Home Office

Scientific Development Branch

Crime Investigation and Officer Safety Sector

Fingerprint Development and Imaging Newsletter

April 2005 Publication No. 20/05

In this issue-

Alan Pratt: Director of HOSDB

HOSDB: NEW NAME, NEW ROLE

PSDB has long provided expert advice and support, set standards and developed new capabilities to meet the operational requirements of the Home Office, police service and other government customers. Our new role is to build on this and strengthen the effective use of science and technology across the range of Home Office business to include increased support for areas such as offender management and immigration. To reflect our broader remit, PSDB became HOSDB - the Home Office Scientific Development Branch - on 1 April 2005. We will continue to provide a high quality, responsive service to the police and our other key stakeholders, ensuring we deliver to our customers' most important issues. HOSDB will also continue to work with other government departments and international contacts.

HOSDB forms part of the new Science and Research Group led by Professor Paul Wiles, the Home Office Chief Scientific Advisor.

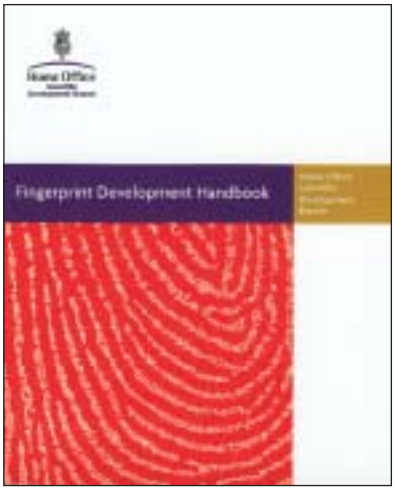
Our mission

HOSDB aims to help build a safe, just and tolerant society through the effective application of science and technology (S&T).
We will:

- Be the definitive source of physical S&T advice and expertise for the Home Office Group
- Deliver innovative S&T capabilities to meet our stakeholders' needs
- Ensure S&T solutions are effective on the ground

REVISION OF THE FINGERPRINT DEVELOPMENT HANDBOOK

The second edition of the Fingerprint Development Handbook is due to be distributed to every police force this month. It includes :



Fingerprint Development Handbook

- Information from 2001 and 2004 updates to the Manual of Fingerprint Development Techniques (DFO, Ninhydrin, Acid Black 1, Acid Violet 17 and Acid Yellow 7)
- Recent best practice recommendations for the recovery of both fingerprint and DNA evidence
- A new Solvent Black 3 (Sudan Black) formulation based on methoxypropanol, which is less flammable than the ethanol-based formulation, making it suitable for use at scenes
- A method for treatment with Superglue at scenes
- New Charts 12 and 13, Fingerprints in Blood on porous and non-porous surfaces

Staff working in fingerprint bureaux, development laboratories and scene of crime departments should have received copies by the time you read this. If this is not the case please contact your manager in the first instance.

SOLVENT BLACK 3 FOR SCENES OF CRIME

There has always been a problem with the treatment of contaminated surfaces at scenes of crime. The introduction of a new formulation of Solvent Black 3 (Sudan Black) goes some distance to alleviate this. It is most effective on non-porous surfaces that are too sticky for the use of powders and where superglue is ineffective.

The new methoxypropanol-based formulation is flammable but since it has a flash–point in excess of 48^{o}C it is usable at scenes of crime. It requires only basic precautions, unlike the 'original' ethanol-based formulation which was highly flammable and unsuitable for use outside controlled environments.

Fingerprint developed with Solvent Black 3 on a door lock

Full details regarding the health and safety and use of new methoxypropanol-based Solvent Black 3 are given in your new Fingerprint Development Handbook (see above).

Preparation of methoxypropanol-based WORKING SOLUTION of Solvent Black 3

1. Weigh out 10g of SOLVENT BLACK 3. Place in a clean, dry, 1 litre plastic-coated glass bottle.

2. Measure out 500ml of 1-METHOXY-2-PROPANOL. Add to the SOLVENT BLACK 3 whilst stirring vigorously. Continue to stir vigorously with a magnetic stirrer for at least 1 hour. A black solution with suspended particles will be produced.

NB. The stirring bar should be dislodged if it sticks in the sediment.

