A Comparison of Cyanoacrylate, Ninhydrin, and Gellifters for the Development of Latent Prints on Latex Gloves.

Stephanie A. Johnson[1]*, BA, D/Sgt. Jay M. Peterson[2], BS, Catherine G. Rushton[1], MSFS, and Pamela J. Staton[1], PhD

[1]Marshall University Forensic Science Program, 1401 Forensic Science Drive, Huntington, WV 25701, [2] Michigan State Police Marquette Forensic Laboratory, Marquette, MI 49855.

Abstract

Latex gloves are notoriously difficult substrates for developing latent prints due to varying degrees of texture, fit and many other variables. This experiment compared three commonly used development techniques, cyanoacrylate fuming with magnetic powder, ninhydrin, and black gellifters, to determine which produced the best results. Samples were processed after being stored for varying amounts of time to determine whether or not time affected the quality of the results. Results indicate that the cyanoacrylate and the gellifter techniques produce comparable results, with the gellifter producing a slightly higher percentage of identifiable prints. The ninhydrin technique produced no identifiable print. Additionally, the amount of time the gloves were allowed to sit did not appear to affect the quality of the results.

Introduction

In the past it has been difficult to develop latent prints on latex gloves and two of the more common techniques, ninhydrin and cyanoacrylate (CA) fuming, don't always provide results of good quality consistently. Since labs often have limited funding, resources, and time, it is important to find a simple, cost-friendly and effective technique for developing latent prints on latex gloves. A newly proposed technique of using black gellifters has given good results in a recent study by Velders (2004) and requires very little processing and time. This current project compared ninhydrin and CA with magnetic powder to the more recently proposed method of using black gel lifters to develop latent prints on latex. The project also aimed to determine whether time was a factor in the quality of the results and the methods were tested on worn glove samples which were previously stored for varying amounts of time. This experiment helped to shed light on the most effective method for developing latent prints on latex gloves as well as the effect of time on results.

Materials and Methods

Sample Collection

- A rating system was developed using test prints which was then used to rate any prints that were developed during research.
- Participants wore size large powder free latex exam gloves for 15 minutes, with a period of at least 15 minutes before wearing the next pair of gloves
- While on the hands, the tips of the fingers were outlined surrounding the primary part of the fingerprint region.
- Gloves were removed by peeling off from the cuff at a moderate/slow and relaxed speed and a circle was drawn in the middle of the palm region on the now inverted glove where a print was then laid down.
- Gloves were separated into 8 different age groups: 1 day, 3 days, 1 week, 2 weeks, 3 weeks, 4 weeks, 5 weeks and 6 weeks
- Gloves were stored in cardboard boxes at room temperature until processed.

Fig 1. Gloves Before Processing with Fingers and Palm area Circled

CA and Magnetic Powder

- Fisher Hamilton fuming hood
- 3-4 drops of Loctite Hard Evidence Cyanoacrylate Fingerprint Developer
- ~ 2 cups hot water
- 12 minutes
- Sirchie silver/black magnetic latent print powder

Fig 2. Gloves Processed with CA and Powder

Ninhydrin

- FDC185 model Sanyo Gallenkamp PLC humidity chamber
- Dry bulb temperature of 80.0°
- Wet bulb temperature of 70.0°
- 10 minutes

Fig 3. Gloves Processed with Ninhydrin

Gellifters

- No prior chemical/physical processing
- Black gellifters cut into 4.3 cm x 6 cm pieces from 13 x 18 cm sheets.
- Expo "Click" retractable dry erase marker was used to fill out the fingers and roll the finger across the gellifter 2-3 times , serially

