



<b>ATF-LS-LP15</b> <b>Physical Developer</b>	Published Online: <b>March 2018</b>
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- I. **Scope:** Physical developer is a product devised specifically for the examination of wetted or water soaked porous items. This technique is a method which utilizes silver nitrate in an unstable ferrous/ferric redox solution in combination with a detergent solution. Unlike the conventional silver nitrate procedure which reacts with the chlorides of palmar sweat, physical developer deposits freed silver for the solution on any non-water soluble sebaceous material that may be present in a latent print residue. Although this technique was developed for water soaked items, it should be used on any porous item - water soaked or not. If used sequentially, in conjunction with ninhydrin and zinc chloride, the full evidence potential of each item can be realized as these techniques work on different types of residue.

Water soaked or wetted papers rarely contain sufficient amounts of amino acids or salts for effective examination with normal porous surface processes. Components in sweat are either completely removed or diffused throughout the surface. Previous attempts to visualize latent prints on wetted porous items involved air drying and magnetic powder. Under optimum conditions when greasy or oily impressions remain on the surface and fiber swell does not create traps for overall painting, magnetic powder will adhere to the residue. Since physical developer is an immersion process of high sensitivity, the reagent penetrates the porous material to detect any lipids which may be present. This reaction with residue other than palmar sweat increases the usefulness of physical developer as a post-treatment to items processed with ninhydrin and zinc chloride. However, physical developer cannot be used after the conventional silver nitrate procedure. Physical developer is a somewhat complicated procedure when initially attempted, but can be efficiently incorporated as an examination technique by batch processing eligible items.

Physical developer requires special care and exact adherence to procedures. Some glassware and utensils must be dedicated to the technique and reagent contamination must be avoided. In spite of these obstacles, the results often obtained can be so productive that it must be included when full evidence exploration of porous items is desired.

II. **References:**

Lee, Henry C.; Gaensslen, R.E., eds. *Advances in Fingerprint Technology*; Elsevier Science Publishers: NY, 1991.

Lennard, Christopher J.; Pierre A. Margot. "Sequencing of Reagents for the Improved Visualization of Latent Fingerprints"; *Journal of Forensic Identification*, September/October 1988, 38, 5, 197-210.

Kent, Terry, ed. *Fingerprint Development Techniques*; Heanor Gate Publisher: Derbyshire, England, 1993.

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

III. **Apparatus/Reagents:**

Stock Detergent Solution (1 liter of the stock detergent solution is sufficient to make 25 liters of Physical Developer - stock detergent has an indefinite shelf life.):

1. Pour one liter of distilled water into a 1500 milliliter beaker containing a large magnetic stir bar previously rinsed with distilled water.

2. Add 2.7 grams of n-Dodecylamine Acetate and stir with a magnetic stirrer. If some of the detergent sticks to the weigh boat, the weigh boat can be immersed in the solution.
3. Add 4 grams of Synperonic N. Place the weigh boat in the solution as the Synperonic N will adhere to the weigh boat.
4. Stir for thirty minutes.
5. Remove the weigh boats.
6. Pour the solution into a one liter glass bottle, transferring any material not yet dissolved. This solution must not be used for at least 24 hours. At this time there should be no visible solids.

#### **Maleic Acid Prewash:**

1. Pour one liter of distilled water into a 1500 milliliter beaker.
2. Add 25 grams of Maleic Acid and a large magnetic stir bar rinsed with distilled water.
3. Stir with a magnetic stirrer until all solids are dissolved.

#### **Silver Nitrate Solution:**

1. Pour 50 milliliter of distilled water into a 100 milliliter beaker.
2. Add 10 grams of silver nitrate and stir for one minute. If using a magnetic stir bar, you must rinse with distilled water. The chlorine in tap water would combine with the silver nitrate and form a milky colored solution (silver chloride), rendering the solution unusable. Never use tap water for any of the working solutions.

#### **Buffered Ferrous/Ferric Redox Solutions:**

1. Pour 900 milliliters of distilled water and place in the beaker and stir.
2. Rinse a large magnetic stir bar with distilled water and place in the beaker and stir.
3. Add the following chemicals in the order given making sure each chemical is fully dissolved before adding the next:
  - 30 grams of Ferric Nitrate
  - 80 grams of Ferrous Ammonium Sulfate
  - 20 grams of Citric Acid
4. Stir until all chemicals are dissolved and then stir an additional five minutes.

Combining the Component Solutions for Physical Developer (must be performed in this order)

1. Add 40 milliliters of the Stock Detergent Solution to the Redox Solution and stir.
2. Examine the Silver Nitrate Solution to ensure that all solid material has been dissolved. Add the entire Silver Nitrate solution to the redox/detergent solution and stir for two minutes.

