A172 Latent Print Development Using Low Pressure Sublimation Vapor Deposition: Evaluation of a Prototype System

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After attending this presentation, attendees will be introduced to novel technology designed to improve the process of developing latent fingerprints using many of the traditional chemical and physical development methods while eliminating the need for the use of any hazardous and destructive chemical solvents.

This presentation will impact the forensic science community by discussing the mechanical operation of the system; the results of a performance evaluation comparing the quality of latent fingerprints developed using this system to traditional processing methods, and other improvements this system may provide over traditional processing methods for the development of latent fingerprints.

Numerous and various processing methods for the development of latent fingerprints have been introduced over the years, but many require costly hazardous and destructive chemical solvents to yield successful results. Chemical solvents are the most significant contributor to the destructive nature of latent print examinations. Because of this, laboratory examinations of evidence must adhere to specific processing sequences through the various forensic science disciplines in order to minimize or eliminate the potential loss of evidence as a result of a particular examination method. Novel technology involving a sublimation gas injection delivery system into a low pressure chamber environment has been developed in a prototype form to eliminate the use of chemical solvents for many of the most common processing methods for the development of latent prints. Each of the current processing methods can be achieved using this technology.

The performance of this prototype system was evaluated by comparing the quality of latent fingerprints developed using seven common traditional processes: (1) Cyanoacrylate Ester; (2) Cyanoacrylate Ester/Rhodamine 6G; (3) Cyanoacrylate Ester/Fluorescent Powder; (4) Fluorescent Powder; (5) Iodine; (6) 1,2-Indanedione; and, (7) Ninhydrin. Eleven different substrates were used in this evaluation consisting of porous, non-porous and semi-porous substrates (including some with thermosensitive layers). Three latent fingerprints were deposited on each substrate sample using the appropriate latent print standard matrix. Each latent fingerprint was cut in half and processed separately using the comparable processing method (i.e. Cyanoacrylate ester, Ninhydrin, etc.). One half was processed according to established procedures for each traditional processing method and the other half was processed with the comparable processing method using the prototype system. The halves of each latent fingerprint were re-joined and photographed. Each image was digitally processed to convert the images to gray-scale to maintain anonymity of the processing method and minimize potential interpretation bias during the evaluation of each latent fingerprint. Each latent fingerprint was digitally presented to six Latent Print Examiners to evaluate whether one half of the latent print contained friction ridges that developed with higher quality and clarity or whether there was no distinguishable difference in the quality and clarity of development. Further examinations were carried out to determine if the processing regime using this low pressure system had any negative effect on other forensic examinations (Drug Chemistry, Forensic Document, and DNA). The Drug Chemistry evaluation consisted of placing a known sample of cocaine on sheets of multi-purpose office paper (20lb), cutting the samples in half and processing one half through each latent print processing method while retaining the other half as a standard control. Cocaine was used as a representative drug sample since it approximates the analytical behavior of most other drugs. Following the latent print processing, all samples and controls were analyzed using a GC-MSD. The Forensic Document evaluation consisted of an analytical comparison of six different ink marks and one pencil mark placed on a standard sheet of multi-purpose office paper (20lb). One set of samples were processed using each of the latent print processing methods in the low pressure system. One set of samples remained unprocessed as a control. Following the latent print processing, six different analytical methods were employed to detect chemical differences in the ink and pencil samples as a result of the latent print processing method. The DNA evaluation consisted of placing a sample of saliva on sheets of mult-purpose office paper (20lb), cutting the samples in half and processing one half through each latent print processing method while retaining the other half as a standard control. Following the latent print processing, saliva samples were evaluated to determine if DNA inhibition and/or degradation was present.

The overall results of the quality of developed latent prints were comparable to traditional processing methods. The Drug Chemistry results were analyzed and revealed conclusive results for cocaine with no apparent interference from any of the latent print processing methods using the low pressure system. The Forensic Document results were analyzed with variable results. For all latent print processes using the low pressure system, except for 1,2-Indanedione, one or more of the Forensic Document analytical methods indicated the latent print processing method negatively affected one or more of the ink and pencil samples. The DNA results were analyzed and revealed full DNA profiles from all samples with no apparent inhibition or degradation.

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The results of this study indicate this method of developing latent prints using a low pressure sublimation vapor deposition system may provide improvements over traditional processing methods. In addition to the overall quality of developed latent prints being comparable to traditional processing methods, other improvements are related to the process, cost, and safety of developing latent fingerprints on multiple forms of evidence (porous, non-porous, semi-porous), no known interference with drug chemistry and DNA examinations, elimination of hazardous and destructive chemical solvents due to the dry process, standardized processing regimens programmed into the system computer, and the ability to rely on the single system for many of the most common processing methods for the development of latent prints.

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Forensic Science, Low Pressure Deposition, Fingerprint Development

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