TECHNICAL NOTE

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A Novel Technique for the Collection and Recovery of Foreign Fibers in Forensic Science Casework

REFERENCE: Choudhry, M. Y., "**A Novel Technique for the Collection and Recovery of Foreign Fibers in Forensic Science Casework,**" *Journal of Forensic Sciences,* JFSCA, Vol. 33, No. 1, Jan. 1988, pp. 249-253.

ABSTRACT: In criminal investigations, especially in rape, sodomy, and murder cases, forensic scientists are frequently asked to establish a possible transfer of fiber evidence. In such cases, the initial task is to recover the minute fragments of transferred fibers from the surfaces of the textile articles involved in an incident. An ideal method should be simple, rapid, efficient, and reliable. A novel technique satisfying all of the above criteria is described which involves the use of an adhesive bed for the collection and recovery of fibers, and laser illumination/stereo light microscopy for search and localization of possible matching fibers. The adhesive bed consists of a clear polyester film (100 by 130 mm) preprinted with a grid and label. The grid area (100 by 100 mm) was covered with Double Coated® adhesive tape. The bed is stored in a document protector. The advantages of this new technique over existing methods include rapid collection of evidence material from large surfaces, convenient handling and storage of samples, and rapid recovery of suspect fibers. This technique is time-saving and practical in routine cases and meets the needs of overburdened crime laboratories.

KEYWORDS: forensic science, fibers, adhesive bed, recovery procedure, laser illumination, casework

The success of any criminal investigation is often dependent upon recovery of trace evidential material for subsequent analytical or comparative examinations or both. Textile fibers are one of the most common types of transfer evidence encountered in forensic science. Transfer of fibers occurs, according to Locard's Exchange Principle [*1*], upon contact of one textile article with another; the transferred fibers are generally invisible to the unaided eye. The collection and recovery of transferred fibers from the textile articles is an important aspect in cases involving fiber evidence.

Since the introduction of the vacuum sweeping technique by Kirk [*2*] in 1953, several methods, including shaking, brushing, scraping, and high and low adhesive tape lifting, have been reported for the collection of fibers from clothing articles. The collection efficiency and the associated limitations of each of these methods have been evaluated by Pounds [*3*].

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense. Presented at the 39th Annual Meeting of the American Academy of Forensic Sciences, San Diego, CA, 16-21 Feb. 1987. Received for publication 18 Feb. 1987; revised manuscript received 15 April 1987; accepted for publication 21 April 1987.

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The process of collection is followed by localization and, then, segregation of significant fibers. All of the available techniques are able to collect fibers; however, the fiber recovery process is time-consuming, tedious, and often frustrating. Even the improved procedures such as the use of adhesive rollings [*4*] and tape scanners [*5*] have failed to gain popularity as a result of associated drawbacks including the loss of area specificity [*6*] with the rolling technique and the possibility of contamination of tape strips as has been pointed out by the developer of the technique [*5*] and others [*7*]. There is clearly a need to develop an improved method for the collection of fibers in complex cases which is effective and rapid and has the ability to maintain area specificity.

A simple, rapid, and efficient technique for the collection, search, localization, and recovery of fiber evidence is described. The technique appears to be ideal for routine casework.

Methods and Materials

Preparation of Adhesive Bed

Transparent polyester film (James River Graphics, South Hedley, Mississippi; KBK-P; thickness 0.004 in. [0.01016 cm]) was cut into 100- by 130-mm pieces. The cut film was printed with a 100- by 100-mm grid, divided into 10-mm squares, and labelled with a Xerox copying machine (Fig. 1). The sheets (four or more, depending on the size of the glass plate) were affixed to a glass plate (by using two strips of double coated Scotch® tape), and the grids were covered with Double Coated® adhesive tape (1 in. [2.54 cm], 3M, stock No. 665) in such a way that each strip joined the next to form a continuous adhesive bed. The tape along the sides of the grid area were cut by using a surgical knife and the sheets with adhesive bed on one side were carefully lifted from the glass plate and stored in clear plastic 9- by 11-in. (23- by 28-cm) document protectors. Adhesive beds of other sizes were similarly prepared for use with smaller or larger textile surfaces. These beds can be routinely prepared by non-technical laboratory personnel with minimal training. These devices (adhesives) of various size may soon become available commercially in the form of a Fiber Collection Kit (patent applied for).

