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Evaluation of Water Soluble Evidence Collection Adhesive Tape

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TECHNICAL REPORT
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EXECUTIVE SUMMARY

Ray Wickenheiser of the R.C.M.P. Regina Forensic Laboratory evaluated a new water soluble tape for its suitability in gathering trace evidence at crime scenes. The tape is recommended for use in gathering non-biological evidence.

The Water Soluble Tape (Scotch Brand Mask Tape Plus II - Product #5414) is available through:

ODV, Inc.
P.O. Box 180
S. Paris, ME 04281
Telephone: 1-800-422-3784
Fax: 1-207-743-5000

RESUME

Ray Wickenheiser, du laboratoire judiciaire de la GRC à Regina, a mis à l'essai un nouveau ruban hydrosoluble pour en determiner l'efficacite à relever des elements de preuve à l'état de traces sur les lieux de crime. On recommande d'utiliser le ruban pour les elements de preuve non biologiques.

On peut se procurer le ruban hydrosoluble (de marque Scotch, modèle Mask Tape Plus II, n° 5414) auprès de :

ODV Inc.
P.O. Box 180
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Abstract

Trace evidence frequently encountered at crime scenes is currently collected using a variety of methods depending on the type(s) of evidence. Swabbing of biological materials and taping exhibits for hairs and fibres are the current methods of choice. A new product, Water Soluble Tape (Scotch Brand Mask Tape Plus II, available through: ODV, Inc., P.O. Box 180, S. Paris, ME 04281, Product #5414) was compared to these traditional techniques. Use of Trace Evidence Gathering Tape is recommended for use in gathering non-biological evidence. Its use was found to reduce laboratory time, although not without some considerations for crime scene technicians in the field. Collection of biological materials through swabbing was found to be more effective than taping.

Introduction

Collection of trace evidence at the scene of a crime has increasingly become a specialty with many police forces as the knowledge base required for proper exhibit collection increased. Greater evidentiary value is constantly being gleaned from smaller and smaller traces of material at crime scenes. The focus on collection of these valuable traces has therefore increased as well. A synthetic fibre as small as 0.3 millimetres in length can be identified and compared to a known source. A full DNA typing profile can be obtained from as little as 10 nanograms (10 billionths of a gram) of purified DNA. One single pulled hair with an attached root sheath can likewise provide a full DNA typing profile for a DNA comparison. Proper collection of these valuable exhibits at crime scenes is therefore of great importance.

Currently, the method of choice for gathering minute fibre evidence is adhesive tape.[1,2] Suspect surfaces are "taped" for trace evidence through the application and removal of a 5-6 inch long strip of standard clear cellulose adhesive tape. Upon application, the trace evidence is effectively caught on the tape. The tape is then removed, carrying the trace evidence, and stuck to a clear plastic sheet, such as an exhibit bag or loose leaf cover, for easy marking and identification and transport to a Forensic Laboratory.

Similarly hair may be removed in this manner. Quite often, due to the much greater size and for ease of handling, hair is placed directly into exhibit vials, thus freeing the laboratory specialist from the labourious task of removing the hair from the tape adhesive,

Biological material found at crime scenes may present themselves in small, but analysable amounts. At present, swabbing biological materials is the method of choice. A sterile swab is applied to the stain or material with a minimal amount of water, and the substance is readily taken up onto the swab. Drying the swab in room temperature air for 2 or 3 hours effectively preserves DNA on the swab for subsequent analysis. DNA in such a dried form is adequately preserved for a period of weeks or months, but will slowly deteriorate over time. Suspect swabs should be submitted shortly after drying. In most cases, the exhibit bearing the biological material itself is most easily seized and submitted directly to the laboratory. Swabbing is generally reserved for exhibits which cannot be cut easily transported, or the stained portion cut out.

Recovery of the hair and fibre evidence from adhesive tape can be quite labourious, especially if there are a large number of fibres collected as background. Such would be the case in taping a fuzzy pile car seat cover in search of fibres left behind by a suspect driver or victim. A rapid technique, which utilized a vacuum filtration system for removing and concentrating fibres, overcame some of these difficulties.[3] In this method, the adhesive holding trace evidence to the tape backing is dissolved, and

trace evidence is caught on a filter membrane for easier handling and examination. More recently, a new water soluble tape product was introduced for the purpose of gathering trace evidence. The added benefit was that the entire tape could be dissolved in water, freeing trace evidence for unencumbered examination.[4] Water Soluble Evidence Gathering Tape (hereafter referred to as "Watertape") shows considerable promise in gathering trace evidence easily, with less of the tedious removal difficulties of traditional clear cellulose adhesive tape.

As an added potential feature, biological material may be removed with adhesive tape. At present, this technique is not recommended for blood, but can be quite useful for small solid fragments of material.

Research was therefore conducted to determine the usefulness of Watertape in its efficiency and effectiveness in areas of handling, evidence gathering, and evidence removal for fibres, hair, and biological material (blood).

Methods

Subjective observations were made throughout regarding the ease of handling Watertape, appropriate size of tape strips used for taping, and the like. Observations and conclusions will be stated in the discussion section.

Known numbers of target synthetic fibres were placed randomly on a variety of surfaces. Watertape was then used in a standard manner. A strip of tape was placed on the exhibit material, gently pressed down, removed, and replaced on the next adjacent untaped area. In this manner, the entire target surface was covered, and loosely held fibres were taken up by the tape adhesive. This testing was preformed to ensure proper tackiness of the adhesive to ensure fibres with evidentiary value would be retained by the Watertape.

