Iowa Division International Association for Identification

Ninhydrin: Basic to Advanced

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ABSTRACT: Ninhydrin, an amino acid reagent, may be applied to porous surfaces in a variety of solutions to develop latent finger and palm prints. The choice of application depends on the surface being processed, the expertise of the examiner, and the equipment and supplies available. Several chemical formulas are discussed, along with methods of application. Choosing the correct formula and method in any given situation will maximize the chances of success while minimizing the hazards, both to the examiner and the evidence.

GENERAL CONSIDERATIONS

Ninhydrin (synonym: 1,2,3-triketo-hydrindene hydrate) has been recognized since around the turn of the century as a reagent for detecting amino acids. However, it was not until the mid 1950's that it was discovered ninhydrin could be used to develop latent prints on porous surfaces. When ninhydrin comes into contact withamino acids in fingerprint residue, the reaction yields a red to purple print.

While effective on virtually any porous surface, ninhydrin is most appropriate for paper. On wood, silver nitrate may yield prints with darker ridges and better contrast because sometimes faint purple ridges of a ninhydrin print may get obscured by the wood grain and brown background color. This discussion, therefore, will address the use of ninhydrin on paper.

Several variables come into play. First, the types of amino acids and their concentration in the print determine whether a reaction will occur. Second, the reaction is most effective in an acidic environment but many white papers have calcium carbonate fillers or whiteners. Such fillers result in a basic environment tin the paper unless a mild acid is added to the ninhydrin

reagent. Third, temperature and humidity influence the development of prints. Fourth, the strength of the ninhydrin and the type of carrier affect the reaction. With all of these variables, the development time and the darkness of the print may differ widely from case to case. it is always suggested that sample prints be placed on paper similar to that of the evidence processed as a control using the ninhydrin solution before actual evidence items are processed. Once the efficacy of the reagent solution has been established, the examiner may proceed with the evidence itself. Experience has shown that occasionally a latent print may only appear after several applications of ninhydrin.

If more than one method of chemical processing is to be used, the methods must be used in the correct order to avoid ruining the chances of subsequent success. On paper, the various methods should be used in the following sequence: 1) iodine fuming, 2) DFO (followed by florescence examination,) 3) ninhydrin, and 4) silver nitrate or physical developer. Not all methods may be advisable in all cases. Depending on the priority of the case and the resources available, an examiner may choose to use only one or two of these methods. But anytime a combination is chosen, the methods should be used in the correct sequence.

In many cases where fingerprints would be important, handwriting is also present on the paper. It should be recognized that any liquid soaking into the paper will alter the indentations left by the writing instrument. In addition, most chemicals used to dissolve ninhydrin also dissolve inks to some degree. Therefore, document examination should always precede fingerprint examination.

SAFETY CONCERNS

Many of the solvents used for ninhydrin are toxic and flammable, while even dry ninhydrin itself is harmful. Therefore, adequate safety precautions must be taken. Nitrile gloves should be worn rather than latex, as latex is soluble in many of the reagents but nitrile is resistant to chemicals. Goggles and a breathing mask should also be used. A lab coat should be worn o protect clothing. For safety reason, dipping the item into the solution or painting the solution onto the item with a cotton ball are preferable to spraying the solution onto the paper. because many of the solvents used are flammable, adequate ventilation should always be used and it should be ascertained that no source of flame or spark is present which might ignite fumes. A vent hood is recommended to remove fumes from the lab, both to remove any chance of explosion, and because many of the solvents and the ninhydrin itself may be hazardous.

PREMIXED SPRAYS

Several premixed sprays are available, including both aerosol cans and pump sprayers. Premixed sprays may be the most convenient way to purchase

ninhydrin. However, it is much less expensive to mix your own solutions. And while all of these premixed sprays work well when "fresh," their shelf life is measured in months, not years. Because the age of a container may not be known when purchased, and the conditions of storage and shipment are variable, there may be little uniformity from can to can. In addition, contamination may occasionally render a can of premixed spray not only ineffective, but damaging to the item being sprayed. Finally, spraying is no longer recommended as a method of application because of the excessive amount of both ninhydrin and carrier introduced into the air. Even when working under a vent hood, airborne droplets of solution may find their way back into the laboratory atmosphere.

