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Police Scientific Development Branch

Crime Investigation and Officer Safety Sector

Fingerprint Development and Imaging Newsletter

April 2004

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Au Revoir to Terry Kent

Terry Kent was given a fitting send-off as he retired from PSDB in February. Family, friends and colleagues, some of whom have known Terry for many years, spent a very enjoyable evening together. The highlight of the evening was the presentation of an album containing messages from colleagues old and new, many from overseas who have collaborated with Terry during his long career in Fingerprinting.



Terry and his wife Emily at the farewell party

The staff at PSDB gave Terry a more formal farewell: he has promised to use his collection for a flying lesson in a Tiger Moth. We are unsure of Terry's retirement plans but hope the slippers he was given will be useful someday, although we suspect it will be some time before they're taken out of the box!



Terry.....slippers?

Invitation for Contributions to the Newsletter

We often receive comments about the usefulness of regular updates from PSDB when members of the Fingerprint team visit force laboratories during the course of their work. The Update publications have been a useful way of communicating small pieces of work as they are completed at PSDB. These short studies are often in response to a specific request from forces and it is useful to be able to circulate information about new methods in advance of full publication in the Manual of Fingerprint Development Techniques.

Updates in this format have been published since 2000. We would like to make two changes to the publication format: the first is to change its title from '*Fingerprint Development and Imaging Update*' to '*Fingerprint Development and Imaging Newsletter*'. The purpose of this change is to encourage a greater exchange of information, so that we are not only publishing information directly generated at PSDB but also including interesting data from other sources. Thames Valley Police have already agreed to the inclusion of their method for ninhydrin treatment of cannabis wrappers in this Newsletter. We would like to hear from other force laboratories who may have information we could include in the next Newsletter.

The second change is to publish on a more regular basis. We are hoping to be in a position to send out Newsletters in April and October each year. This will generally mean that new methods can be implemented more swiftly and we can set clearer deadlines for material to be submitted for inclusion.

We trust that this will be a useful development to this communication and look forward to your comments.

Thames Valley Police:

Martin Cox, Susan Ryley and Tim Harvey

Fingerprinting Cellophane Cannabis Wrappers (9-Bar Wraps)

Comparisons were made between powders, superglue with BY40 dye and ninhydrin for

the development of marks on cellophane cannabis wrappers.

Ninhydrin was found to develop fingerprints on cellophane in 2000 and subsequently used on operational material. 573 items from 12 cases were treated with ninhydrin and a total of 162 fingerprints were developed. Only one of the 12 cases failed to develop marks using the technique described below.

Method

Before processing, remove all of the wrappings from the cannabis resin bar.

Dip the wrapping through ninhydrin working solution as normal.

Place onto blotting paper and allow to dry before placing in the ninhydrin oven, which should be set to dry heat 80°C with the humidity 'off' as if you were processing a solid article (see Section 11.5 of the Manual of Fingerprint Development Techniques).

Pre-heating should only last 10 minutes before switching the wet bulb to 68%.

Wrappings should be monitored whilst in the oven as marks can be easily over-developed and no more than 2 minutes treatment should normally be necessary after the target humidity is reached.

If fingerprints are observed, remove the wrappings from the oven and photograph them, using a light box. Fingerprints should be printed both correct and laterally reversed.

Wrappings can be re-introduced into the oven for further development of fingerprints if required (ensuring that initially the oven is returned to dry heat only, as the process is repeated.)



Fingerprints developed on a cellophane wrapping

Contrast Enhancement of Physical Developer (PD) with an Iodide Reagent

The last Update (November 2003) included methods for darkening Physically Developed fingerprints by bleaching with sodium hypochlorite or by toning with Fotospeed Blue toner. A method is given below which can be used to lighten Physically Developed fingerprints to improve contrast on dark samples using an iodide reagent.