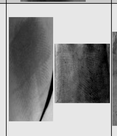
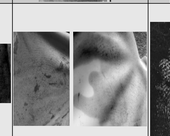
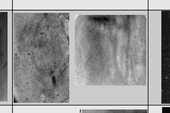
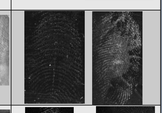
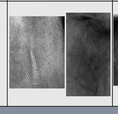
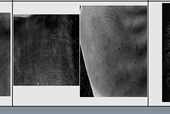
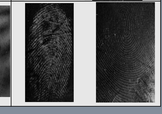
Fig 4. Processing Gloves with a Gellifter

Photography

Prints were photographed using a Fujifilm FinePix S5Pro digital camera with a Nikon 60 mm F2.8 lens, with ISO 100 sensitivity, auto exposure and no flash. Photos were obtained using the Fujifilm Studio Utility version 1.0.2.3 program on Windows XP and were enhanced in Adobe Photoshop CS3 version 10.0.1

Results

Table 1. Rating Scale for Cyanoacrylate, Ninhydrin and Gel Lift Techniques Including Score, Description and Examples

Level	Description	Cyanoacrylate	Ninhydrin	Gel Lifts
0	No fingermark or print present, or a mark which lacks all levels of detail in sufficient quality.			
1	A mark which lacks 3rd level detail and which has 2nd level detail present but not sufficient to make an ID. An overall pattern (1st level detail) may or may not be present			
2	A print with sufficient 2nd level detail to make an ID, but lacking in either 1st or 3rd level detail			
3	A print with good clarity in 1st, 2nd, and 3rd level detail allowing for an ID			

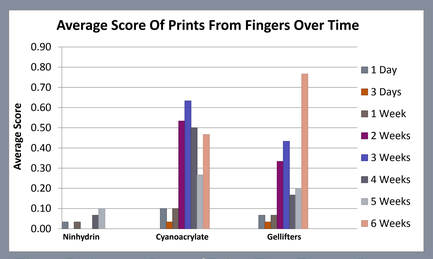


Figure 5. Average Score of Prints From Fingers Over Time for each Method

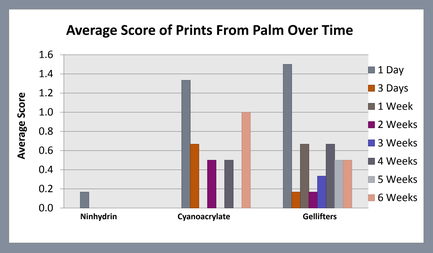


Figure 6. Average Score of Prints From Palm Area Over Time for each Method

Table 2. Score Distribution and Percentage of Identifiable Prints for each Method

Fingers					
Method	0	1	2	3	% ID
Cyanoacrylate	184	45	7	4	4.6
Ninhydrin	234	6	0	0	0.0
Gellifter	197	31	7	5	5.0
Palm					
Method	0	1	2	3	% ID
Cyanoacrylate	30	12	6	0	12.5
Ninhydrin	47	1	0	0	0.0
Gellifter	27	17	2	2	8.3

Using the number of prints given a score of 2 and 3, the percent of identifiable prints was calculated for both locations on the glove by dividing the total number of results given a score of 2 or 3 by the total number of prints