3. Measure out 500ml of PURIFIED WATER. Add to the black suspension and continue to stir vigorously with a magnetic stirrer for at least 1 hour. A black WORKING SOLUTION will be produced.

NB. Stirring bar should be dislodged if it sticks in the sediment. Not all the SOLVENT BLACK 3 will dissolve; some will remain as particulate matter in suspension or as sediment.

4. Label bottle with a list of contents, the person who made the solution, the date and the end of its useful life.

NB. The WORKING SOLUTION will keep for 1 month.

(Contrary to information currently in the Manual of Fingerprint Techniques, the effectiveness of ethanol-based SOLVENT BLACK WORKING SOLUTION decreases considerably after 2 weeks.)

Supply of chemicals

1-Methoxy-2-propanol - is available from Sigma-Aldrich or VWR International.

Solvent Black 3 CI26150 - is available from Sigma-Aldrich, Fisher Scientific (Sudan Black B) and DH Scientific.

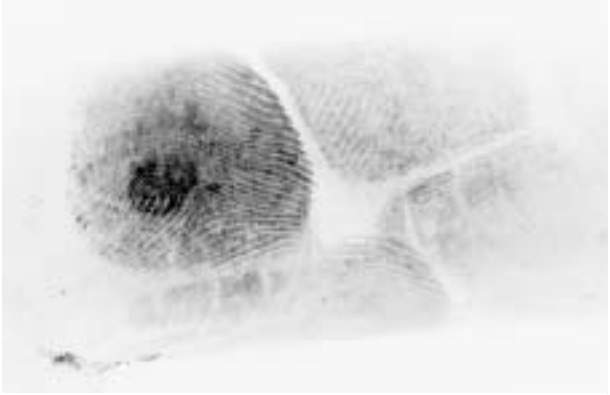
Treatment of surface with Solvent Black 3 working solution

Rinsing surface after treatment

FOCUS ON LIGHT

- Fluorescence Examination with a Nd:YAG Laser

In the last newsletter (Publication No. 71/04) we reported that the number of marks found with fluorescence examination of untreated surfaces can be increased by using a Nd:YAG laser in addition to a traditional arc-lamp light source. As a continuation of the Nd:YAG laser feasibility study, PSDB was tasked by its User Group to determine if these additional marks could be enhanced with currently used (and generally more effective) fingerprint development processes described in the Manual of Fingerprint Development Techniques. Some of the marks found with the laser could not be developed subsequently with powders, superglue/BY40 or vacuum metal deposition.



Mark found on a metal chair – which could not be developed subsequently with powder

The feasibility study has demonstrated that the Nd:YAG laser finds marks that would otherwise not be detected by currently recommended processes. Our next step is to gather data via an operational trial involving force fingerprint laboratories and scene of crime units. Initial fluorescence examination would generally only be used for serious crime, as in most cases it will not be the single most effective process. As the process is non-destructive its use would be most beneficial after initial fluorescence examination with a Quaser and prior to chemical treatment.

If your force is interested in participating in a trial please contact Helen Bandey for further details.

- New Light from Old Quasers

It is now possible to have a high-intensity light source that is as powerful as the Quaser 100 (Q100) but is smaller and lighter so that it is easier to take it to scenes of crime.

The Q100, the most powerful arc lamp system ever produced for fingerprint detection and enhancement, can be rejuvenated by conversion into the new Q101 with no loss of power. This product has been developed in a collaborative project between HOSDB and Electronic Services and has passed strict EMC standards.

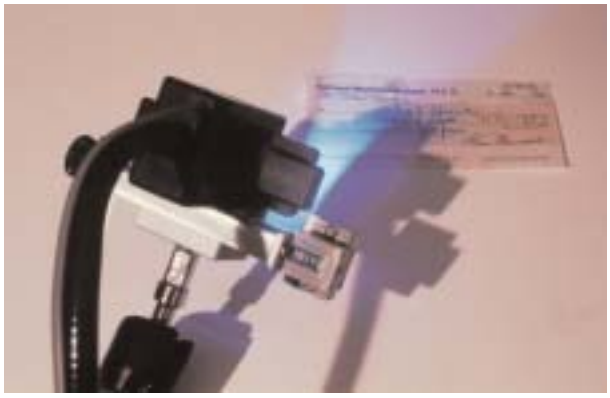
The Q101 conversion costs in the region of £3500 and involves removing the Q100 optical components and rebuilding them into a new case with new electronic components. The unit is approximately the size of the old Q40 and weighs less than 18kg.

