A Comparison of Physical Developer Formulas

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Although the process is time consuming, using Physical Developer when other methods have failed could be the factor that helps solve a case.

On porous materials, a reaction occurs between the lipids, fats, oils, and waxes found in sebaceous sweat and the silver-based liquid reagent known as Physical Developer (PD) to produce a silver-gray deposit visible to the naked eye. Since these sebaceous components are not soluble in water, the PD latent print development technique is particularly useful on wet paper or paper that has previously been wet. When the amino acids in fingerprints have been washed away or failed to react with Ninhydrin, 1,2- Indanedione, or DFO; processing with PD may still produce identifiable latents. However, PD is time-consuming, expensive, destructive, and has a short shelf life. Therefore, one should only utilize PD as a final process in circumstances where it will be the most effective.

This preliminary study consists of comparisons made by the Canyon County Sheriff's Office Crime Lab in Caldwell, Idaho between a commercially, premixed PD kit and PD prepared in the laboratory. In addition to price determinations, three different types of paper were subjected to extended periods of environmental conditions prior to processing.

MATERIALS AND METHODS

The paper samples consisted of white printer paper, yellow lined notebook paper, and newspaper touched by several donors with their fingers and palms. One donor applied a full palm print to the center of each paper while the others applied fingerprints randomly to various areas. These latter prints were left unmarked so that the papers would be treated as though they were actual evidence. One sample of each type was then placed in one of two environmental conditions. The first set was placed in a drawer and allowed to age protected for approximately one month. The second set was exposed to the outdoor elements including snow, rain, wind, and sun for approximately seven hours and then allowed to dry indoors. Finally, each sample was cut in half for the two separate treatments and labeled as shown in Table 1.

Type of Paper	Environmental Conditions	Commercial Kit	Lab Prepared
White Printer	Exposed to Weather	A-1	A-2
Yellow Notebook	Exposed to Weather	B-1	B-2
Newspaper	Exposed to Weather	C-1	C-2
White Printer	Protected in Drawer	D-1	D-2
Yellow Notebook	Protected in Drawer	E-1	E-2
Newspaper	Protected in Drawer	F-1	F-2

Table 1.

The first step in either protocol involved soaking the papers in a slightly acidic pre-wash for at least five minutes to neutralize any alkaline binders and fillers which react strongly with PD. A Maleic Acid Pre-treatment Solution was prepared by stirring 50 g of maleic acid into 2 L of distilled water before transferring it to a clean plastic tray.

In the second step, the samples were removed from the prewash, placed in a clean glass tray containing PD, and soaked with agitation for approximately 15 minutes. An electric rocker was used to gently tilt the tray back and forth. The commercially prepared kit required combining one part (5 mL) of the 20% silver nitrate Solution A with eighteen parts (90 mL) of the reductant Solution B.

Preparing PD "from scratch" consisted of mixing three separate stock solutions that were combined in a specific order to form the Working Solution. For the Stock Detergent Solution, 2.7 g of the surfactant n-dodecylamine acetate was

dissolved in 1 L of distilled water. Synperonic A7 detergent was diluted by adding 1.5 mL to 98.5 mL of 30-40°C distilled water. Approximately 4 mL of the dilution was then added to the Stock Detergent Solution. Its purpose was to prohibit silver metal from depositing prematurely. The Silver Nitrate Solution contained 20 g of silver nitrate dissolved in 100 mL of distilled water to produce silver ions needed for deposition. A buffered ferrous/ferric reduction/oxidation system was established in the Redox Solution with 60 g of ferric nitrate, 160 g of ferrous ammonium sulfate, and 40 g of citric acid dissolved respectively in 1800 mL of distilled water. While continuing to stir the Redox Solution, 80 mL of the Stock Detergent Solution was added before finally adding the 100 mL of Silver Nitrate Solution.

The third step was to immerse the sample papers in a plastic tray with running water until PD was thoroughly washed out. The papers were then carefully removed and laid flat on towels to dry completely. Prints were further enhanced by submerging the samples in a 50/50 household bleach solution for several minutes to lighten the background.

