

# THE DEVELOPMENT OF FRICTION RIDGE DETAIL ON A CLASS OF COUNTERFEIT CURRENCY

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## Abstract:

Physical Developer is routinely used to develop latent friction ridge detail on porous and semi-porous items. Physical Developer is a multi-step process that uses water-based solutions. Items that are produced with two pieces of paper and then secured together to form one piece are sometimes separated during processing. This separation allows for the detection of latent friction ridge detail on the protected, interior surfaces of the evidence.

## Introduction

Counterfeit Federal Reserve Notes (FRNs) are produced for financial gain to the counterfeiters and/or their organization by passing the counterfeit FRNs within the general public for goods and services. These FRNs are generally detected by businesses or banks who then notify the U.S. Secret Service – an agency whose mission includes the protection of the integrity of the financial obligations of the United States of America.

As the counterfeit currency (FRNs) is passed through the public, it is handled by a great many people. Extensive handling and exposure to adverse conditions (i.e., moisture, extreme temperature changes, contaminants) also challenge the Fingerprint Specialist's ability to develop identifiable latent prints.

In January 2000, a case with approximately 10,100 counterfeit \$100 FRNs was received as a result of an investigation of a foreign crime syndicate. It was determined that this class of FRNs was created by printing them on two pieces of paper, then securing the two pieces of paper together to allow for the placement of a security strip between the two pieces of paper to mimic that of genuine currency. These FRNs were subsequently submitted to the Forensic Services Division of the U.S. Secret Service for latent print examination. The counterfeit FRNs were processed for latent prints with Ninhydrin solution and then subsequently with Physical Developer<sup>[1]</sup>, the most frequently used reagents on counterfeit documents by the U.S. Secret Service.

## Methods

### *Ninhydrin (0.6% w/v)*

120 grams ninhydrin crystals  
1-liter 200-proof ethanol  
Mix together and dissolve the ninhydrin crystals.  
Add 19 liters petroleum ether.  
Agitate to ensure solution is mixed well.

Procedure: The FRNs were dipped and then allowed to air dry. When completely dry, the FRNs were placed in a humidity chamber set for 60% humidity at 60 degrees Fahrenheit for at least 45 minutes, or until Ruhemann's Purple reaction was observed. It should be noted that the evidence should be periodically checked to monitor the development as some items develop prints quicker than others and over processing can occur.

### *Physical Developer*

#### MALEIC ACID PREWASH:

1. One liter of distilled water.
2. Dissolve 25g of maleic acid in water.
3. Solution should be clear and colorless.
4. Store in glass or polyethylene container.

#### REDOX SOLUTION:

There are three stock solutions that are needed in order to make Physical Developer. One solution is a reduction-oxidation (REDOX) solution that reduces the silver nitrate to its metallic state (silver) as the iron is oxidized from the ferrous/ferric redox solution. The reduction of the silver occurs rapidly; however, the detergent/surfactant solution, added to the Physical Developer solution, prevents the uncontrollable reduction of silver into the solution. This enables the silver to slowly deposit onto the material it's reacting with, allowing the specialist to cease the development by rinsing the evidence with cold tap water.

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1. Measure 900ml of distilled water.
2. Dissolve 30g of ferric nitrate in water.
3. Dissolve 80g of ferrous ammonium sulfate in above solution.
4. Dissolve 20g of citric acid in above solution.

NOTE: Each chemical must be thoroughly dissolved before adding the next chemical.

#### DETERGENT SOLUTION:

1. Measure one liter of distilled water.
2. Dissolve 4g n-dodecylamine acetate in water.
3. Dissolve 4g or 4ml of Syperonic-N in the above solution.
4. The solution can be stored in a clear glass container.

Detergent solution may appear cloudy; however, make sure the solid substance is completely dissolved.

#### SILVER NITRATE SOLUTION:

1. Measure 100ml of distilled water.
2. Dissolve 20g of silver nitrate in water.
3. Store solution in amber bottle.

#### PHYSICAL DEVELOPER SOLUTION:

The following formula is used to make approximately one liter of the working solution of Physical Developer:

- 900ml of redox solution
- 40ml of detergent/surfactant solution
- 50ml of silver nitrate solution

Mix the detergent solution with the redox solution thoroughly and then add the silver nitrate solution. The detergent solution must be mixed before the silver solution; otherwise, the silver will not stay suspended in the solution.

**Procedure:** The FRNs were placed into trays containing distilled water and agitated on orbital shakers for approximately 15-20 minutes. It should be noted that the FRNs should not be crowded into a tray, as they must freely move within the solutions in order to achieve the best results and allow monitoring of latent print development. The distilled water was then removed and the FRNs agitated in the Maleic Acid solution for 20-30 minutes. These two steps remove the

Ninhydrin stains and other contaminants that may be present. The FRNs were then placed in the Physical Developer working solution for approximately 30 minutes, or until latent print development was observed. The Physical Developer was discarded and the FRNs were rinsed several times in tap water to remove the excess Physical Developer. The FRNs were placed on blotters to remove the excess water and then dried on a photographic paper drum dryer.

When working with these solutions, dispose of them in a manner that is within your jurisdiction's environmental and disposal guidelines.

#### Results

The processing resulted in the development of one hundred thirty-nine (139) latent prints on the exterior surfaces. However, it was noted that during the Physical Developer process, the FRNs would partially separate in the aqueous solutions into two pieces generally near the implanted security strip. After the FRNs were dried, those that had not previously separated in the aqueous solutions were gently pulled apart. It was then observed that an additional five hundred forty-seven (547) latent fingerprints had been developed on the interior surfaces (some latent fingerprints could be seen on the interior surfaces of the separated FRNs while still in the physical developer working solution). See Figure 1.



Figure 1 – Counterfeit FRN showing partial separation of glued pieces of paper. Note development of latent print on the protected inside surface.

The advantage of the subsequent Physical Developer examination was the development of the latent prints on the inside, or protected surfaces of the FRNs, which could not have been placed there by casual contact or as result of receiving the counterfeit as change from a business or trade transaction.

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## **Conclusion**

This one case dramatically shows the success that the U.S. Secret Service has had using Physical Developer for developing latent prints on currency. It is the continuous success that makes this technique valuable in the identification and apprehension of counterfeiters.

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## **References**

- [1] United States Secret Service, Procedure Manual for Latent Print Examinations.