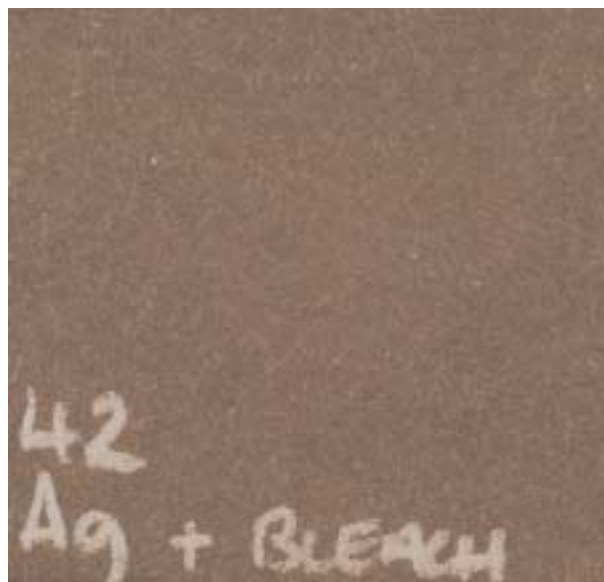
Treatment with iodide results in pale yellow silver iodide fingerprints and a darkened paper substrate. Both effects fade with time and exposure to light. Contrast can also vary as the substrate dries, so it is important to photograph the treated fingerprint after treatment and again after drying.

Method:

1. Bleach Physically Developed sample for approximately 3 minutes in a 3% aqueous solution of sodium hypochlorite. This is an essential step and will darken the print.
2. Wash the sample with copious amounts of water and allow to dry naturally.
3. Photograph the darkened fingerprint if necessary.
4. Dissolve 20g potassium iodide in 100ml distilled or deionised water with stirring.
5. Prepare a redox solution by adding to 900ml distilled water, in the following order and with stirring,
 - 30g iron (III) nitrate
 - 80g ammonium iron (II) sulphate
 - 20g citric acid
6. Add 1 part potassium iodide solution to 19 parts of redox solution with stirring.
7. In a PD dish, immerse the item in the potassium iodide/redox solution and with gentle agitation, allow the reaction to proceed under subdued lighting until good detail becomes visible and any white portions of the paper darken (15 mins to 2 hours).
8. Do not wash.
9. While the sample is still wet, photograph any visible marks.
10. Allow sample to dry naturally and photograph any visible marks.



PD developed fingerprint



Bleached PD developed fingerprint



Bleached PD developed fingerprint treated with iodide reagent

Operational Support

Lab Design Advice

Are you planning the design of a new laboratory or refurbishing an old one? If so, then the Fingerprint Group at PSDB can provide assistance at all stages to include specification, design, supplier liaison and troubleshooting. We would welcome the opportunity to work with your project manager from the initial planning stage and continue the dialogue until the project is finished. This service is free of charge to police forces.

We have worked with several police forces over the last few years at various points during the process but prefer involvement as early in the process as possible.

Do not hesitate to contact us if you are interested in our assistance.

IRIS Support

The operational IRIS systems continue to provide effective, versatile support to police fingerprint laboratories and have significantly reduced the time taken to photograph, print and transmit marks to the bureau.

The six IRIS workstations installed in forces have been recently upgraded to reduce the time taken to print images and to enable data to be backed up on plug-in hard drives. Further software enhancements have been incorporated to eliminate the need to type in repetitive image data and to aid the collation of images from single cases.

By the time this Newsletter is published, three further IRIS workstations will have been delivered to UK forces. One of these incorporates an alternative camera system, which has recently been evaluated by PSDB and found to give images of similar quality to that used in current workstations. Potential advantages of the new camera are the larger image capture size (156mm x 103mm) and the lower purchase cost.

The versatility of the system has also been demonstrated in the use of IRIS for applications other than fingerprint imaging. The IR filters and fluorescence functionality have been used by several forces to reveal erased or obliterated writing and in the suppression of patterned backgrounds (see article on IR filters in this publication).

The NAFIS link via the bureau is now active in Essex and the IRIS Imager software is in the process of being revised to be compatible with the Generic interface, which will enable connection to NAFIS via the LAN and CJX. Future versions of the IRIS Imager software will also allow input of images from scene of crime cameras.

Two 'benchtop' IRIS workstations are now available for loan, either for forces to evaluate the technology or to address laboratory backlogs. To date, three forces have taken the opportunity of a loan period and one system has been loaned to Centrex for demonstrations during FERRT courses. During the first loan period to a force laboratory, significant, measured improvements in laboratory performance were obtained.

Please contact PSDB if you would like any further information on IRIS or would like to arrange the loan of a benchtop system.

