B156 Development of a Method to Produce Lead Particle Patterns

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Attendees will learn how to make reproducible lead oxide particle patterns of know amounts of lead oxide on various substrates.

This presentation will impact the forensic community and/or humanity by assisting individuals interested developing improved methods of visualizing lead particle patterns and recovering GSR particles.

This research involves the development of a simple procedure to produce lead particle patterns on paper or cloth that resemble those used to estimate muzzle to target firing distances. Forensic examiners have long used the patterns produced on the target by lead particles and burned and partially burned smokeless powder particles to estimate the distance between the muzzle of a firearm and the object through which the bullet passed. Test patterns for evaluation of method variations were produced by firing a weapon from different distances into a piece of filter paper or cloth. This usually requires a trip to a firing range and produces rather variable patterns due to inconsistencies in the amount of smoke and lead produce by a weapon from shot to shot. In addition, it would be convenient to be able to measure the efficiency of various gunshot residue (GSR) recovery techniques. To be able to do valid comparisons it is necessary to be able to control the amount of lead deposited on the substrate. This is virtually impossible when producing patterns in the normal way at a firing range.

The authors have tried to develop a laboratory method for producing patterns of fine lead oxide particles, similar to muzzle to target patterns, on paper and cloth substrates. One can purchase very fine lead oxide powders in the size range of GSR particles[1]. Suspending these particles in water, similar to the molybdenum sulfite suspensions used for the fingerprint reagent "small particle reagent"[2], followed by delivering a known volume of the solution to the target would allow the delivery of a known amount of lead oxide to the target. A simple squirt gun can be used to produce fairly tight patterns similar to those produced at several inches by most firearms. To produce more diffuse patterns, similar to those observed from shots of one foot or greater distances, a simple spray bottle can be used. By weighing the squirt gun or spray bottle before and after a "squirt" one can calculate the amount of liquid delivered to the target. By knowing the concentration of the lead oxide in the suspension one can calculate the amount of lead being delivered to the target. Using varying concentrations of lead oxide in the suspension allows control of the amount delivered over a fairly large range.

Three different substrates were usedfilter paper, Whatman 3MM, Electrophoresis blotting pads S&S and white cotton cloth. It was found that using an inexpensive squirt gun fairly reproducible patterns could be generated by firing vertically down from a range of three to five feet. Using a spray bottle a more diffuse pattern could be made spraying from six inches to twelve inches in a horizontal direction. The patterns were visualized using the standard two step-sodium rhodizinate method[3]. As expected the diameter of the pattern increased as the distance increased. Similar patterns over a number of shots were reproduced. The patterns produced at the same distances on all three substrates were very similar in appearance.

By weighing the squirt gun filled with distilled water it was determined that it deliver 0.40 g of water quite reproducibly. A lead stock solution containing 15g of lead oxide in 500 ml. of water was prepared. It was found that the patterns produced with this solution were too concentrated to resemble gunshot patterns. A working solution was prepared by diluting ten ml. of the stock solution to one hundred ml. This working solution was used to obtain patterns as indicated above and the patterns were visualized with sodium rhodizinate.

This technique produced quite reproducible looking patterns the spread and intensity of which could be conveniently varied as indicated above.

1. Alfa Aesar Research Chemicals Iron Oxide -325 Mesh Powder
2. *Advances in Fingerprint Technology*, H.C. Lee & R.E. Geansslen, 2nd Ed., CRC Press, Chapter 4 p 113-4
3. M.R. Bartsh, H.J. Korbus, & K.P. Wainwrght, *J. Forensic Sciences* 1996;41: 1046-1051

GSR, Sodium Rhodizinate, Muzzle-Target Distance

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