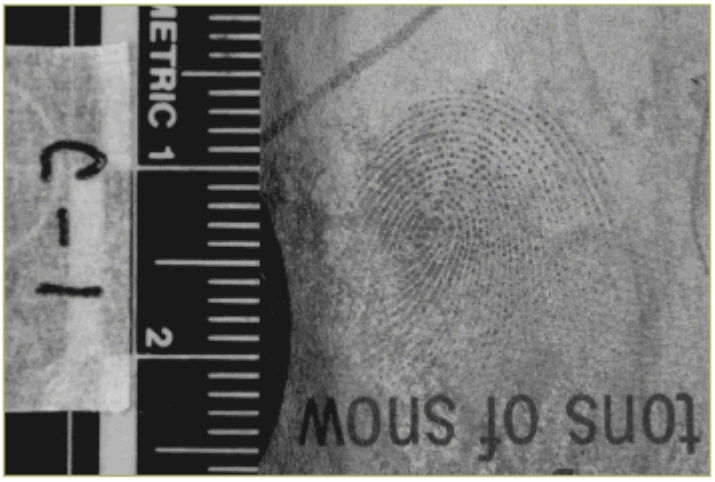

Figure 1. Newspaper exposed to elements and processed with commercial PD kit.

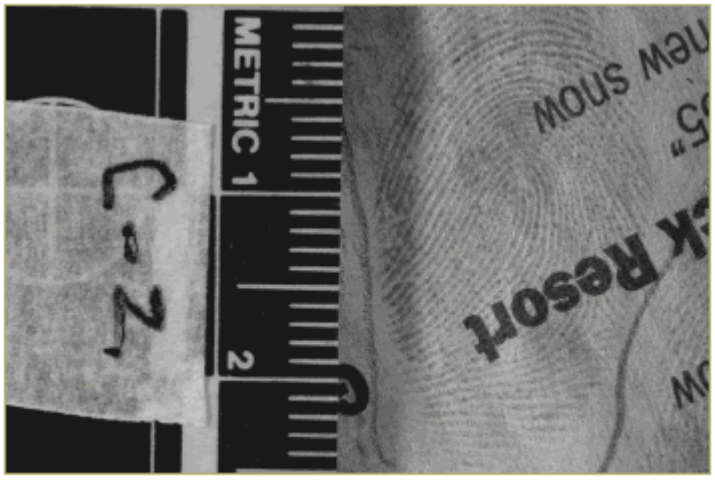

Figure 2. Newspaper exposed to elements and processed with PD prepared in lab.

RESULTS

Upon examination with a magnifier, viable prints were marked with pencil, photographed, and enhanced in Photoshop CS2. Our observations revealed that the newspaper reacted much better with PD mixed in the lab (Figures 1 and 2). The yellow notebook paper processed with lab PD also yielded better latent prints. The protected white printer paper had clearer results with the lab PD as well (Figures 3 and 4). The commercial kit only produced prints with more detail on the white printer paper subjected to the weather. The main difference between the two PD solutions was the cost to prepare

them. Although the lab PD took a little extra time to order materials and prepare, a crime lab will save approximately $5.30 per liter of Physical Developer.

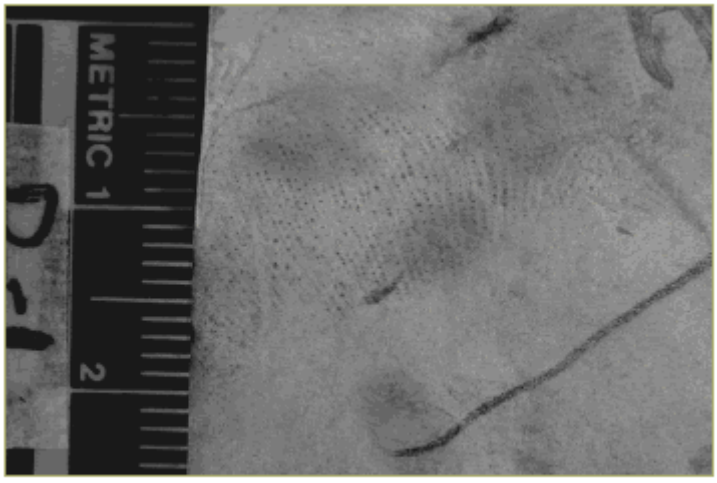

Figure 3. Printer paper aged in drawer and processed with commercial PD kit.