The prototype Q101 (top) is easily dwarfed by the old Q100 (bottom)

Further details may be obtained from –
Nick Hartley, Electronic Services.
Tel : 0208 969 9030

- Quaserchrome® – Gathering Dust or Useful Tool?

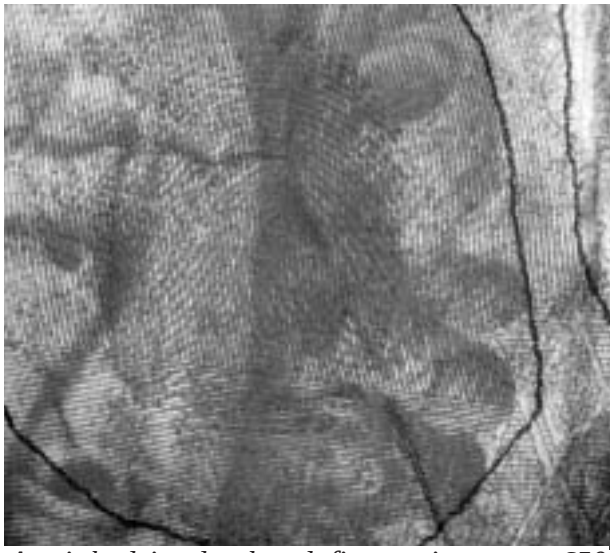
When was the last time your force used the Quaserchrome? In some cases this accessory has become a bit of a curiosity, gathering dust on the back of a bench or cupboard. In fact, the Quaserchrome is a useful tool for revealing marks on coloured and patterned backgrounds and can be very effective when used on most of the current Bank of England banknotes.



A prototype monochromator in use

The Quaserchrome is an accessory that can be connected to a Quaser system operating in white light mode. It enables the user to adjust the wavelength of the illuminating light through the entire visible spectrum, using only a narrow bandwidth (~ 25nm) of the spectrum at a time. This precise control allows the user to match the colour of the illuminating light to that of a printed background, thus enabling it to be suppressed.

The use of such a narrow bandwidth enables the user to distinguish between subtle differences in the colour of a printed background and the colour of a developed mark. Recent investigations have shown that the Quaserchrome is particularly useful for imaging ninhydrin marks on the higher denomination banknotes (£10, £20 and £50). In the case of the £10 note, viewing the note under orange-yellow light suppresses the background colours and makes the purple ninhydrin marks stand out. For the £20 and £50 notes use the deep red region of the spectrum to distinguish the ninhydrin marks from the background.



A ninhydrin developed fingerprint on a £50 note in daylight

A ninhydrin developed fingerprint on a £50 note using the Quaserchrome®

(Images provided courtesy of Tim Watkinson of Hampshire Constabulary)

The Quaserchrome is easy to use and the optimum illumination wavelength can be quickly determined by eye. Next time you are faced with a mark against a coloured, patterned background give the Quaserchrome a try – it might be quite revealing!

If this article has inspired you and you would like a Quaserchrome then contact Paul Stevens from Devon and Cornwall Constabulary on 01392 223165. He has a Quaserchrome that is now surplus to requirement as the IRIS workstation includes this.

TREATMENT OF FABRICS

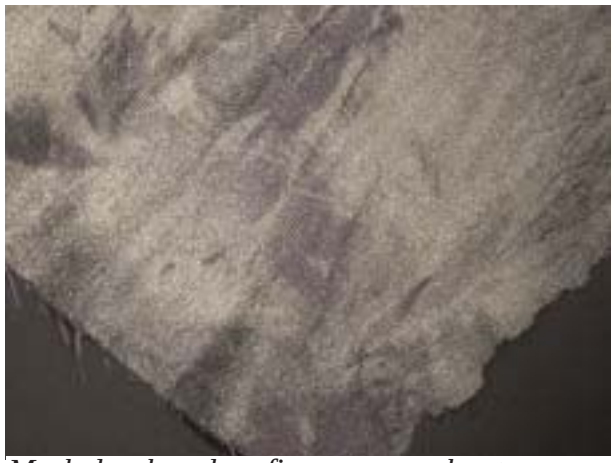
The recent refurbishment of our laboratories has resulted in a reassessment of the equipment maintained by HOSDB. One decision taken has been to place the Radioactive Sulphur Dioxide equipment into storage pending a further decision about the future need for this technique. As a consequence, the User Group has asked HOSDB to review what alternative techniques are available to develop fingerprints on fabrics.

