TECHNICAL NOTE

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The Use of Frequency-Doubled Neodymium:Yttrium Aluminum Garnet (Nd:YAG) Laser for Enhancement of Weak Bloody Fingerprints

REFERENCE: Cheng, S.-G., **"The Use of Frequency-Doubled Neodymium:Yttrium Aluminum Garnet (Nd:YAG) Laser for Enhancement of Weak Bloody Fingerprints,"** *Journal of Forensic Sciences*, JFSCA, Vol. 33, No. 4, July 1988, pp. 1022-1026.

ABSTRACT: Ninhydrin/zinc chloride, which has been proven to be unsuitable for the neodymium:yttrium aluminum garnet (Nd:YAG) laser development of latent fingerprints, is demonstrated here because of its pronounced improvement in weak bloody fingerprint detection.

KEYWORDS: criminalistics, fingerprints, lasers, ninhydrin, zinc chloride, bloody fingerprints, neodymium:yttrium aluminum garnet laser

A number of chemical reagents, including ninhydrin, amido black, TMB, benzidine, luminol, and so forth [*1-3*], have been used for the enhancement of bloody fingerprints. Although the ninhydrin method is considered one of the very common techniques in examining latent fingerprints, it has the disadvantage of poor image contrast when applied to dark background surfaces.

In the past few years, some laser techniques for the detection of latent fingerprints have been successfully developed [*4-10*]. It is understood that the intensity of fluorescence varys when different wavelengths were applied. For instance, latent fingerprints treated with ninhydrin/zinc chloride are suitable for argon ion laser exciting purposes, but unsuitable for the doubled-frequency neodymium:yttrium aluminum garnet (Nd:YAG) laser because the fluorescence intensity obviously decreased.

In recent years, some laser aided techniques such as Super Glue®/laser dye staining and formic acid/hydrogen peroxide [*11,12*] were introduced for bloody fingerprint detection. In this study, the technique of combining ninhydrin/zinc chloride reagent with the frequency-doubled Nd:YAG laser has been employed to detect bloody fingerprints. Its effectiveness is demonstrated.

Received for publication 17 July 1987; revised manuscript received 30 Sept. 1987; accepted for publication 16 Nov. 1987.

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Materials and Methods

Reagents

The solutions of ninhydrin and zinc chloride are the same as those recommended for development of latent prints [5].

Ninhydrin Solution—Mix 500 mg of ninhydrin with 1 mL of glacial acetic acid and 3 mL of ethanol. The solution is then diluted with 95 mL of Freon®.

Zinc Chloride Solution—Three grams of zinc chloride are dissolved in 25 mL of ethanol followed by 5 mL of glacial acetic acid, then the solution is mixed with 70 mL of Freon.

Laser

The frequency-doubled Nd:YAG laser (Laser Printfinder, Laser Photonics Inc.), delivering lines at 532 nm, is used in this work.

Surfaces

Stainless plate; glass plate; raw wood; and varnished wood with white, brown, and transparent color, respectively, are also used for the work.

Treatment of Bloody Fingerprints

The articles bearing the bloody fingerprints are sprayed with ninhydrin solution followed by zinc chloride solution, 3 h are waited for a complete reaction, and then the fingerprints are examined through safety goggles (Glendale Optical Z87) when illuminated by the Nd:YAG laser.

Results

The luminescence of bloody fingerprints gives a bright yellow color. The best contrast results are obtained on stainless steel plate, glass plate, and white varnished wood; less effective results are found on brown varnished wood; and no luminescence is found on transparent wood as well as raw wood.

The results of weak bloody fingerprints on a white plate are shown at room light in Fig. 1 and in laser light in Fig. 2. The dark ridges in Fig. 2 are caused by the quench effect of luminescence. For those weak bloody fingerprints, laser aided detection techniques reveal the improvement of ridge details as shown in Fig. 2.

Figures 3 and 4 reveal the comparison of treated bloody fingerprints on stainless steel plate when visualized at room light and laser. An excellent contrast is obtained in Fig. 4.

Discussion

In general, the ninhydrin/zinc chloride procedure can be used to improve the contrast of weak ridges of bloody fingerprints against background. On some occasions, for those failure results when treated with ninhydrin, the laser aided method might increase the visibility of the bloody fingerprints.

During the study, ninhydrin/cadmium nitrate had also been tried and similar results were shown to the ninhydrin/zinc chloride treatment.

The reason why ninhydrin/zinc chloride treatment is suitable for the Nd:YAG laser detection of bloody fingerprints rather than latent fingerprints may result from the various compounds and their different concentrations in blood.

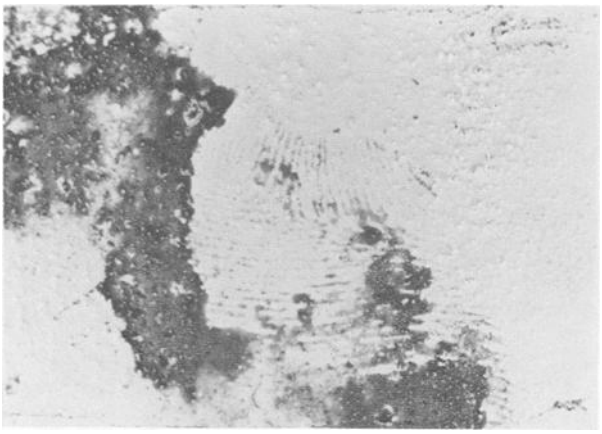

FIG. 1—*Weak bloody fingerprints on white wood when treated with ninhydrin/zinc chloride and viewed at room light.*

FIG. 2—*The same bloody fingerprints as Fig. 1 viewed with the Nd: YAG laser.*

Conclusion

The ninhydrin/zinc chloride method for the enhancement of weak bloody fingerprints is demonstrated to be very suitable for the exciting of the frequency-doubled Nd:YAG laser.

Because of the portability of the Nd:YAG laser, it is more convenient and practical for processing at the crime scene.

Acknowledgment

This work is supported by the Criminal Investigation Bureau under its Research Development Program.

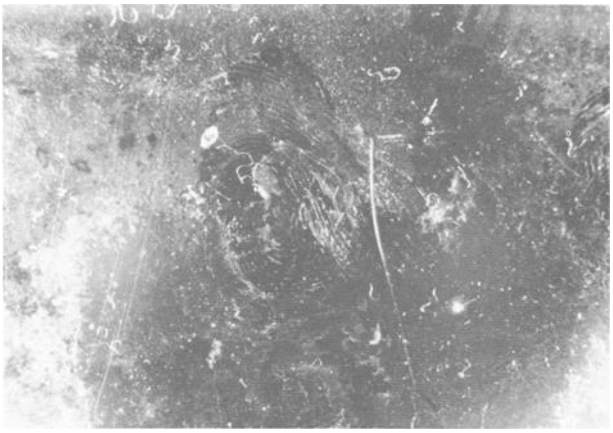

FIG. 3—*Weak bloody fingerprints on stainless plate when treated with ninhydrin/zinc chloride and observed at room light.*

FIG. 4—*The same bloody fingerprints as Fig. 1 viewed with the Nd: YAG laser.*

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