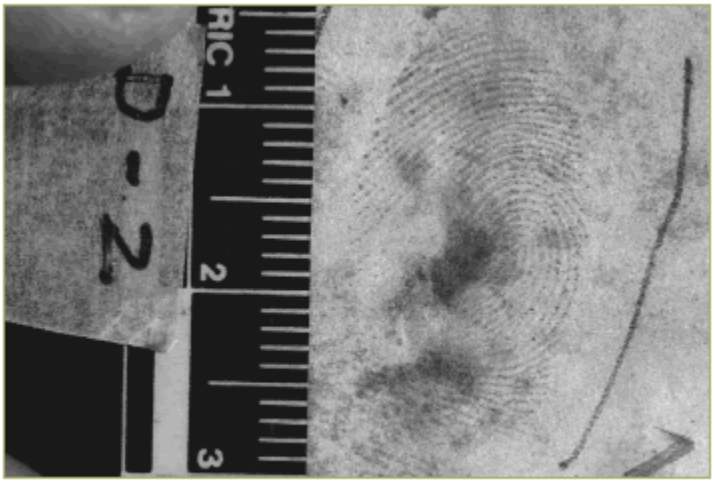

Figure 4. Printer paper aged in drawer and processed with PD prepared in lab.

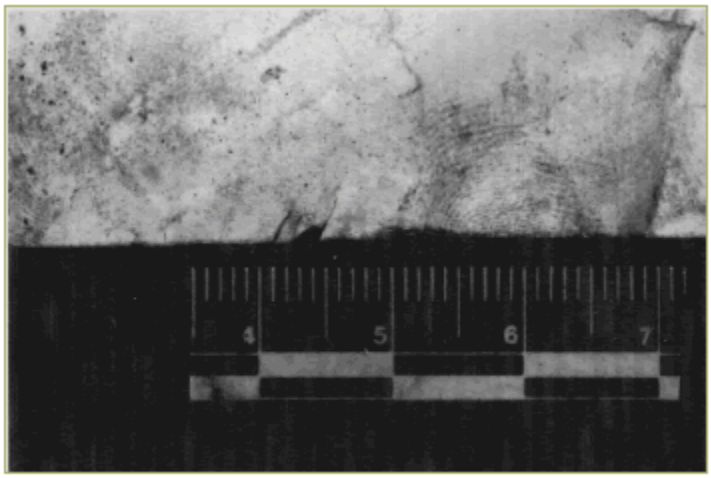

Figure 5. Paper evidence from a real case found in the desert after one month.

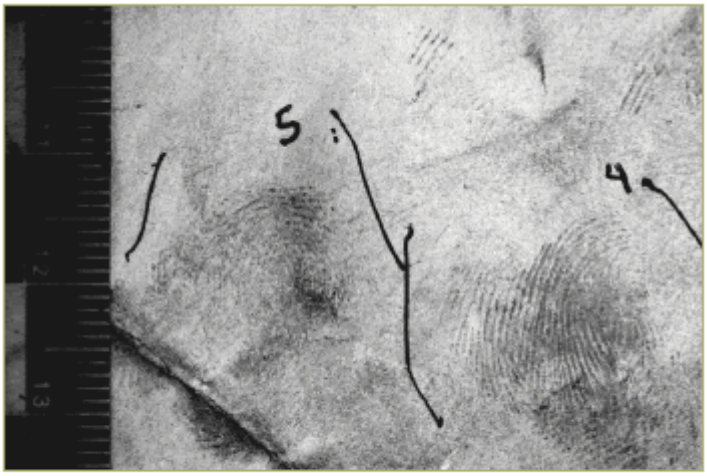

Figure 6. Paper evidence from a real case locked in storage for 24 years.

CONCLUSION

Physical Developer has been used to visualize latent prints on porous materials since the 1970s. Recently, two local cases reestablished the importance of this method. In one case, papers were found out in the desert after one month. DFO and Ninhydrin produced negative results, but processing with PD yielded 24 comparable prints (Figure 5). Paper evidence in another case had been placed in storage for 24 years. Again, Ninhydrin developed negative results. However, six visible prints were observed after utilizing lab-prepared PD (Figure 6). The ultimate goal of this article was to remind investigators about the benefits of taking that extra step. Whether one chooses to purchase the kit for convenience or the individual chemicals for cost efficiency, Physical Developer could reveal the one latent that solves a case.

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