Following the procedures noted above should result in approximately one liter of Developer. The solution should be prepared on an as needed basis as the combined working solution is unstable and should not be stored.

#### **Polymax Fixer Rinses:**

##### **Rinse 1**

1. Four or five drops of fixer per liter of tap water in a glass or plastic tray.

##### **Rinse 2**

1. Prepare normal photofix solution with tap water in a glass or plastic tray (one part photographic fixer to nine parts tap water).

**Bleach Solution:**

1. The bleach solution is made by diluting household bleach at a ratio of 1:1 with tap water.

**IV. Safety Precautions:** This procedure involves the use of hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution should be exercised and the use of personal protective equipment should be utilized to avoid exposure to dangerous chemicals. Consult the appropriate MSDS for each chemical prior to use. Take special care since n-Dodecylamine Acetate is possibly toxic via oral, inhalation or absorption through the skin. It is considered a severe hazard.

**V. Procedures:** The procedure for Physical Developer involves three stages; a prewash, reagent development and rinse. Since the working reagent is unstable a pre-treatment wash is necessary to avoid the introduction of contaminants to the reagent (unless the items to be processed are too fragile). The rinse stage removes contaminants and stabilizes the reaction.

**Step 1 - Maleic Acid Prewash:**

1. Pour enough maleic acid prewash to cover the item that is being processed into a glass tray.
2. Immerse the item in the solution for five to ten minutes or until bubbles are no longer given off.

**Step 2 - Physical Developer Solution:**

1. Pour enough Physical Developer to cover the item being processed into a glass tray.
2. Drain the items of excess prewash.
3. Immerse the items in the working solution and gently rock the tray.
4. Keep the items separated and be careful not to crease or handle the items extensively.
5. The processing time will vary from as little as one minute to as much as twenty minutes. It is important to monitor the development very closely to avoid over processing and obliteration of weaker impressions. Remove the item when optimum contrast is observed.

**Step 3 - Rinse:**

Two types of rinses are appropriate. The items can be rinsed in a tray of tap water with a constant gentle flow of water into the tray, or a two step photofix rinse can be employed.

**Photofix Rinse:**

1. After sufficient development in the physical developer solution place the item in the first photofix rinse for 30 seconds.
2. Rinse items for a second time in the standard photofix solution for three minutes.
3. Wash items under running tap water for three to five minutes.

**Step 4 - Drying:**

1. Allow the items to air dry on a flat surface. The items may be blotted carefully to speed the drying process taking care with fragile evidence.
2. Impressions developed with physical developer are relatively stable. However in most instances all developed impressions should be recorded.

**Step 5 - Bleach Solution (optional - should be used when trying to improve the contrast of darker**

impressions):

1. Record all developed impressions before moving to next step in process.
2. Place the item in bleach solution for two to three minutes.
3. Rinse the item under running tap water for two to three minutes.
4. Record any improved impressions.

**Quality Assurance/Quality Control:** Documentation of control testing of working solutions of Physical Developer shall be made using the appropriate reagent log. Test solution by placing test impressions on paper test strips and expose to working solution. If the test prints are visualized, the solution is working properly.

All equipment associated with the prewash and reagent must be dedicated. Scrupulously clean glass trays must be used. Beakers for mixing should be dedicated to each specific solution, and clearly labeled as such. Plastic or bamboo tongs without serrated edges should be used to handle the evidence being processed. Rinse trays can be the plastic photographic type, but must be clean. Physical Developer reacts with even trace amounts of various rubber products - rubber tipped tongs cannot be used. Similarly, certain gloves will leave trace on the evidence which can attract silver deposit - contact of the evidence with gloved hands should be avoided after the prewash. Processing of porous items with physical developer is similar to photographic development. Latent prints appear as dark gray images with increased contrast. The depletion of working solution is unpredictable due to the inherent instability of the reagent. Failure to produce an image may be due to insufficient reactive material present in the item, or exhaustion of the chemicals necessary to cause the reaction. Frequent use of test impressions is essential to insure proper reagent reactivity. Weaker impressions may benefit from additional processing with the physical developer solution. Items being retreated should not be subjected to fixing with photographic fixer and/or bleaching as these treatments will affect the success of the retreatment.

Articles which appear too fragile for the maleic acid prewash, such as charred papers or extremely water soaked items, may be introduced directly into the physical developer working solution. Such evidence should be treated one item at a time. The solution should be checked carefully for the effects of contamination. The use of plastic canvas as described by Clarence Philips, et al, may help when the items are too fragile to manipulate by other means. Usually contamination will precipitate the silver from the working solution in the form of dark reddish-brown particles resembling curds. Contaminated solutions should be discarded immediately.