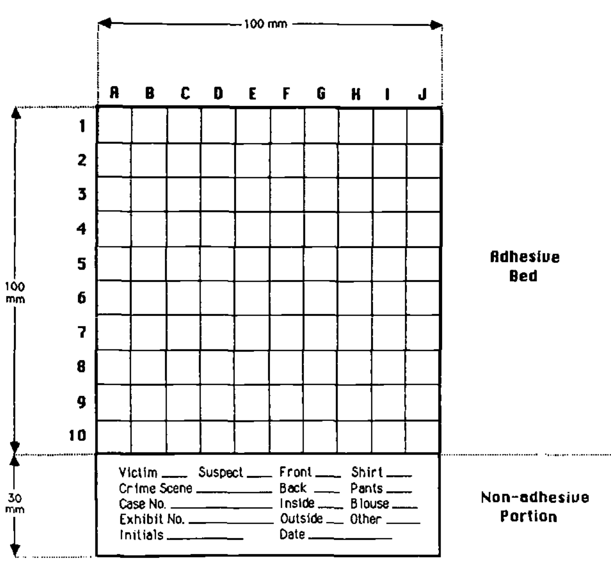

FIG. 1—*Adhesive bed preprinted with grid and label.*

Collection of Fibers

The fabric article to be examined was placed on a clean sheet of paper and all visible types of evidence, such as hair, fibers, vegetable substances, and so forth, were removed using forceps as suggested by Pounds [*3*] and De Forest et al. [*8*]. The adhesive device was removed from the document protector and placed over an area of the garment from which the fibers were to be collected. Mild to moderate pressure was applied (depending upon the fabric texture). The device was lifted and applied to an adjacent area of the fabric and the procedure repeated until all of the area under investigation was processed or the adhesiveness of the bed diminished considerably or both. Pertinent information was then recorded on the preprinted label and the device was stored in the document protector.

Search and Localization of Potential Matching Fibers

Two optical systems were used to search and localize the suspected fibers collected by the adhesive device: (1) stereo light microscopy and (2) laser illumination. In both cases, the adhesive bed was examined without removing it from the document protector. Suspect fibers were searched and localized by using a standard stereo light microscope. The scanning of the adhesive surface was carried out with the adhesive surface of the device facing downward and still attached to one side of the document protector.

If the known (control) fabric fibers fluoresced by laser illumination, then the adhesive device was searched by the laser beam and suspect fibers were marked (using a Pilot marker pen) by encircling them directly on the nonadhesive side of the device. The laser illumination system consisted of a beam of modest energy (5 W) emitted by a laser (Spectra-Physics argon ion laser, Model 171-19) and directed from one side of a wooden box (400 by 400 by 400 mm) to a mirror placed at 45° in the box (Fig. 2*a*) such that the reflected beam impinged upon the glass plate on which the document protector containing the adhesive bed was placed (Fig. 2*b*). Safety goggles (Laser-Guard® for use with argon lasers; optical density (OD) 15 at 488 nm and 11 at 514.5 nm, luminous transmittance 59%; Glendale Optical Co., Woodbury, New York) were used during search and localization process by laser illumination.