Use of Infra-Red Filters for Suppression of Patterned Background

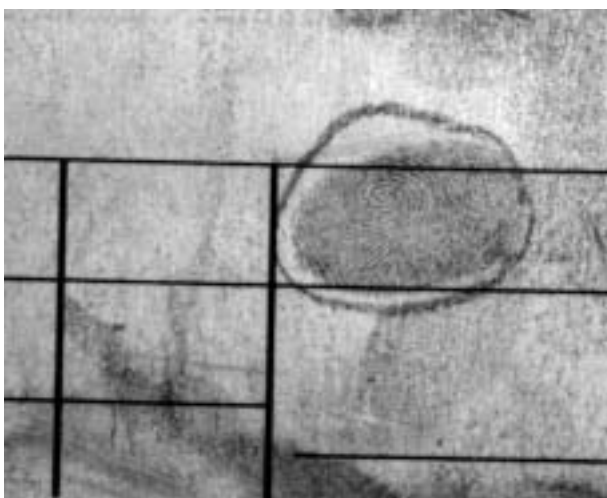
Recent research at PSDB has identified a technique that may prove valuable for distinguishing marks on patterned backgrounds. For fingerprints developed using processes involving metal or metal particles, it may be possible to suppress background patterns by using Infra-red (IR) filters such as those used in document examination equipment. This will work for

- Physical Developer
- Vacuum Metal Deposition (VMD)
- Small Particle Reagent
- Powders (aluminium or magnetic flake)

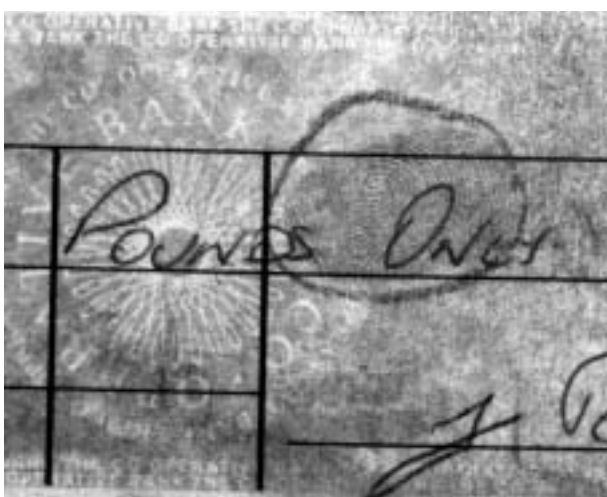
The reason why marks developed with these techniques are suitable for this process is that metal particles are reflective to IR, whereas the pigments used in many inks are IR transparent or IR opaque. This means that when IR filters are used, there is a contrast between the mark and the background.

In order to see the effect, a digital camera with spectral sensitivity in the IR region is required. This may necessitate the purchase of a specialist camera, because most commercial cameras have IR blocking filters bonded to the chip. The other requirement is a set of IR viewing filters

(these typically have 'cut-on' frequencies between 615 and 1000nm). The sample should be viewed under reflected tungsten light which has spectral output in the red and IR regions and an appropriate IR filter used on the camera. In practice, IR filters with cut-on frequencies close to 1000nm are best in suppressing background patterns but image resolution may be poorer. Lower cut-on filters, such as Schott glass RG780, may offer a better compromise. Some examples of PD fingerprints with and without an RG780 filter in place are illustrated below.



