CPRC CCRP

CANADIAN POLICE RESEARCH CENTRE

CENTRE CANADIEN DE RECHERCHES POLICIÈRES

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Fingerprints on Skin

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TECHNICAL REPORT

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NOTE: Further information about this report can be obtained by calling the CPRC information number (613) 998-6343

Unlimited

Executive Summary

A patent has been filed through the Canadian Police Research Centre to cover a development made by the Royal Canadian Mounted Police Forensic Identification Support Section. This development allows one to detect cyanoacrylate developed latent fingerprints. D.A. Wilkinson, A.H. Misner and J.E. Watkin collaborated their efforts to develop this TEC dye. The dye is created when three molecules of thenoyltrifluoroacetone bind to one atom of europium in the solution.

The TEC dye is applied to fingerprints after exposure to CA under vacuum. There are two different methods to develop the prints the first is for hard surfaces and skin and the other is for large surface areas, which includes plastic bags.

One of the problems with using cyanoacrylate on its own to develop fingerprints is that it cannot develop weak prints to a stage where they are visible to the naked eye.

Presently permission is given to accredited police agencies only, to make up and use the solutions for their investigative purposes. In the future the material may be supplied commercially as a package.

Résumé

Un brevet a été déposé par l'entremise du Centre canadien de recherches policières en vue de protéger une technique mise au point par la Section de l'assistance à l'identité judiciaire de la Gendarmerie royale du Canada. Cette technique permet de déceler les empreintes digitales latentes révélées avec un cyanoacrylate. D.A. Wilkinson, A.H. Misner et J.E. Watkin ont travaillé de concert pour mettre au point ce colorant TEC qui est obtenu lorsque trois molécules de thénoyltrifluoroacétone se lient à un atome d'europium dans la solution.

Le colorant TEC est appliqué sur les empreintes après exposition au CA dans une enceinte sous vide. Deux méthodes différentes permettent de révéler les empreintes: la première est appliquée dans le cas des surfaces dures et de la peau, tandis que l'autre est utilisée pour les grandes surfaces, dont les sacs en plastique.

Le fait que le cyanoacrylate ne permette pas, à lui seul, de rendre visibles à l'oeil nu les empreintes peu intenses constitue l'un des problèmes liés à son utilisation.

Actuellement, on autorise les services de police accrédités, et eux seuls, à préparer et à utiliser les solutions dans le cadre de leurs enquêtes. Ce matériel pourra, plus tard, être vendu dans le commerce sous forme de trousse.

Background:

A patent application has been filed by the Canadian Police Research Centre to cover this development. In the future the material may be supplied commercially as a package. In the meantime permission is given to accredited police agencies only, to make up and use the solutions for their investigative purposes.

The method is still under development. Conditions and concentrations given below are preliminary and may be changed as experience is gained.

We would greatly appreciate your contacting us about successful results or queries. In return we will keep you up to date.

Contact: A.H. Misner (613) 998-9719 / Fax: (613) 957-9156

Principle of Method:

Three molecules of thenoyl trifluoroacetone bind to one atom of europium (a rare earth element) in the solution to form a dye(TEC).
The solution is colourless but absorbs long wavelength ultraviolet light strongly. The energy of the UV light is transferred to the europium which fluoresces strongly in the red at 614nm with a narrow band emission.

Methyl ethyl ketone (MEK 22%) is added to the dye solution. When a latent coated with cyanoacrylate polymer is immersed in the solution some of the MEK dissolves in the polymer but no water does. The TEC then prefers to dissolve in the pure MEK in the print thus concentrating the TEC by a factor of 100 to 1000 fold. After the print is removed from the solution the MEK quickly evaporates into the air and the TEC is left inside the polymer. Any excess TEC that is deposited on the background maybe removed by washing with 70% methanol-water, that dissolves the background TEC but cannot get at the TEC in the polymer. The situation is similar to the dry cleaning of dyed fabrics with a solvent.

Sufficient dye is transferred to most prints so that a cheap ($300) UV lamp radiating 10mw/cm2 onto the surface will give strong, easily seen fluorescence.

Preparation of TEC:

1. Preparation of Methyl Ethyl Ketone* Solution:

a) Pour 220ml of MEK* into a two litre container with a resealable lid.

b) Weigh out 1 gram of thenoyltrifluoroacetone and dissolve in the MEK*

2. Preparation of Aqueous Solution;

a) Pour 780ml of distilled water into a one litre container.
b) Weigh out 0.190 grams of Tris (hydroxymethyl) aminomethane and dissolve in the water.
c) Add concentrated hydrochloric acid (a drop at a time) until the pH meter indicates that the pH has reached 8.
d) Weigh out 0.455 grams of europium (III) chloride hexahydrate and dissolve in the water.

