

Technical Procedure for 1,2-Indanedione-Zinc

1.0 Purpose - This procedure describes how to make the 1,2-indanedione-zinc solution and apply it to items of evidence.

2.0 Scope - This procedure applies to porous items of evidence that are to be examined for the presence of latent prints. 1,2-indanedione-zinc reacts with amino acids present in fingerprint residue and produces fluorescent impressions when the reaction is complete.

3.0 Definitions – N/A

4.0 Equipment, Materials and Reagents

4.1 Equipment and Materials

- Laboratory coat and gloves
- Face shield visor and/or safety goggles
- Magnetic stir bar, and magnetic retriever
- Glass beakers
- Graduated cylinders
- Dark, shatter-proof container
- Weigh boats
- Forceps
- Fume hood
- Glass tray, paint brush, or aerosol sprayer (for application)
- Camera
- Dust or mist respirator (for application outside of fume hood)
- Humidity equipment

4.2 Reagents

- 1,2-Indanedione powder
- Ethyl acetate
- Glacial acetic acid
- Zinc chloride powder
- Ethanol
- HFE-7100
- Dichloromethane

5.0 Procedure

5.1 Chemical Preparation – Two chemical formulations of 1,2-indanedione-zinc are approved for use.

5.1.1 Zinc Chloride Stock (Solution 1)

5.1.1.1 Place 0.4 g of zinc chloride powder and a magnetic stir bar into 500 mL beaker.

5.1.1.2 Add 10 mL of ethanol to the beaker and stir until the zinc chloride powder has completely dissolved. Do not use heat.

5.1.1.3 Add 1 mL of ethyl acetate while stirring.

5.1.1.4 Add 190 mL of HFE-7100 to the mixture. Continue stirring for an additional 5 minutes.

5.1.1.5 Transfer the concentrate solution to a clean, dark, shatterproof container.

5.1.2 1,2-Indanedione-Zinc (Solution 1)

5.1.2.1 Place 0.8 g of 1,2-indanedione powder and a magnetic stir bar into a 1500 mL beaker.

5.1.2.2 Add 90 mL of ethyl acetate to the beaker and stir. Do not use heat.

5.1.2.3 Add 10 mL of glacial acetic acid and add to the solution while stirring.

5.1.2.4 Add 80 mL of the zinc chloride stock to the solution while stirring.

5.1.2.5 Add 820 mL of HFE-7100 to the solution. Continue stirring until the 1,2-indanedione powder has completely dissolved.

5.1.2.6 Transfer the resulting working solution to a clean, dark, shatterproof container.

5.1.3 1,2-Indanedione-Zinc (Solution 2)

5.1.3.1 Place 0.75 g of 1,2-indanedione into a 1,000 mL beaker with a magnetic stir bar.

5.1.3.2 Add 35mL of ethyl acetate to the beaker and stir. Do not use heat.

5.1.3.3 Add 0.5 mL of ethanol to the solution while stirring.

5.1.3.4 Add 0.02 g of zinc chloride to the solution while stirring.

5.1.3.5 Add 450 mL of HFE-7100 to the solution while stirring.

5.1.3.6 Add 15 mL of dichloromethane to the solution while stirring.

5.1.3.7 Allow completed solution to stir until all contents are completely dissolved.

5.1.3.8 Transfer the resulting working solution to a clean, dark, shatterproof container.

5.2 Processing Procedures

5.2.1 Chemical Application

5.2.1.1 Dipping Method – Completely submerge the item in the working solution for 5 to 10 seconds.

5.2.1.2 Brush Method – Dip the brush into the working solution and brush directly onto the item.

5.2.1.3 Spray Method – Spray the item with the working solution to completely saturate the item.

5.2.1.4 Allow the item to dry completely prior to proceeding.

5.2.2 Latent impressions will develop over time at room temperature. Several methods are available to enhance the development process.

5.2.2.1 Plastic Bag – Place the item in a sealed plastic bag until latent impressions develop.

5.2.2.2 Steam Iron – The iron is used to provide heat and moisture to the item. Hold the iron above the item and steam it, taking care to avoid contact between the item and the iron.

5.2.2.3 Microwave – Heat a tray or beaker of water in the microwave in order to produce steam. Place the item in the microwave for approximately 5 minutes, or until impressions develop. Do not turn on the microwave with the evidence inside and do not allow the evidence to contact the hot water bath.

5.2.2.4 Humidity Chamber – Items may be placed in a humidity chamber to assist in latent print development (See Technical Procedures for porous processing reagents for guidelines for the use of a humidity chamber). The chamber shall be checked periodically to ensure adequate moisture is present.

5.2.3 Preservation of Developed Impressions – Preserve the developed impressions through photography (see photographic equipment procedures) and/or by electronic recording (see Section Image Processing Procedure).

5.3 Standards and Controls – The Forensic Scientist shall produce a self-made test print to be processed concurrently with items of evidence.

5.4 Calibration – N/A

5.5 Sampling – N/A

5.6 Calculations – N/A

5.7 Uncertainty of Measurement – N/A

6.0 Limitations

6.1 Latent prints treated with 1,2-indanedione-zinc will fluoresce yellow under an alternate light source. Background fluorescence shall be considered when using this chemical.

6.2 Zinc chloride stock and 1,2-indanedione-zinc solutions shall be stored in dark, shatter-proof containers until needed.

6.3 Shelf Life

6.3.1 Zinc chloride stock - 6 months.

6.3.2 1,2-indanedione-zinc Solution - 3 months.

7.0 Safety

7.1 The process shall always be used in a fume hood as the fumes may cause some irritation when in contact with the eyes or skin and may be harmful if inhaled or ingested.