The conclusions of this review are that the advice given for fabrics in the Manual of Fingerprint Development Techniques is still valid. Radioactive Sulphur Dioxide remains the most sensitive technique for developing marks on fabrics but the guidance regarding the weave size and whether the fabric has been wet must be followed. If Radioactive Sulphur Dioxide ceases to be available, there is a chance that marks can be developed using superglue. However, this will be most valid for dark exhibits where the white superglue deposits can be easily visualised against the dark background. For light exhibits the superglue will be difficult to see and cannot be enhanced by dyeing because the dyes used will also dye the fabric itself.

Another technique that can also be used to develop marks on fabrics is Vacuum Metal Deposition. Although previous unpublished PSDB studies show that VMD is only half as effective as Radioactive Sulphur Dioxide, it is capable of developing relatively fresh marks on fabrics and could be used as an additional technique if fabrics are to be treated. The use of VMD is not mentioned in the Manual because of its inferior performance to Radioactive Sulphur Dioxide, but it is more widely available and could be used where fabric exhibits meet the appropriate criteria.

Despite the small number of suitable processes for developing fingerprints on fabrics and the subsequent difficulties in imaging the marks developed against the background weave pattern, recent advances in DNA technology may make chemical treatment of fabrics more worthwhile. In line with the advice given in the 2004 Manual update, carrying out a chemical treatment on a fabric exhibit may reveal where it has been touched by a suspect, even though it may not reveal sufficient ridge detail for identification. The area that has been touched may then be swabbed for subsequent DNA analysis with more confidence that the region has actually been in contact with the suspect.

Mark developed on fine-weave polyester fabric using superglue.



Mark developed on fine-weave polyester fabric using VMD

SUPERGLUE OR POWDERS ON CARS?

We receive many enquiries about the use of superglue at scenes. The guidance we have given and published in Home Office Report 30/03, is as follows:

- smooth surfaces should be powdered at the scene
- those textured surfaces that are unsuitable for powdering but suitable for treatment

with superglue and that can be removed should be taken back to the laboratory and treated there

- any surfaces that are unsuitable for powdering, are suitable for treatment with superglue but cannot be removed can be treated with superglue at the scene using a system such as SUPERfume as long as all Health and Safety implications are considered.

This guidance is as applicable to the treatment of a car as to any other scene.

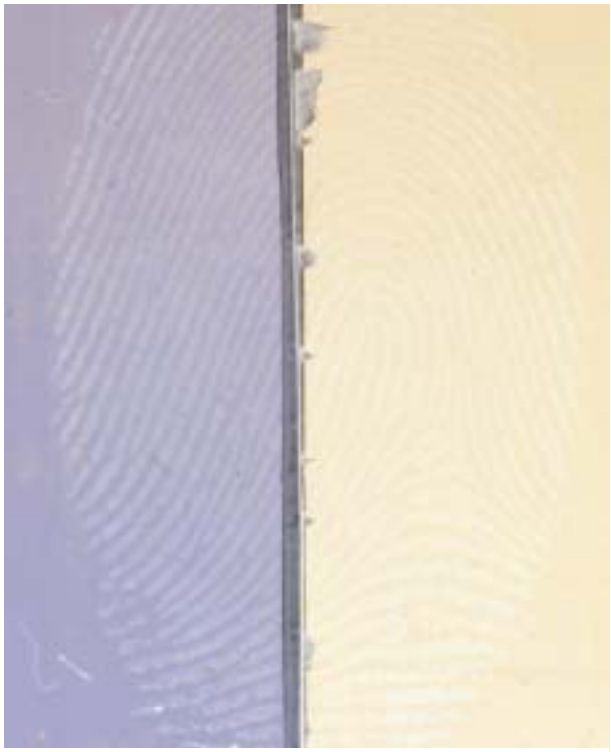
We have recently carried out further work to compare the effectiveness of aluminium flake powder and superglue on car windows. Fingerprints were collected on clean car windows from a range of donors and were aged for between 24 hours and a month before treatment. The aluminium powder was applied with a glass fibre brush and imaged using reflected light. The superglue treatment was carried out in an MVC 5000 superglue cabinet and developed marks enhanced with Basic Yellow 40 (BY40) dissolved in ethanol. The result of the work was that at all fingerprint ages aluminium powder was more effective than superglue on this surface. It should be noted that if a car were treated with superglue without a humidity controlled cabinet and then treated with BY40 dissolved in water the performance would be significantly lower than that in controlled humidity and with ethanolic BY40.

