



LIGHTNING
POWDER COMPANY, INC.

1230 Hoyt Street SE
Salem, Oregon 97302
Tel. 503-585-9900 or 800-852-0300
FAX 503-588-03-98 or 800-588-03-99
e-mail: info@redwop.com www.redwop.com

Technical Note No. 1-0038
September 2000

1,8-DIAZAFLUOREN-9-ONE (DFO)

TECHNICAL NOTES

Introduction

1,8-DIAZAFLUOREN-9-ONE (DFO) is a Ninhydrin analogue which reacts to the amino acids present in the body protein. Research has shown using DFO on paper evidence develops 2.5 times more latent prints than when Ninhydrin is the sole process used.

Safety

As with all chemicals, always read the MSDS (material safety data sheet) to learn about the health hazards of each chemical. Due to the flammable nature of some of these carriers, caution should be exercised in the use and storage of these solutions. They should be mixed and used in a fume hood. If no fume hood is available, the technician mixing and using these chemicals should be protected with a full-face breathing apparatus, gloves and other protective clothing. No one else should be near this operation unless similarly protected. DFO is classified as "Harmful if Swallowed."

Mixing Instructions

Solution One

3M has suggested a new solution using 3M™ Novec™ Engineered Fluid HFE-7100, a safe replacement for Freon. Freon has been banned because it is an ozone depleter.

1. In a 250 ml beaker, dissolve .25 grams DFO in 40 ml of methanol.
2. Add 20 ml acetic acid.
3. Continue mixing until all the DFO has dissolved into solution.
4. Transfer this "stock solution" to a one-liter beaker.
5. Stir in 940 ml of 3M™ Novec™ Engineered fluid HFE-7100.
6. Cover and allow the solution to settle for approximately 30 minutes. A thin oily-looking film may form on the top of the solution. This film consists of water, excess methanol and DFO and must be removed prior to use. This oily film can be removed by any of the following procedures:
 - a. If available, process the working solution through a separatory funnel. Again, allow the solution to settle for at least 30 minutes. Drain the bottom phase into a squirt bottle or storage container. Stop draining when the separate, clear-looking solution nears the bottom of the funnel, or approximately 50-100 ml of solution remains in the funnel. This remaining solution should be discarded in a proper waste container for flammable solvents as it consists of undissolved ethanol, water and ninhydrin.
 - b. If a separatory funnel is not available, use a pipette to skim the oily film from the top, again discarding the waste in a proper waste receptacle.
 - c. If neither a separatory funnel nor pipette is available, simply transfer the solution into a squirt bottle. This will help insure a clean solution. When the solution level is below the straw in the squirt bottle, discard the remaining solution in a proper waste receptacle.
8. When not in use, protect from direct light to preserve the shelf life of the solution.

3M™ Novec™ Engineered Fluid HFE-7100 is safe to use without a fume hood and does not run most inks. This formula is recommended by the British Home Office as an alternative to the Freon mixture.

Solution Two

DFO Stock Solution
0.5 gram DFO
100 ml Methanol
100 ml Ethyl Acetate
20 ml Acetic Acid
gives a total of
220 ml stock solution

DFO Working Solution-One Liter
220 ml DFO stock solution
780 ml Petroleum Ether
gives a total of
1,000 ml DFO working solution
Do not mix the working solution until you are ready to use it.

The DFO powder and the DFO stock solution have longer shelf lives than the working solution has. It is recommended to mix only enough working solution that will be used within two to three weeks. It may last longer than three weeks, but the effectiveness may be less.

STOCK SOLUTION: Measure and mix these solvents in a fume hood. While a magnetic stirrer is not necessary, it does make the mixing process go faster. Dissolve 0.5 gram of DFO powder in 100 ml of methanol. When the powder is dissolved, add 100 ml of ethyl acetate. When it is thoroughly mixed, add 20 ml of acetic acid. Store this solution in a dark brown glass or polypropylene bottle and label it.

WORKING SOLUTION: Measure and mix these solvents in a fume hood. Do not mix this solution until you are ready to use it. The manufacturer recommends for best results, do not use any working solution that is older than two to three weeks. If a liter (1000 ml) of working solution is needed, take the entire 220 ml of stock solution and add 780 ml of petroleum ether, mixing thoroughly. If less working solution is desired, halve or quarter the solutions accordingly.