3. Preparation of TEC;

a) Pour the aqueous solution into the MEK* solution and shake vigorously.
b) Sonicate in the ultrasonic bath for approximately 5 minutes or until the solution exhibits uniform fluorescence.

Application of TEC:

After exposure to CA under vacuum there are two techniques of applying TEC depending upon the type of surface on which the print has been
deposited. Application of the dye and washing of the prints is always recommended whilst viewing under UV light if possible.

For hard surfaces and skin;

a) gently stream the solution from a squeeze bottle over the area where prints are anticipated
b) allow the MEK* to evaporate for a few seconds
c) gently wash with 70% methanol in water

For large areas including plastic bags;

a) use a diluted solution (x 0.1, 22% MEK) in a large open-neck container with a resealable lid
b) immerse the plastic object or bag until completely covered then close the lid (to prevent excessive loss of the MEK)
c) at 2 minute intervals check for prints
d) when prints have been observed wash as for hard surfaces.

Chemicals and Apparatus:

Prices in this list are only a rough guide. They may be in Canadian or American dollars. The sources are those we purchased from, but not particularly endorsed by the RCMP. Many of the materials are available from several sources.

Aldrich Chemical Company
1001 West Saint Paul Ave.
Milwaukee, Wisconsin
53233 USA
1-800-558-9160

1. Europium Chloride Hexahydrate 99.9%
   21, 288-1 25g $135
2. Thenoyltrifluoroacetone 99%
   T2, 700-6 100g $58
3. Methyl ethyl ketone (2-butanone)
   11, 026-4 18L $84
4. Tri (hydroxymethyl aminomethane)
   T8, 760-2 1kg $28

Union Carbide Corp.
Old Ridgebury Rd.
Danbury, CT
06817

Tergitol 15-S-7 Nonionic Detergent

ETM Industries
P.O. Box 610
266 Hall Ave.
Renfrew, Ontario
K7V 2E4 Canada
Tel: 613-432-6136
613-432-9689
Fax: 613-432-9547

Watkin Vacuum Fingerprint Chamber
Under $10,000
Manufactured under licence from **Canadian Police Research Centre**

Spectronics Corp.
956 Brush Hollow Rd.
P.O. Box 483
Westbury, New York
11590
Tel: 516-333-4840
Fax: 516-333-4859

Built-in-Ballast Black Light Lamp price $300

Corion Corp.
73 Jeffrey Ave.
Holliston, MA 01746
508-429-5065

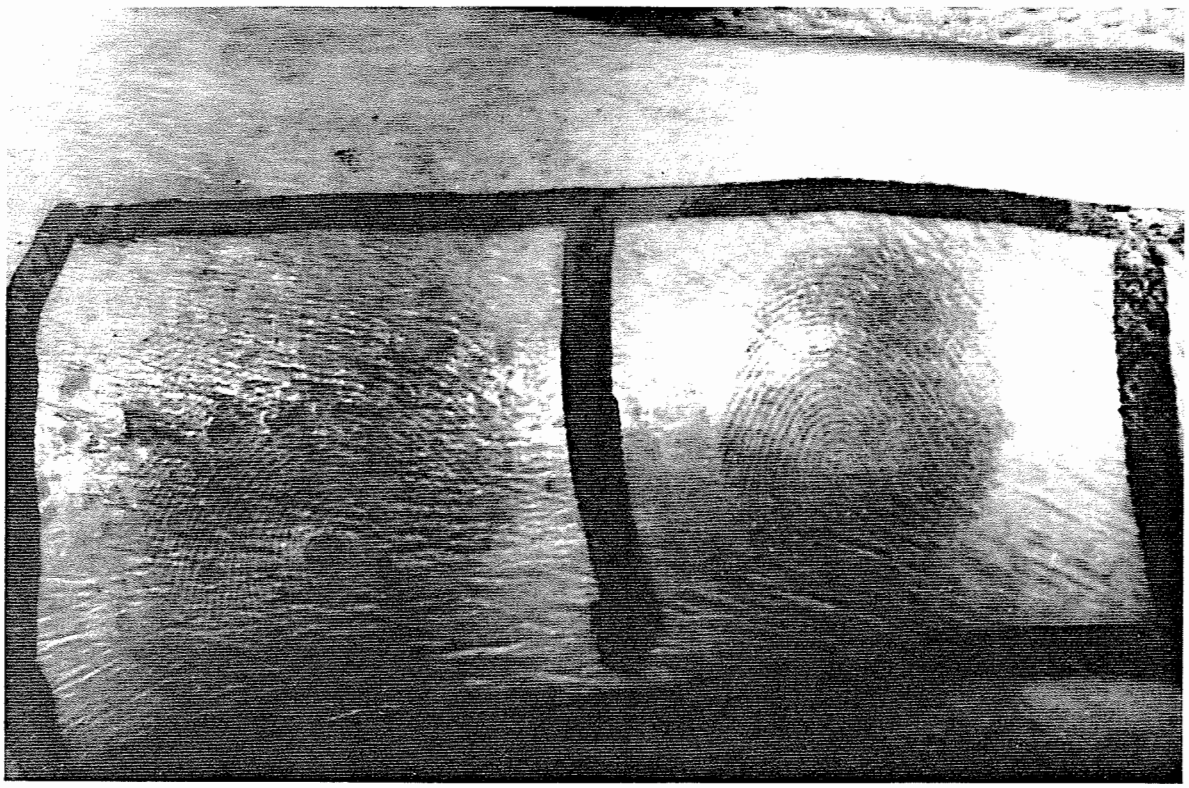
Narrow band filter (10nm centred at 620nm)
S10-620-R $150

