B25 1,2-Indanedione: Is it a Useful Fingerprint Reagent?

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After attending this presentation, attendees will gain an understanding of the fingerprint reagent 1,2-indanedione: its strengths, weaknesses and the inconsistencies reported over the last 8 years in terms of its value as a fingerprint reagent. Recommendations will be made based on the results of the research performed.

This presentation will impact the forensic community and/or humanity by the presentation of the results of this research which will contribute to the body of information already available on the value of 1,2-indanedione as a fingerprint reagent. Conflicting results have been reported to date. This study, under Australian conditions, indicates that 1,2-indanedione is a viable alternative to ninhydrin and DFO for latent fingermark detection on porous surfaces.

Ninhydrin is the accepted, routine reagent for the chemical detection of latent fingermarks on porous surfaces such as paper. Ninhydrin reacts with the amino acid component of the latent fingerprint deposit to produce a dark purple product known as Ruhemann's purple. Secondary treatment of a ninhydrin-developed mark with a zinc or cadmium metal salt produces a coordination complex that is luminescent under certain conditions. Significant enhancement is possible in the luminescence mode. Numerous research projects have been undertaken since the early 1980s to find ninhydrin analogues that offer advantages over ninhydrin itself.

In 1995, whilst researching ninhydrin analogues, Jouillé and coworkers, in conjunction with the U.S. Secret Service, synthesised a new type of latent fingerprint visualising agent, 1,2-indanedione (Ramatowski, 1997). Since then, researchers around the world have conducted research into the capabilities of 1,2-indanedione as a fingerprint reagent. The results have been varied, with conflicting results and different recommendations made.

A critical review of the literature regarding 1,2-indanedione was performed. A number of discrepancies exist in the literature as to which formulation and which development procedure produces optimal results. As a result, this project set out to determine the best formulation and development procedure under Australian conditions, encompassing all published recommendations as well as some novel approaches. 1,2-Indanedione formulations were compared with respect to initial color, luminescence, concentration of reagent, acid concentration, and the effect of different carrier solvents.

Numerous development conditions were investigated, including a conventional oven, a heat press, humidity, metal salt treatment and liquid nitrogen. A heat press set at 165º C for 10 seconds proved to give the best initial color and the highest luminescence. Secondary metal salt treatment improved initial color and luminescence. The Polilight (Rofin), the VSC2000 (Foster & Freeman), and the Condor Chemical Imaging Macroscope (ChemImage Corp) were used to detect the fingerprints developed with 1,2-indanedione on a variety of highand low-quality porous surfaces. Overall, very good results were obtained.

The optimum formulation for 1,2-indanedione was found to be a 1% (w/v) solution using HFE 7100 as the carrier solvent. 1,2-Indanedione treated fingermarks were best developed using a heat press set at 165º C for 10 seconds, after which they display a bright pink initial color and a high degree of luminescence at room temperature.

Field tests were also conducted to compare 1,2-indanedione with DFO and ninhydrin, showing that 1,2-indanedione develops more fingerprints than the conventional reagents and thus should be considered as a viable alternative for the development of fingerprints on porous surfaces. It is obvious that 1,2-indanedione, as a fingerprint technique, is very much dependant on environmental conditions, reagent formulation, and development conditions for optimum results to be obtained. It is for this reason that different research groups around the world have had varying results with respect to the application of this reagent.

It has been well established that ninhydrin reacts with amino acids to form Ruhemann's purple. Very little information on the chemistry of 1,2indanedione exists in the literature and the product formed upon reaction with amino acids has not been confirmed to date. The current research aims to characterize the reaction product using fluorescence spectroscopy, infrared spectroscopy, UV-visible spectroscopy, mass spectroscopy, and nuclear magnetic resonance spectroscopy.

Latent Fingermarks, Porous Surfaces, 1,2-Indanedione

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