TECHNICAL NOTE

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Rapid Method of Super Glue® Fuming Application for the Development of Latent Fingerprints

REFERENCE: Kendall, F. G. and Rehn, B. W., **Rapid Method of Super Glue® Fuming Application for the Development of Latent Fingerprints,"** *Journal of Forensic Sciences*, JFSCA, Vol. 28, No. 3, July 1983, pp. 777-780.

ABSTRACT: A method for developing latent fingerprints on various problem surfaces has been in demand for many years. Super Glue® fuming has met this challenge in resolving many of the frustrations of the latent fingerprint examiner. However, time is a factor that cannot be ignored and therefore this method is presented to minimize the time element between the introduction of the Super Glue in the fuming chamber and the actual development of the latent prints. Fuming is increased in a shortened period of time through the chemical reaction known as polymerization. The latent development time lapse is minimized to approximately 1h or less as opposed to several hours to several days described in the nonaccelerant method.

KEYWORDS: criminalistics, fingerprints, polymerization

The published method, "Super Glue Fuming Application For the Development of Latent Fingerprints," by Kendall [*1*], states that the latent development may take from several hours to several days. With this time lapse we decided that a procedure should be developed if possible to shorten this time period.

Knowing that Super Glue® is approximately 98 to 99% cyanoacrylate ester and 1 to 2% inhibitor, several avenues were explored to release the fumes in a minimal period of time with the maximal fuming exposure for the development of latent prints.

A variety of chemicals were used which created copolymers with the cyanoacrylate ester, including a 33% emulsion of triethyldiamine in dipropylene ester; *N,N,N',N'* tetramethylethylenediamine; butadiene; and various triol polyesters and various other amines, esters, and ethers. Fumes were released with most of these chemicals in a shorter period of time but left an unacceptable oily vapor film on the various experimental surfaces containing known latent prints. Sodium bicarbonate was also suggested but did not increase fuming. Rubber carpet backing and Freon® blown foam rubber were tried but the fuming cycle, smoke release period, was too short. The availability of the foam rubber would be limited. Referring to manufacturer's and distributor's brochures of handling precautions a statement is made

Received for publication 6 Aug. 1982; accepted for publication 24 Sept. 1982.

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that rags or tissue should not be used to wipe up spills. The fabric will cause polymerization and may generate heat on curing causing smoke and strong irritating vapors.

Rags and tissue contain cellulose which is composed of long chains of cellobiose molecules. The larger the quantity of cellulose within the rags or tissue, the more likely polymerization will occur. Polymerization is the process of joining two or more like molecules to form a more complex molecule whose molecular weight is a multiple of the original and whose physical properties are different. Knowing that cellulose used in the manufacture of paper (which is obtained from wood pulp) when treated with sodium hydroxide and sodium sulfite removes lignin (hemicellulose which has a lower molecular weight bound by a higher molecular weight polymeric substances), cotton came to mind [2]. Cotton, which is about 95% cellulose with impurities of fat and waxes, when removed by washing with ether becomes known as absorbent cotton. Therefore, treating absorbent cotton with sodium hydroxide ensures polymerization when in contact with the cyanoacrylate ester (Super Glue). Upon experimentation, it was discovered that 0.5*N* sodium hydroxide gave the optimum balance of maximum fuming (smoke) within the most controllable time lapse using both low, medium, and high viscosity cyanoacrylate esters. Viscosities ranged from 3 to 5 kPa·s (3 to 5 cP) to 1500 to 1700 kPa·s (1500 to 1700 cP). The time of the chemical reaction for complete polymerization is dependent upon the thickness of cotton (saturated in 0.5*N* sodium hydroxide and dried), the surface area covered with the Super Glue, temperature, and humidity. However, these factors are not critical in development of the latent print and, therefore, should cause no concern.

Apparatus and Reagents

0.5*N* Sodium hydroxide (dissolve 20 g of sodium hydroxide in 1 L of distilled water). Absorbent cotton is used. (Note: be sure that the cotton does not contain rayon or other noncellulose synthetic fibers.) Apparatus needed are a dispenser of Super Glue (cyanoacrylate ester), a fuming chamber—various size glass tanks with a well-sealed lid, and small brackets made from screen wire approximately 127 by 51 mm (5 by 2 in.) to elevate cotton approximately 13 to 25 mm (½ to 1 in.) off bottom of the fuming chamber.

Procedures

Saturate absorbent cotton with 0.5*N* sodium hydroxide. Gently squeeze out excess. The excess sodium hydroxide may be reused to saturate more pads. Hang the saturated cotton to dry *completely*. (Note: though 0.5*N* sodium hydroxide is not critically harmful, it is strongly suggested rubber gloves be used when removing excess sodium hydroxide solution by hand.) The pads should be cut no smaller than 51 by 51 mm (2 by 2 in.). For various applications, pade can be cut in larger sizes or additional pads can be used to increase an area for the Super Glue to be applied.