MIXING YOUR OWN SOLUTIONS

While mixing your own solutions may not be quite as easy as using a spray can off the shelf, it is significantly less expensive and generally more effective for developing latent prints. A number of different solutions may be prepared, depending on the specific application involved and your comfort in mixing chemicals. Different solutions have different characteristics, as well as different advantages and disadvantages.

Solutions may be mixed ahead and stored for later use, or a small amount may be mixed sufficient only for the application at hand. Some solutions may require a "stock solution" and a "working solution." In those, a concentrated solution is prepared (the stock solution) and mixed with a carrier prior to use (the working solution.) You may select as simple or sophisticated a solution as you are comfortable with, and either mix it ahead or for each use separately. Since it is up to you, the examiner, to determine what is most appropriate and defend your choice in court, it is important that you be familiar with different methods and make an informed decision on which one to use. Two ninhydrin solutions are presented here for your consideration, one simple to prepare, the other slightly more sophisticated.

SIMPLE SOLUTION: NINHYDRIN IN ACETONE (or methanol, or ethanol)

The simplest solution to prepare is made by using a 25 gram jar of ninhydrin powder or crystals. Obtain a gallon (4 liters will do) can or jar of acetone from a paint store or chemical supply house. Pour the entire jar of ninhydrin powder into the gallon container and stir until completely dissolved. The solution is ready for use and should last a month or two if kept out of light and away from heat.

Because of shelf life concerns, unless you use a large amount of ninhydrin, it is not recommended you mix it all at once. Instead, by using approximately the proportions given above, smaller amounts of solution may be prepared. For example, for a single use amount for a forged check. a few spoons of acetone may be used, and a "pinch" of ninhydrin stirred in until dissolved. WARNING: Acetone dissolves most inks, and the writing on the check,

threatening letter, or drug ledger may be completely washed out using this simple method.

based on availability, methanol (methyl alcohol) or ethanol (ethyl alcohol may be preferred to acetone. Alcohols evaporate more slowly than acetone, and therefore the paper takes longer to dry. Also, the alcohols do not have as strong an odor os acetone, and one is less apt to be aware of breathing hazardous fumes. Like acetone, alcohols dissolve ink. Acetone and alcohols are flammable, so care must be exercised in keeping these solutions away from any source of ignition.

BETTER SOLUTION: NINHYDRIN IN HEPTANE

With the banning of freon, it is no longer possible to use of the most popular and effective solutions for ninhydrin. An alternate carrier has been sought for several years. The Police Scientific Development Branch of the Home Office, UK, recently found a suitable replacement formula using heptane. Their formula for ninhydrin in heptane is as follows:

Ninhydrin.....5 grams
Ethanol.....75 milliliters
Ethyl Acetate.....25 milliliters
Acetic Acid.....3 milliliters
Heptane.....1 liter

First, dissolve the ninhydrin in the ethanol, ethyl acetate, and acetic acid. Then add the heptane. The solution has a shelf life of several months. Heptane is flammable, so care must be exercised in keeping the solution and fumes away from any source of ignition. This solution results in only minimal running of ink and is very effective at developing latent prints. In fact, efficacy studies at the Home Office indicate this formula may even be more effective than the old freon formula.

CONCLUSION

When fingerprinting paper items, freshly mixed solutions are generally more dependable than premixed chemicals. if a document examination is appropriate, it should be done before fingerprint chemicals are applied. If more than one technique is to be tried, such as iodine or silver nitrate, the various techniques must be done in the correct sequence. From a safety standpoint, dipping the item in a tray of ninhydrin solution or painting the ninhydrin onto the surface with a cotton ball are preferable to spraying. Acetone or alcohol solutions are more likely to damage inks than a heptane formula. Nitrile gloves, a lab coat, safety goggles, and breathing mask should be worn at all times when working with ninhydrin powder or solutions.

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