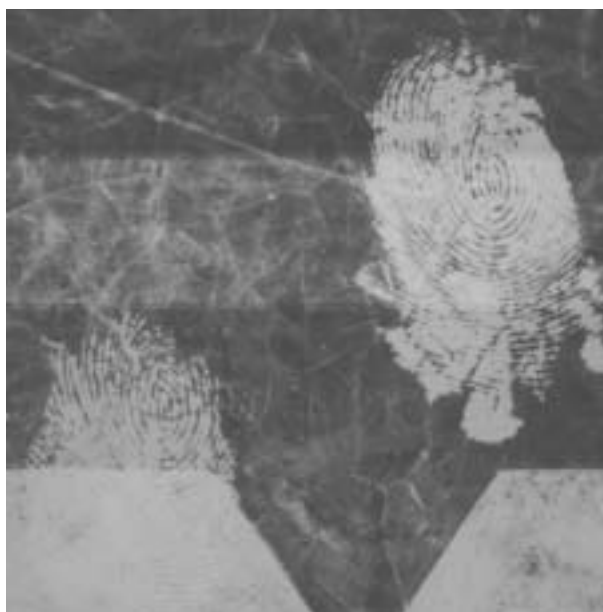
PD - with filter



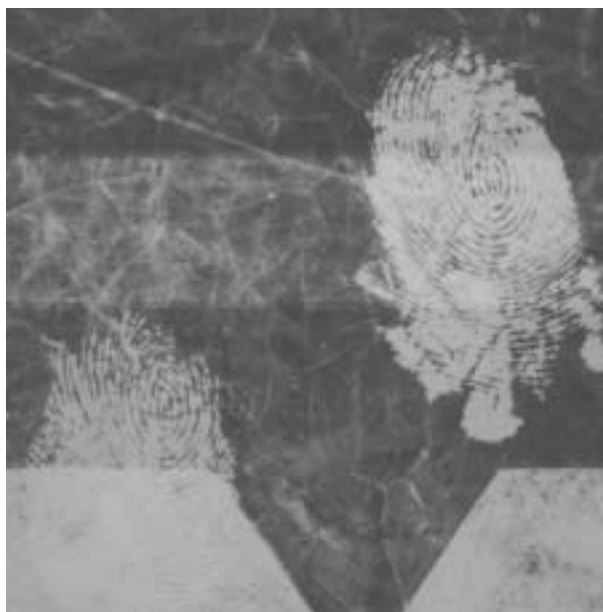
PD - without filter

The same technique will work for VMD samples viewed in transmitted light and examples of marks imaged in this way are also illustrated. The technique will not work for all types of inks but is worth trying if the mark crosses over a patterned area or writing. Most blue, red and green (and some black) biro marks

seem to disappear, whereas printing on glossy magazine covers may not.



VMD - with filter



VMD - without filter

Operators of IRIS workstations will be able to use this technique by using the IR filter wheel below the camera and activating the secondary focusing cursor. Laboratories with access to document examination facilities should be able to utilise the technique by linking to a camera with IR spectral sensitivity for image capture.

For further details contact Steve Bleay.

Vacuum Metal Deposition using Alternative Metals

Vacuum Metal Deposition has been shown to be one of the most sensitive techniques for the detection of fingerprints and is recommended in the Manual as the method of choice for development of marks on plastic bags. However, there are plastic surfaces such as clingfilm and plasticised PVC that are problematic for the recommended process, with little or no zinc deposition occurring after several deposition cycles.

There have been no changes to the VMD process since zinc was substituted for cadmium for health and safety reasons, but early studies into the process did consider several other metals that can be used successfully to develop marks. PSDB have recently been re-evaluating some of these metals to see if alternative VMD processes can be developed that are capable of developing marks on problematic surfaces.

Studies have focused on clingfilm and other plastics used as clear wrapping materials, using copper, silver, indium and tin as deposition metals. Preliminary results have indicated that the deposition of silver (and to a lesser extent, copper) may develop marks on surfaces that have previously been difficult to treat using the existing gold/zinc process. Silver is far less selective than zinc in where it deposits and provides a uniform background stain to the sample ranging from brown to violet in colour depending on the substrate. Viewed in transmitted light, the fingerprint ridges are apparent as a different colour from the background stain. An example of a mark developed using silver on a clear polypropylene film is illustrated below.



Mark developed by VMD using silver

Laboratory studies have shown that for many of the substrates where problems are experienced with deposition of zinc in the gold/zinc process, subsequent processing with silver in a single metal deposition cycle will develop marks. A protocol is currently being developed for operational trial work to see if this technique has further potential.

It must be stressed that this technique is not regarded as a replacement for the gold/zinc process, but if implemented would be a subsequent step in a sequential process. The outcome of operational trials will be given in future Newsletters. Please contact us if you have any details of substrates that have proved difficult to treat with the conventional gold/zinc process, or if you would like further details of the work carried out to date.

DFO: Effects of Pre-humidification

It had been brought to our attention that pre-humidification of paper to be treated with DFO might increase the sensitivity of the method.

A number of tests were carried out as described in the Manual on various paper types and with a range of donors, to evaluate the theory. Relative humidities were varied between 18%, 45.5% and 73% and no evidence of greater intensity or improvement in developed detail was observed.

Consequently there is no change to the method published in the Manual of Fingerprint Development Techniques (2001).

Operational Trial of New Adhesive Tape Techniques

Our laboratory based experimental work for the adhesive tapes project is now completed.

We have identified and optimised three new techniques for the development of fingerprints on adhesive tapes. The new techniques have been compared using tens of thousands of fingerprints, against those currently recommended (and many others) and have proved to be the best performers overall. The next stage is for us to trial these new techniques with a number of forces to validate their effectiveness in operational casework. The forces involved in the trial are Surrey, Thames Valley and West Yorkshire. Depending on the

course of the trial we would hope to update the Manual of Fingerprint Development Techniques in 2005.