Processing Instructions

The paper specimen should be dipped into the solution for ten seconds and allowed to dry. This step should be repeated, as two dippings and dryings seem to be better than one application. (Although it is *possible* to spray this solution, it is **not recommended** due to the health hazards involved and its inability to soak the specimen adequately.) Heat is then applied. While expensive chemical ovens can be used, a regular household toaster oven will work. The specimen should be heated for ten minutes at 100° C (212° F). View the paper item under a Forensic Light Source or laser.

As an alternative, a hair dryer or dry iron will work. If using one of these alternative heat sources, place a thick towel or other protective material on the counter first. Then, place a few paper towels on it, the paper evidence goes next and a few more paper towels on top of that. Apply dry heat to the surface for several minutes. A dry iron can be placed directly on top of the paper towels. It is possible to stop ironing to check the progress with a forensic light and, if the latent prints are not very bright, continue to iron for a few minutes longer. Sometimes this added application of heat will improve the results. The latent prints may or may not be visible to the naked eye, but should be viewed under a Forensic Light Source or laser.

Fluorescence Examination

DFO excels in the development of latent prints on white papers, most pastel colored papers and glassine envelopes/packets (commonly submitted in drug cases). Suggested viewing wavelengths with the orange goggles are 450, 485, 525, and 530 nanometers for most papers. Good results can be expected on manila envelopes, brown paper bags, cardboard, Kraft paper, and most yellow legal pad paper when viewed at 570 to 590 nanometers through a red filter. Experimentation is suggested with any piece of evidence to obtain the best amount of fluorescence with different colored goggles and different excitation wavelengths.

Sequential Processing

When DFO, Ninhydrin and Physical Developer are each going to be used in the processing of a specimen, DFO must be used as the first process if there is to be any fluorescence. DFO will not fluoresce on a specimen if the Ninhydrin compound has been applied first. However, for those agencies without a Forensic Light Source, applying DFO after Ninhydrin has been shown to enhance some latent prints. On some specimens Ninhydrin will develop prints that DFO fails to develop; therefore, in most instances, Ninhydrin should also be used. Physical Developer can then be used after Ninhydrin.

Photography

Latent prints developed with each process must be photographed before going on to the next chemical process, as each subsequent process may obliterate the latent prints developed from the previous one. It is necessary to use a filter over the camera lens when photographing a latent print illuminated with forensic light sources. Include a fluorescent scale in the photograph. Match the camera lens filter color to the color of the goggles being used to view the latent prints. A Nikon 056 equates to the orange goggles and a Wratten 29 equates to the red goggles. Any type of panchromatic black and white film will work, as will color print film and color slide film. For more information on fluorescence photography, request our free Fluorescence Photography technical note 6-0001.

Additional Reading

Fingerprint Detection by Fluorescence Examination by the British Home Office
Manual of Fingerprint Development Techniques by the British Home Office, second edition
An Introduction to Lasers, Forensic Lights and Fluorescent Fingerprint Detection Techniques by Dr.
E. Roland Menzel

Ordering Information

Catalog No. 1-0039 DFO, 1 gram
Catalog No. 1-0037 DFO, 5 grams
Catalog No. 1-2720 3M™ Novec™ Engineered Fluid HFE-7100, one gallon
Catalog No. 6-3847 Adhesive Fluorescent Scales, 2 in—50 mm, pack of 50
Catalog No. 6-3816 6 inch Fluorescent Scales, cardstock, pack of 10
Catalog No. 6-3885 INCH "L" Shaped Scale, Fluorescent, cardstock, pack of 5
Catalog No. 8-5015 HOME OFFICE/*Manual of Fingerprint Development Techniques*, 2ND edition
Catalog No. 8-5039 HOME OFFICE/*Fingerprint Detection by Fluorescence Examination*
Catalog No. 8-5043 MENZEL/*Intro to Lasers, Forensic Lights & Fluorescent Fingerprint Detection*

© 2000 Lightning Powder Company, Inc., Salem, Oregon, USA
Prepared by Kathleen D. Saviers, CLPE, CSCSA