Schott Optical Glass
Duryea, Penn. 18642
717-457-7485

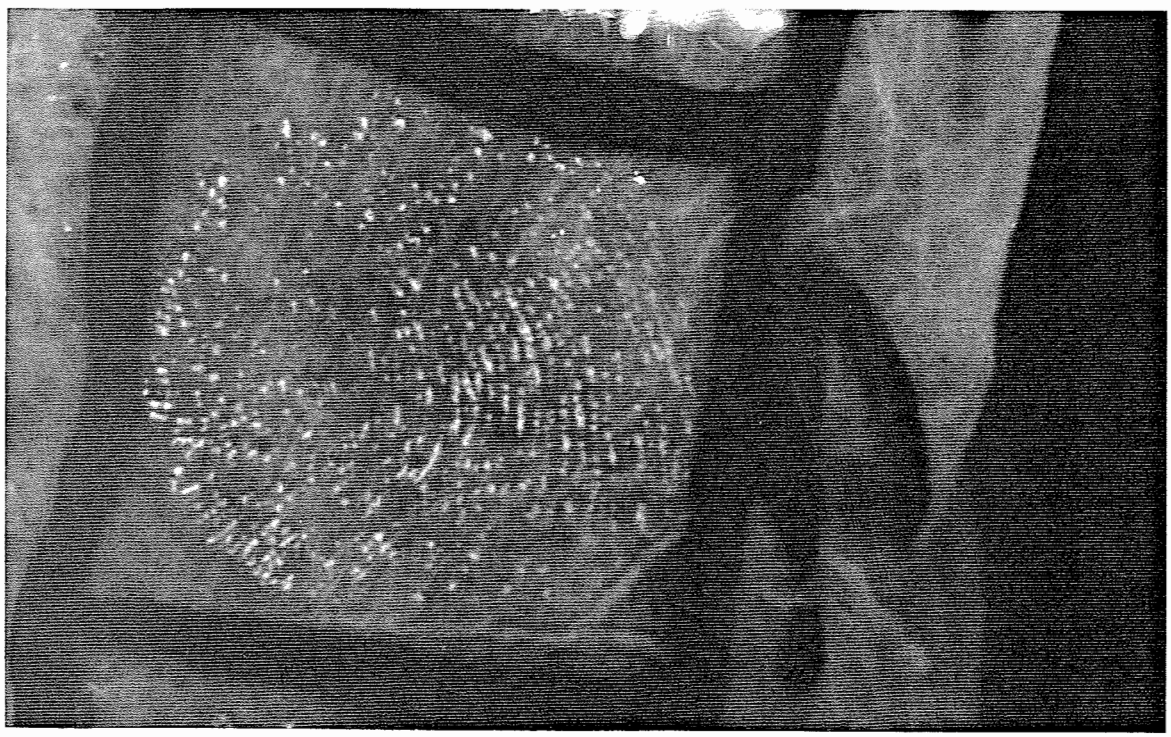
KV 550 Filter price $40

Cole Parmer Inst. Co.
Chicago, Ill 60648
1-800-323-4340

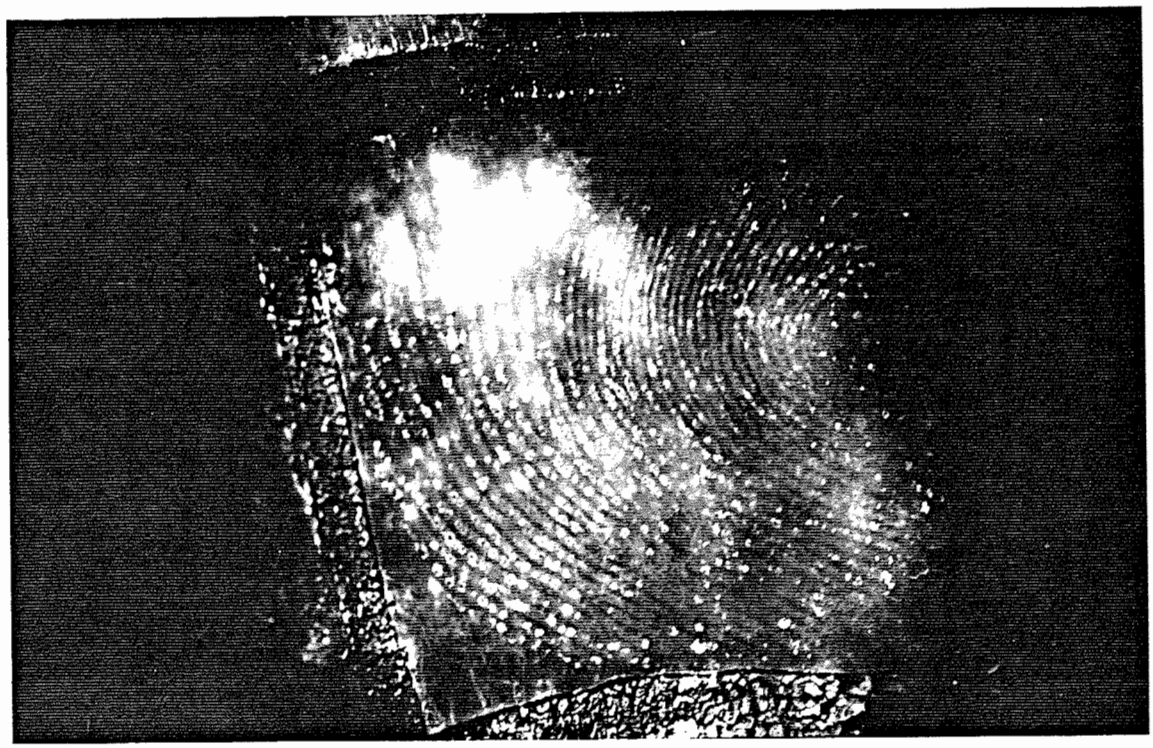
Hygrometer (electronic)
L-37400-00 $130



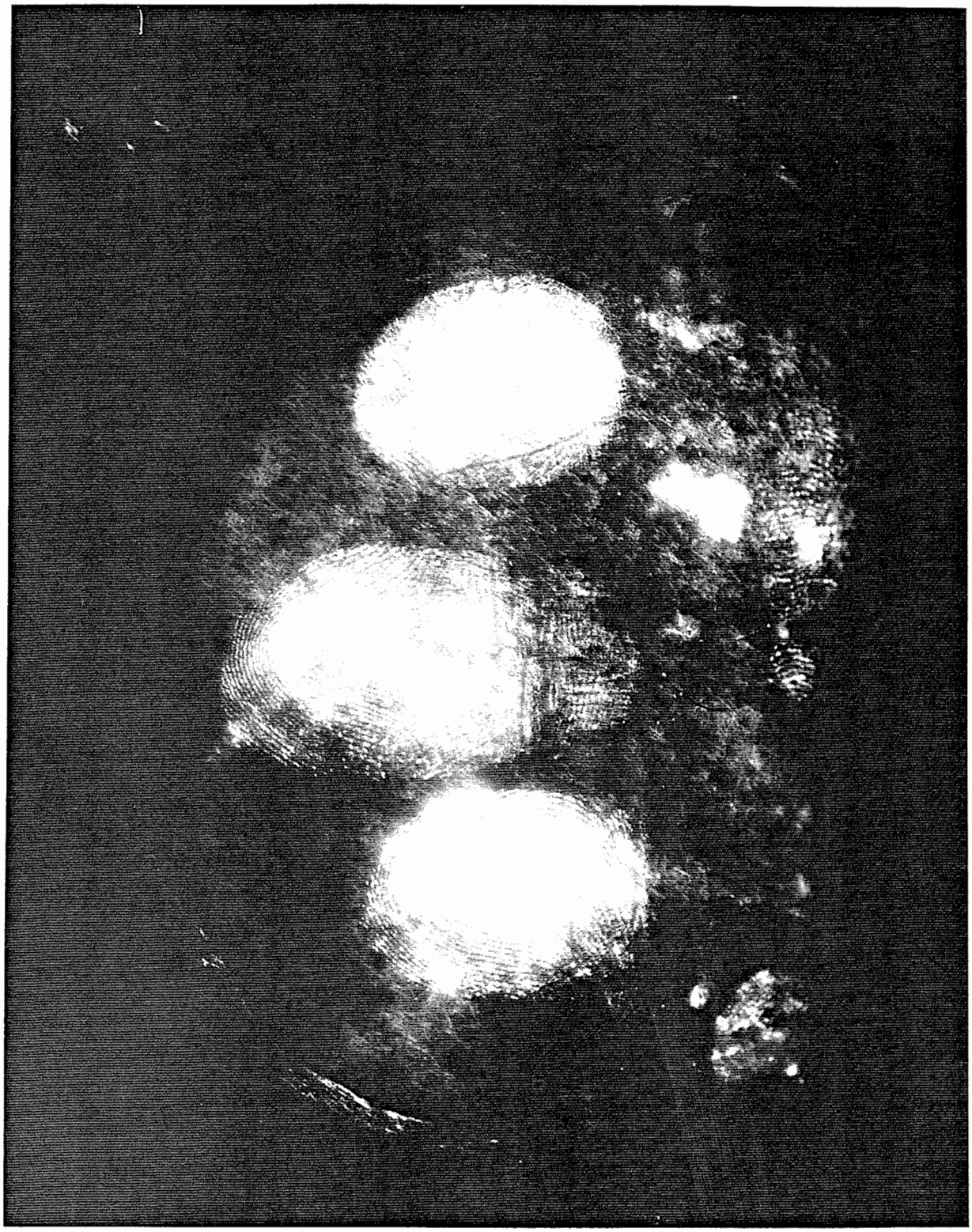
PHOTOGRAPH 1. Fresh prints deposited on the ankle of a female cadaver. Developed immediately with magna powder (black) to check the quality of the prints.



PHOTOGRAPH 2. Fingerprint developed by cyanoacrylate on the skin of a female cadaver. The ridges appear broken due to excess humidity.



PHOTOGRAPH 3. Fingerprint developed by cyanoacrylate and dyed with TEC on the ankle of a male cadaver. Ridge detail is continuous and even shows pore detail in the upper left hand corner.



