Distilled water - 1000 mL

B. Stir until solid dissolves.

5.1.3.3 Silver Nitrate solution

A. Combine:
   - Silver Nitrate - 200 g
   - Distilled water - 1000 mL

B. Stir until solid dissolves.

5.1.3.4 DGME Physical Developer working solution

A. While stirring, combine in the order listed:

- Redox solution - 900 mL
- Detergent solution - 50 mL
- Silver Nitrate solution - 50 mL

B. Stir for at least ten minutes.

5.2 Application

5.2.1 Tween 20 Application

Personnel will complete the following steps in order:

A. Immerse item(s) in Maleic Acid solution.
B. Agitate solution, manually or with orbital shaker, for a minimum of 15 minutes.
C. Immerse item(s) in Physical Developer working solution.
    1. Agitate solution, manually or with orbital shaker, for 10-15 minutes.
D. Immerse item(s) in first water rinse for at least 1 minute.
E. Rinse item(s) in second water rinse.
F. Dry item(s) in air or by applying heat with an iron, heater, or dryer.
G. Preserve appropriate friction ridge detail as applicable (e.g., digitally).
H. Record the specific Physical Developer formula used in the case notes.

5.2.2 DGME Application

Personnel will complete the following steps in order:

A. Immerse item(s) in Maleic Acid solution.
B. Agitate solution, manually or with orbital shaker, for a minimum of 10 minutes or until bubbles no longer form in the solution (whichever takes longer).
C. Immerse item(s) in Physical Developer working solution.
D. Agitate solution, manually or with orbital shaker, for approximately 15 minutes.
    1. If latent print over-development begins to occur, samples may be removed prior to the 15 minutes.
E. Immerse item(s) in first water rinse for at least 1 minute.
F. Rinse item(s) in second water rinse.
G. Dry item(s) in air or by applying heat with an iron, heater, or dryer.
H. Preserve appropriate friction ridge detail as applicable (e.g., digitally).
I. Record the specific Physical Developer formula used in the case notes.

5.3 Storage

A. Maleic Acid, Redox, and Detergent solutions may be stored in any type of laboratory acceptable receptacle.
B. Silver Nitrate solution must be stored in a dark bottle.
C. Physical Developer working solution is not stored and is prepared as needed.

5.4 Shelf Life

A. Maleic Acid and Redox solutions have indefinite shelf lives provided the reagent checks are satisfactory.

B. Detergent and Silver Nitrate solutions have shelf lives of 1 year provided the reagent checks are satisfactory.
C. Physical Developer working solution is not retained and is prepared as needed.

6 SAFETY

See FBI Laboratory Safety Manual for appropriate information.

7 REVISION HISTORY

Revision	Issued	Changes
04	07/01/2022	Format Updated. Section 1 – Scope updated.
05	10/15/2024	Synperonic N and Bleach rinse removed throughout and DGME solutions and application steps added. Distilled water added to equipment list. Requirement to record specific process used added.