Place the sodium hydroxide pads on the wire stand brackets in the fuming chamber and then place or suspend carefully the suspected evidence as shown in Fig. 1. It is recommended that the fuming chamber be placed in a well-ventilated hood. Apply an even bead of Super Glue (approximately 3 g) on the surface of the sodium hydroxide treated dry cotton pads and immediately place the lid on the fuming chamber. Within approximately 15 to 20 s white smoke will rise from the cotton pads and will continue for approximately 1 to 1-½ min. You will be able to see the smoke throughout the fuming chamber.

The time needed for exposing the evidence in the fuming chamber is mainly dependent upon the concentration of the smoke. Generally, evidence can be removed after 1 h. It is suggested that the evidence should remain in the fuming chamber of a minimum of 30 min. If there are little or no visible signs of latent print development, the items should be examined by cross lighting. In some instances, the latent print may appear as a dark stain. This has occurred on such surfaces as the smooth or glossy side of black plastic electrical tape, box

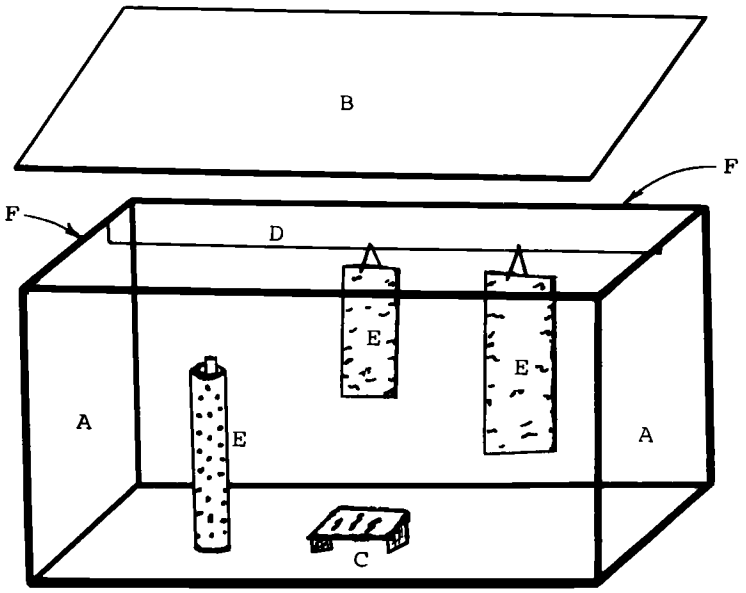

FIG. 1—*Fuming chamber where* (a) *is glass aquarium,* (b) *is glass cover or lid,* (c) *is small bracket holding treated cotton pad,* (d) *is removable wire holder,* (e) *is evidence, and* (f) *is adhesive backed weatherstripping. Note: adhesive backed weatherstripping around top edge for assurance of a satisfactory seal.*

surfaces, and some metal surfaces. The latent can be photographed satisfactorily with cross lighting and still maintain acceptable contrast. Subsequent processing with fingerprint powder, in the normal manner, may even further enhance the existing latent. If necessary, the latent may be lifted after dusting and usually will still be visible on the item when observed with indirect lighting.

Results

Developed latents do not have the tendancy to slightly overdevelop as they did with the prior method, "Super Glue Fuming." Extremely fresh latents may possibly (slightly) overdevelop.

It has been found that previously processed plastic bags when subsequently treated in the fuming chamber have had latent prints develop that were not observed after being powdered.

The results obtained on actual case evidence and experimental items were excellent. Latent fingerprints developed using the original process have been accepted as evidence in a criminal case.

Latent fingerprints developed on black plastic electrical tape were introduced in a case in the Eighth Judicial Circuit of Florida. Both defendants were found guilty on all charges in January 1982. The crime occurred on 9 May 1981, and was received for processing on 14 Sept. 1981, about 4-½ months after the tape had been collected and retained as evidence. The defense briefly questioned, but did not challenge the processing method.

Results like this verify that this is a feasible and reliable process to be used on otherwise difficult surfaces for the development of latent fingerprints that could not normally be developed.

Acknowledgment

The authors gratefully acknowledge Deputy Sheriff Billy Sheppard, crime scene investigator, Santa Rosa County Sheriff's Office, Milton, FL (retired); Tim Brown, urethane project engineer, Flexible Products Company, Marietta, GA; Dick Thompson, senior application engineer, Industrial Product Group, Loctite Corp., Newington, CT; Carol Donnelly, operations manager, Apple Adhesives, Inc., Ridgewood, NY; and Ernest D. Hamm, crime laboratory analyst supervisor, F.D.L.E. Regional Crime Lab, Jacksonville, FL.

References

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[*2*] Hart, H. and Schuetz, R. D., *Organic Chemistry*, The Riverside Press, Cambridge, MA 1953.

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