Nanoparticles

PSDB staff recently visited Sunderland University where Dr Fred Rowell and Brendan Thigger are developing nanoparticles that they intend to use for fingerprint development.

The nanoparticles that have been produced are silica based spheres which are between 200 and 600 nanometres in diameter.

The surface of these nanoparticles can be modified to give them specific properties such as fluorescence or an affinity for certain fingerprint components. Currently work is at a very early stage and the team at Sunderland is hoping to produce powders or powder suspensions that have specialised fingerprint applications.

Publications

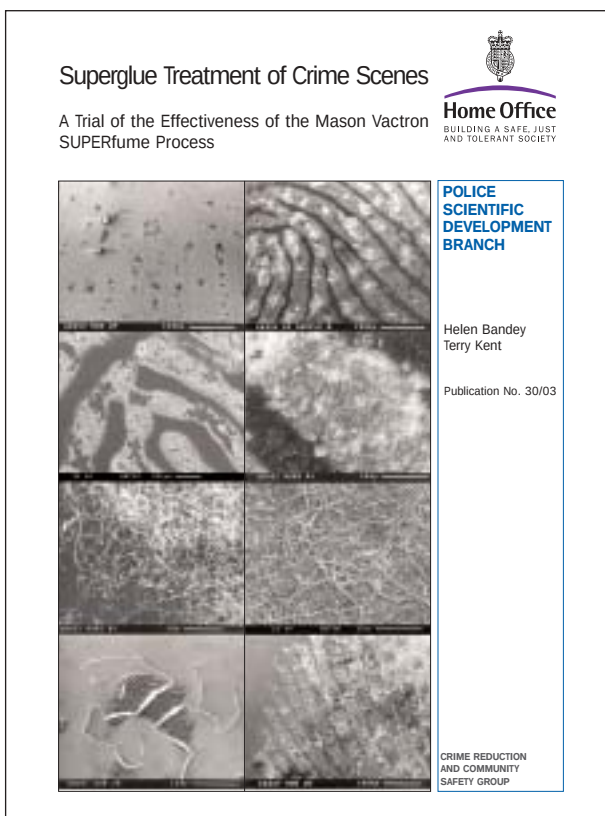
Home Office Publication 30/03

Superglue Treatment of Crime Scenes:

A Trial of the Effectiveness of the Mason Vactron SUPERfume Process

Helen Bandey & Terry Kent

Contains background information on the superglue process, trial results and proposals for best practice.



PSDB Fingerprint Development and Imaging User Group Structure

The first meeting of a re-formed User Group for the PSDB Fingerprint Development and Imaging Programme was held in early February. The User Group is made up of practitioners who can guide the programme of work at PSDB, helping to prioritise the various projects new and old. The User Group reports to the National Fingerprint Board Development Working Group via its chair, Tristram Elmhirst, Head of Forensic Services, West Mercia Constabulary.

The terms of reference have been revisited and clarified. There is now a clearer understanding of the relationship between the PSDB programme of work and its outputs in relation to the National Policing Plan, the Police Science and Technology Strategy and the ACPO Futures Group.

All members of the User Group have a responsibility to represent a wider user community than their home force in debating the relative values of particular projects in satisfying the emerging needs of the police service. We feel therefore, that User Group members offer another opportunity for wider communication between PSDB and forces.

Current membership is:

Tristram Elmhirst (Chair)	West Mercia
John Harwood	Lancashire
Dave Tadd	MPS
Sarah Merrick	West Midlands
Kim Oliver	GMP
Ian Hogg	Strathclyde
Haydn Oakey	Essex
Hannah Guille	West Mercia
Lee Rouse	Gloucestershire
Tony Green	PSDB Police Adviser

We would encourage you to contact us or your nearest User Group member if there are any issues which you would like to raise at our next meeting in June.

Supplier Information

If you need to purchase silicone release paper for the storage of sticky tape, you are no longer able to buy from the original supplier quoted in the April 2003 Update. An alternative can be purchased from

Bartec Paper & Packaging Ltd

Telephone: 01606 354664

Product name: Double-sided silicone release paper (100gsm)

Samuel Banner have reduced the pack size of 3M HFE 7100 from 27 kg to 15 kg in order to comply with Manual Handling Regulations.

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