This work supports our previous guidance on the choice between superglue and powders on different surfaces.

DEVELOPMENT OF VMD TECHNIQUES

Our resident student, David Philipson is working principally with the Vacuum Metal Deposition technique. His project, designed to overcome deposition problems on awkward surfaces, has been experimenting with different metal combinations on a variety of plastic bags to improve contrast. This work supports the ongoing operational trial of the silver VMD process.

It has been noted that although silver does develop additional marks after the gold/zinc process and has been shown to do so operationally, on some surfaces the developed mark has poor contrast against the background. The ongoing work is examining whether different combinations of gold and silver can provide the additional contrast needed to image the mark easily.
As you can see, early results are positive and using gold before silver does seem to improve visualisation.



Gold/Silver v Silver

Will VMD soon be coming in a range of different colours?

Strips of freezer bag treated with different VMD metal combinations

REDUCED WASHING OF PD-TREATED ARTICLES

We have been asked whether it is possible to reduce the time needed to treat articles with Physical Developer (PD). The answer is that treatment time can be shortened by about 15 minutes but if this course is taken, re-treatment to improve contrast or detail will not be possible.

PD is a modified photographic process. To save time, it can be fixed with a photographic fixer and then washed in tap water instead of using an extended washing regime in distilled water. Any fix remaining in the article will prevent later retreatment.

Method:

Articles may be transferred from the PD WORKING SOLUTION and into a commercially available fix bath for 1 minute and then rinsed in cold running TAP-WATER for 10 minutes. This removes the need for carrying out STEPS 5, 6 & 7 from the Manual of Fingerprint Development Technique : Section 7.2 (Treatment of Articles with PHYSICAL DEVELOPER).

HEALTH AND SAFETY ISSUES

Use of Highly Flammable Formulations for Fingerprint Development

It is extremely unsafe and therefore unacceptable to use a highly flammable formulation for fingerprint development outside controlled conditions.

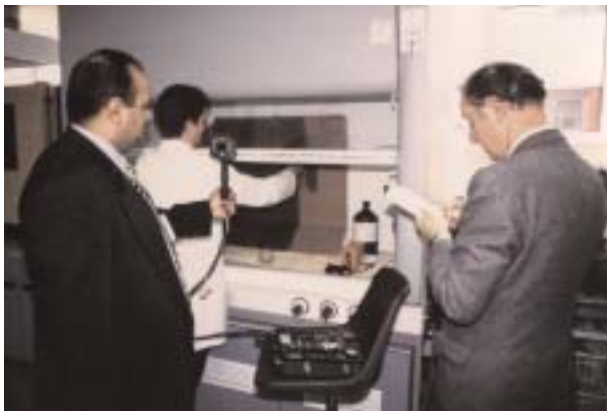
There are only two highly flammable formulations recommended in the Manual of Fingerprint Development Techniques; ethanol-based Sudan Black (Solvent Black 3) and ethanol-based Basic Yellow 40 for dyeing of superglue. It would be highly irresponsible and dangerous to use any other highly flammable fingerprint development formulations. Prosecution of the responsible person is likely to follow any accident due to the flammability of the solvent, as its use could not be justified where safer alternatives are available.