7.2 Protective goggles, gloves, and lab coats shall be worn at all times during processing.

7.3 Glacial acetic acid and ethyl alcohol are extremely flammable and shall be handled properly.

8.0 References

- Almog, J., Hirshfeld, A., and Klug, J.T. **Reagents for the Chemical Development of Latent Fingerprints: Synthesis and Properties of Some Ninhydrin Analogues.** *Journal of Forensic Sciences.* Vol. 27, No. 4. 1982, pp. 912 – 917.
- Cantu, A.A., Leben, D.A., Joullie, M.M., Heffner, R.J., Hark, R.R. **A Comparative Examination of Several Amino Acid Reagents for Visualizing Amino Acid (Glycine) on paper.** *Journal of Forensic Identification.* Vol. 43, No. 1. 1993, Pgs 44 – 66.
- Cava, M.P., Litle, R.L., Napier, D.R. **Condensed Cyclobutane Aromatic Systems. V. The Synthesis of some α -diazoindanediones: Ring Contraction in the Indane Series.** *Journal of the American Chemical Society.* Vol. 80. 1958, Pgs 2257 – 2263.
- Perkin, W.H., Roberts, W.M., Robinson, R. **XXVII. 1,2-diketohydrindene.** *Journal of the Chemical Society.* Vol. 101. 1912, pp. 232 – 237.
- Ramotowski, R., Cantu, A.A., Joullie, M.M., Petrovskaia, O. **1,2-Indanediones: a Preliminary Evaluation of a New Class of Amino Acid Visualizing Compounds.** *Fingerprint World.* Vol. 23, No. 90. 1997, pp. 131 – 140.
- Hauze, D.B., Petrovskaia, O., Taylor, B., Joullie, M.M., Ramotowski, R., Cantu, A.A. **1,2-Indandiones: New Reagents for Visualizing the Amino Acid Components of Latent Prints.** *Journal of Forensic Sciences.* Vol. 43, No. 4. 1998, pp. 744 – 747.

- Roux, C., Jones, N., Lennard, C., Stoilovic, M. **Evaluation of 1,2-Indanedione and 5,6-dimethoxy-1,2-indanedione for the Detection of Latent Fingerprints on Porous Surfaces.** *Journal of Forensic Sciences*. Vol. 45, No. 4. 2000, pp. 761 – 769.
- Almog, J., Springer, E., Wiesner, S., Frank, A., Khodzhaev, O., Lidor, R., et al. **Latent Fingerprint Visualization by 1,2-indanedione and Related Compounds: Preliminary Results.** *Journal of Forensic Sciences*. Vol. 44, No. 1. 1999, pp. 114 – 118.
- Wiesner, S., Springer, E., Sasson, Y., Almog, J. **Chemical Development of Latent Fingerprints: 1,2-indanedione Has Come of Age.** *Journal of Forensic Sciences*. Vol. 46, No. 5. 2001, pp. 1082 – 1084.
- Gardner, S., Hewlett, D.F. **Optimization and Initial Evaluation of 1,2-indanedione as a Reagent for Fingerprint Detection.** *Journal of Forensic Sciences*. Vol. 48, No. 6. 2003, pp. 1288 – 1292.
- Wilkinson, D., Mackenzie, E., Leech, C., Mayowski, D. **The Results from a Canadian National Field Trial Comparing Two Formulations of 1,8-diazafluoren-9-one (DFO) with 1,2-indanedione.** *Ident Canada*. Vol. 26, No. 2. 2003, pp. 8 – 18.
- Merrick, S., Gardner, S.J., Sears, V.G., Hewlett, D.F. **An Operational Trial of Ozone-Friendly DFO and 1,2-indanedione Formulations for Latent fingerprint Detection.** *Journal of Forensic Identification*. Vol. 52, No. 5. 2002, pp. 595 – 605.
- Kasper, S.P., Minnillo, D.J., Rockhold, A.M. **Validating IND (1,2-indanedione).** *Forensic Science Communications*. Vol. 4, No. 4. 2002, <http://www.fbi.gov/hq/lab/fsc/backissu/oct2002/index.htm>.
- Wallace-Kunkel, C., Lennard, C., Stoilovic, M., Roux, C. **Optimisation and Evaluation of 1,2-indanedione For Use as a Fingerprint Reagent and Its Application to Real Samples.** *Forensic Science International*. Vol. 168. 2007, pp. 14 – 26.
- Stoilovic, M., Lennard, C., Wallace-Kunkel, C., Roux, C. **Evaluation of a 1,2-indanedione Formulation Containing Zinc Chloride for Improved Fingerprint Detection on Paper.** *Journal of Forensic Identification*. Vol. 57, No. 1. 2007, pp. 4 – 18.
- Wilkinson, D. **Spectroscopic Study of 1,2-indanedione.** *Forensic Science International*. Vol. 114. 2000, pp. 123 – 132.
- Patton, Emma L.T., David H. Brown, and Simon W. Lewis. **Detection of Latent Fingerprints on Thermal Printer Paper by Dry Contact with 1,2-indanedione.** *The Royal Society of Chemistry Issue* 6. 2010, pp. 631-637.

9.0 Records – N/A

10.0 Attachments – N/A

Revision History		
Effective Date	Version Number	Reason
08/29/2014	1	Original Document
03/30/2017	2	Header Update – Removed Digital reference.
01/19/2018	3	Updated issuing authority in header. Added 5.1.3 for additional formulation. 5.3 – Moved requirement for test print to “Standards and Control.”
02/01/2019	4	Changed number references to be numerals only instead of spelled out throughout document 4.2: removed chemical amounts 5.1.3.5: corrected amount to show 450 mL 6.3.2: removed capitalization of chemical name 8.0: added citation