Once retained, fibres must be released from the tape adhesive for high power microscopic viewing. Many examiners prefer to examine fibres directly on the tape using a low power microscope. This method can be very effective if the target fibre is very conspicuous in colour or construction. Conversely, it can be very tedious if the target fibres are unremarkable compared to other captured fibres of no significance (background fibres). Once a likely candidate has been selected, it too must be removed from the tape for further examination.

Removal of fibres from the Watertape involves placing the tape strips in a beaker, and dissolving the tape, backing and all, in 60 degree C water. Once in solution, the suspended fibres are removed from the liquid by vacuum filtration.[3] Standard filtration would seem a logical substitute, however, fibres stuck to the cellulose nitrate vacuum filtration membrane can be mounted directly. The cellulose nitrate vacuum membrane becomes transparent with application of mounting media, thus eliminating the step of removing fibres from the filter surface for mounting. Once set up, the vacuum filtration system is very fast, and can operate with suction from a tap outlet.

Known quantities of whole human blood (50 micro litres) was placed on a smooth surface (arborite) in liquid form in single spots, then allowed to air dry for one day. Spots were then taken up by swabbing, versus scrapping and taping the resulting blood flakes onto the Watertape. Tape strips of minimal size (2 centimetres) were utilized, in an effort to restrict the amount of water required to dissolve the tape. In this manner, the DNA would remain in a the concentrated form required for extraction. Likewise, minimal amounts of distilled water was used in the swabbing procedure in efforts to keep DNA as concentrated as possible on the sterile swabs.

Control blood samples were placed directly into extraction tubes. Swabs and blood tapings were also placed in their own respective tubes. DNA was then extracted and quantified, and amount of human DNA compared.

Discussion

In practical taping testing, all target fibres were found to be retained by the Watertape. The tape adhesive was found to saturate with fibres somewhat quicker than standard adhesive tape, necessitating the use of a larger number of strips. Also, due to the less rigid nature of the tape, shorter strip size of four (4) inches was found to be easier to work with.

Removal of fibres from Watertape was very straightforward, with complete dissolution of tape adhesive and backing in less than 30 seconds in 60 degree C water. Additional rinses of handling equipment is recommended to ensure all fibres are retained on the filter membrane.

Care must be taken to ensure complete drying of filter membranes prior to mounting. Any residual water causes the cellulose nitrate membrane to become opaque upon mounting. Proper drying by exposing the membrane to air at room temperature for 30 minutes remedied this difficulty.

No perceivable difference in quantity of extracted human DNA was found between the swabbed blood and the control samples. A large loss of DNA was found in the taped sample. Only 10% of the DNA was recovered in the tape sample, in comparison to the control samples. During the extraction procedure, the tape did not completely dissolve given the small amounts of extraction solvent added. It is quite likely the DNA was not sufficiently freed from the tape for efficient extraction. Application of larger amounts of solvent could possibly remedy this difficulty, but would result in modification to the extraction procedure, and likely involve a concentration step. Given the success of the swabbed samples, swabbing is recommended as the method of preference for obtaining biological materials on large immovable substrates.

Watertape was found to be somewhat more difficult to handle in an evidence gathering capacity than standard adhesive tape, particularly if high humidity was present. Still, use of the Watertape was found to represent a time saving to lab personnel involved with examination of tapings. Watertape dissolved rapidly and completely, with no remaining residue or visible effects on fibres. As a result, fibre manipulation in the laboratory setting is quicker, less tedious, and more efficient.

Use of Watertape by field personnel is therefore recommended, with conditions. Under extreme circumstances, such as very high humidity, use of standard adhesive tape is dictated. Watertape is expensive, and must be stored in a sealed condition to prevent drying. A previously opened package can be resealed with standard adhesive tape, or the tape can be stored in an air tight container. Use of Watertape in conjunction with vacuum filtration is highly recommended for lab personnel handling fibre trace evidence. This is particularly true when dealing with target fibres lacking contrast with background fibres.

Recommendations regarding gathering of trace evidence:

1. Whenever possible **submit the entire exhibit** item to the laboratory (ex. clothing, weapons). In this way, trace evidence can be preserved and removed in controlled surroundings. Items must be air dried at room temperature to preserve biological materials from breakdown by microorganisms.

2. Where it is not possible to submit the entire item, **tape** for hair and fibre trace evidence if applicable using either Watertape or standard adhesive tape. Place tapes on clear sheet(s) of plastic, such as a loose leaf protector, seal and label.

3. After taping as necessary, where biological materials are suspected, **cut out the area of interest** (photography before and after is recommended). Once again, the trace evidence can be removed in controlled surroundings. Often, a sample of the material is placed directly into test tubes for extraction, negating the swabbing step, to ensure all possible evidentiary DNA is available for analysis.

4. Swab as a last resort on large immovable items (ex. rocks, sidewalk, etc.). Use as small a quantity of distilled water as possible to take up the biological material onto the swab. The swab itself may be wet, excess water being shaken off prior to swabbing. Use all surface area of the swab including the sides as required to absorb the stain. **Air dry** at room temperature, package, label, and submit to the Forensic Laboratory.

References

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