Solvent Black 3 has now been reformulated for use at scenes of crime (see above), and the Basic Yellow 40 dyeing of superglue should be carried out in deep tanks with restricted surface area and adequate laboratory ventilation in accordance with the regulations. The Workplace (Health, Safety and Welfare) Regulations 1992 with Amendments 2002, regulation 6 requires the employer do what is needed to make sure that every enclosed workplace is ventilated by a sufficient quantity of fresh or purified air. The 'sufficient quantity' should be adequate to ensure that flammable limits are never reached. This should form part of the COSHH assessment for this process.

When not in use, deep tanks should be covered with a floating lid and another cover.

Flammable Gas Monitors

The HSE has just issued general advice on the selection and use of Flammable Gas Detectors. This may be found at - http://www.hse.gov.uk/pubns/gasdetector.pdf and should be complied with when considering their use with the new blood reagents (Acid Black 1, Acid Violet 17 and Acid Yellow 7) and Solvent Black 3 at scenes of crime.



Monitoring to determine the likelihood of an explosive atmosphere being formed whilst using a highly flammable fingerprint formulation.

Transport of Working Solutions Within Force Boundaries

A query regarding this issue was received recently. The relevant legislation is The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2004.

No chemical or solution should be transported within the cab of the vehicle or van.

Flammable liquids including ethanol-based Basic Yellow 40, working solutions of Acid Black 1, Acid Violet 17, Acid Yellow 7 and Solvent Black 3 should be transported in combination packages i.e. a bottle or bottles inside a second robust container.

Bottles or containers should be either plastic-coated glass, corrosion resistant stainless steel or polythene and be no larger than 5 litres.

The outer packaging should be of suitable material e.g. boxes of natural wood, plywood, reconstituted wood, fibreboard, plastics, steel or aluminium and such a fit so that inner bottles or containers are unable to knock against one another with enough force to break or puncture.

Ninhydrin working solution can be transported in metal or plastic drums that are secured so that they cannot break or be punctured.

In addition, each package must be clearly and durably marked with the classification symbols, i.e. Flammable, Toxic, Irritant etc. and a complete list of the contents.

Respiratory Protection Equipment at Work

The HSE has just published revised guidance on the selection and use of Respiratory Protection Equipment (RPE) at Work, HSG 53, ISBN 0 71762904 X. It costs £10.95 from HSE books: 01787 881 165.

This book provides essential guidance for the correct selection and use of RPE in the workplace in order to comply with the law.

The guidance is divided into the following sections:
Introduction
Part 1:
Selection and use of respiratory protective equipment
What is RPE?
Legal requirements
Hazardous Substances
Selecting respiratory protective equipment
Implementing RPE use in the workplace
Part 2:
Filters and types of RPE
Filters for respirators
Some common misuses of RPE
Appendices and References.

Using a simple step-by-step approach, it explains when you should use RPE, enabling you to decide the right level of protection for a given hazardous substance and how to select the right RPE for the particular wearer and the work environment. This is done using the RPE Selector and its use is illustrated by worked examples. It also describes significant misuses of RPE and how to prevent them as well as advice on how to ensure that the selected RPE keeps working effectively.

MOFDT AUGUST 2004 ERRATA

The process of producing an update for the Manual of Fingerprint Development Techniques is such a large undertaking that it is inevitable that some errors occur.

In Acid Black 1 and Acid Violet 17 Section 7.2 STEP 4 should read –
Immerse article in WORKING SOLUTION for 3 to 4 minutes.

In Acid Yellow 7 Section 7.3 STEP 3 it should read –
Ensure area of interest is damp for 5 to 10 minutes.

Please feel free to make changes directly to your manual pages.

SUPPLIER INFORMATION

Supply of Dyes

All dyes and chemicals listed in the MoFDT as available from Keystone Europe Ltd should be purchased from DH Scientific Ltd. This includes:
Acid Black 1 (Amido Black)
Acid Violet 17
Acid Yellow 7
Basic Red 14
Basic Yellow 40 (Keyazine Brillant Flavine 10 GFF)
Solvent Black 3 (Sudan Black B)
Carrier ACC

D H Scientific Ltd.
Brooks Mill House
Carr Lane
Slaithwaite
Huddersfield, HD7 5BQ
Tel: 01484 843708

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