Figure 7. Print with a Score of 3, Developed with Cyanoacrylate in Week 2

Figure 8. Print with a Score of 3, Developed with Cyanoacrylate Week 2

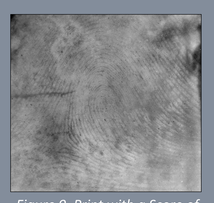


Figure 9. Print with a Score of 3, Developed with Cyanoacrylate in Week 4

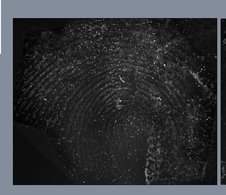


Figure 10. Print with a Score of 3, Developed with Gellifter Week 2

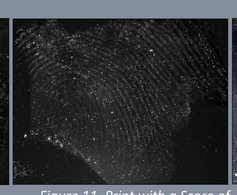


Figure 11. Print with a Score of 3,Developed with Gellifter in Week 2

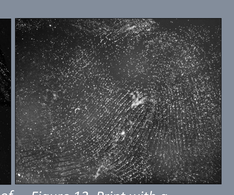


Figure 12. Print with a Score of 3, Developed with Gellifter in Week 6

Discussion

- Gellifters and CA produced comparable results in both areas.
- Ninhydrin produced no identifiable prints and consistently produced less ridge detail throughout the entire experiment.
- Ninhydrin also produced significant background staining of the glove which could have affected the visibility of results.
- The gellifters yielded more prints with a score of 3, and given that the CA and gellifter methods appear to be equal in their ability to develop prints on latex gloves, the fact that the gellifter produces more clear detail could give it an edge above CA.
- Time does not appear to affect the quality of results as prints with a score of 3 were present all the way up through 6 weeks.
- The biggest factor in the quality of results obtained was the fit of the glove

Conclusion

Cyanoacrylate with magnetic powder and the gellifter methods seemed equally effective at developing latent prints on latex gloves. However, the gellifters captured more prints with 3rd level detail which would make it more ideal. Ninhydrin proved to be quite unsuccessful at developing latent prints and is not recommended for use on latex gloves. Further research should be done to optimize other methods for use with latex gloves such as comparing powders, dyes and alternative light sources after cyanoacrylate fuming, or by focusing on the different degrees of texture to see if any methods work well on gloves which are more textured.

References

Causin V, Marega C, Marigo A, Carresi P, Della Guardia V, Schiavone S. A method based on thermogravimetry/differential scanning calorimetry for the forensic differentiation of latex gloves, Forensic Science International 2009; 188: 57-63.

Georgia Bureau of Investigation Forensic Science Division. GBI Latent Prints Information [Internet]. (GA): n.d. [cited 2011 Aug. 11]; [about 4 screens]. Available from:http://dofs.gbi.georgia.gov/00/article/0,2086,75166109_75730407_128595732,00.html

Jelly R, Patton E L, Lennard C, Lewis S W, Lim K F. The detection of latent fingermarks on porous surfaces using amino acid sensitive reagents: A review, Analytica Chimica Acta 2009; 652: 128-142.

Jones N. Metal deposition techniques for the detection and enhancement of latent fingerprints on semi-porous surfaces [dissertation]. Sydney, Australia: University of Technology Sydney; 2002 July 5. 203 p. Department of Chemistry, Materials and Forensic Science, Sydney, Australia, http://hdl.handle.net/2100/1026

Paine M, Bandey H L, Bleay S M, Willson H. The effect of relative humidity on the effectiveness of the cyanoacrylate fuming process for fingermark development and on the microstructure of the developed marks, Forensic Science International 2011; Available from: http://www.sciencedirect.com/science/article/pii/S0379. Accessed 2011 Aug. 9. Article in Press

Smith M A. Latent Fingerprints on Latex Gloves [report on the Internet]. (IA): Iowa Division of the International Association for Identification; n.d. [cited 2011 Apr. 20]. [about 3 screens]. Available from: http://www.iowaiai.org/latent_fingerprints_on_latex_gloves.html

Sodhi G S, Kaur J. Detection of Latent Fingerprints: A Review, The Indian Police Journal 2009; 56 (3): 62-66.

Velders, M.J.M. Visualization of latent fingerprints on used vinyl and latex gloves using Gellifters. Bureau voor Dactyloscopische Artikelen [BVDA]: International Association of Identification; 2004 Aug.; St. Louis (MO): BVDA; 2004, 10 p.

Acknowledgements

The materials and facilities for this research were provided by the Michigan State Police Marquette Forensic Laboratory. A special thanks to D/Sgt. Jay Peterson of the Marquette crime lab for supervising and lending his knowledge and experience to the project. I would also like to thank Mrs. Catherine Rushton and Dr. Pamela Staton for advising and reviewing my research.