PHOTOGRAPH 4. Cluster of fingerprints developed by cyanoacrylate and dyed with TEC on the inner thigh of a female cadaver. Further washing eventually produces a black background.

PHOTOGRAPH 5. Cluster of fingerprints developed by cyanoacrylate and dyed with TEC on the shin of a female cadaver. The prints were so weak that even after developement with cyanoacrylate they were not visible to the eye. They could only be visualized with TEC.

Overheads of "CA PRINTS ON SKIN"

CA Prints on Skin

Humidity and Development of CA Prints on Cadavers

- Keep humidity in bag low
- Measure with hygrometer
- Fume at room temperature
- Avoid condensation at all costs

CA Prints on Skin

Conclusion

A skin latent will be detected

IF

Deposited with identifiable detail

AND

It has survived.

- Cheap and easy method
- Nothing to lose
- Please try!

CA Prints on Skin

Conditions Under Which Cyanoacrylate Prints Were Successfully Developed on a Cadaver

a) Elderly female, smooth hairless skin on legs

b) Deceased 24 hours

c) Body conditioned at autopsy – 19°C, 4 hours, 36% rel. humidity

d) Normal test prints deposited with light pressure on soft and bony areas

e) After 20 minutes exposed to CA at 21°C and 60% RH in bag for one hour

f) Witness prints seen in 10 minutes.

CA Prints on Skin

Detection of Latents on Living Skin

The latents last less than one hour