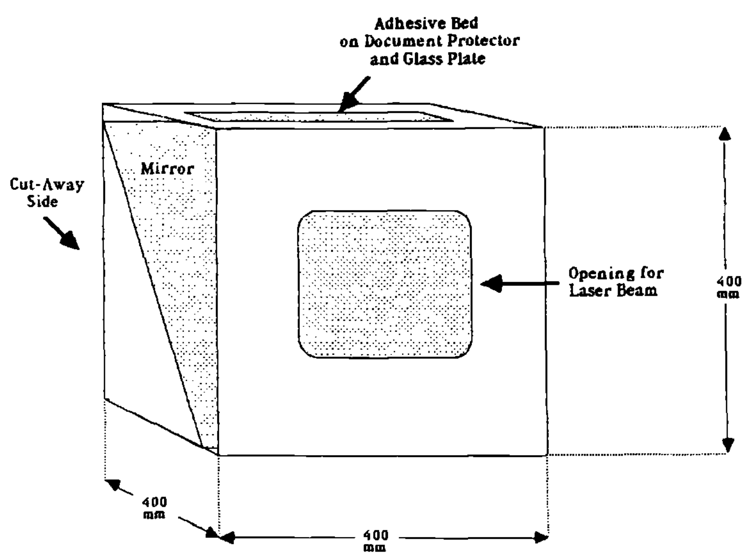

FIG. 2*a*—*Cutaway view of fibers luminescence viewing box.*

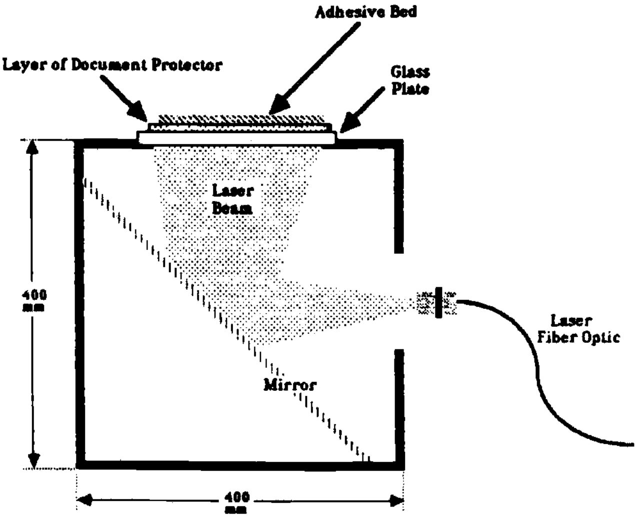

FIG. 2*b*—*Laser illumination of the adhesive bed.*

Recovery of Matching Fibers

After localization either by stereo light microscopy or by laser illumination, the suspect fibers were removed from the adhesive bed with fine forceps while constantly viewing and scanning the device under the microscope. These recovered fibers were preserved on microscope slides for additional examination by means of polarizing microscopy or other comparative methods or both.

Results and Discussion

The process of making the adhesive beds of different sizes was quite rapid and simple. Although adhesive beds of several sizes were made (for small and large size clothing articles), the standard size bed (100 by 130 mm) was found to be appropriate for small surfaces (shorts, underpants, brassieres, and so forth) as well as larger surfaces. The device was tested in actual caseworks for the collection and recovery of foreign fibers.

The proposed adhesive bed technique is simple, effective, practical, and time-saving. The advantages of this technique over previously described procedures are as follows.

1. Since the present fiber collection device has a large surface, each contact with the textile material covers a large area (as compared to using narrow strips of adhesive tape). Thus, a large piece of clothing is processed rapidly and completely. The chances of leaving out unexplored areas will be much lower than would exist if individual strips of adhesive tape were used. Further, in the case of articles with coarse texture, collection of fibers will not be a problem (compared to the individual tape lift method) since appropriate pressure can be applied to recover the suspect fibers from such areas.
2. Since the Double Coated tape used to construct the device is not highly adhesive and is comparable to the conventionally used 3M Scotch 810 Magic tape in adhesive thickness and material, the problem of picking up a greater number of background fibers during collection does not arise.
3. As the adhesive devices are transparent, the search for matching fibers is relatively easy and rapid.
4. Since the present device stays flat (as compared to the individual strips of adhesive

tape), focusing and refocusing of the microscope is not necessary, and consequently, the adhesive area can be scanned rapidly.

5. The associated printed grid helps to keep track of the areas examined and aids in the identification of the location of matching fibers, as the field of view of a stereo light microscope will usually cover an entire square of the grid at sufficiently high magnification (×20). This also results in rapid scanning and localization of matching fibers.

6. Unlike the individual strips of tape used in tape lifts, the present device will not easily tear, fold, or get entangled.

7. The storage, cataloging, and sorting of the adhesive beds in document protectors is simpler and more convenient as compared to narrow adhesive strips.

8. Removal of matching fibers was relatively easier with the present adhesive bed compared to the individual tape lift method as a result of the convenient handling of the device.

9. The adhesive bed technique has not only made the laser search and localization of matching fibers possible but also made the procedure convenient and rapid.

10. The device can also be used in the field by the crime scene processing personnel.

Conclusion

The adhesive bed technique offers a single step procedure for each stage of collection, search and localization, and recovery. Also, the fibers collected do not come in contact with other surfaces (other than the clean clear plastic of the document protector). Thus, the integrity and reliability of the evidence is maintained. In the light of these advantages, the author believes that the new adhesive bed technique is highly valuable, time-saving, and practical for laboratories with high case loads.

References

[1] Pounds, C. A. and Smalldon, K. W., "The Transfer of Fibers Between Clothing Material During Simulated Contacts and Their Persistence During Wear. Part 1. Fiber Transference," *Journal of the Forensic Science Society*, Vol. 15, No. 1, Jan. 1975, pp. 17-27.

[2] Kirk, P. L., *Crime Investigation*, Interscience Publishers, New York, 1953, pp. 100-108 and 629-635.

[3] Pounds, C. A., "The Recovery of Fibers from the Surface of Clothing Submitted for Forensic Examination," *Journal of Forensic Sciences*, Vol. 15, No. 2, April 1975, pp. 127-132.

[4] Fong, W., "Fiber Evidence: Laboratory Methods and Observations from Casework," *Journal of Forensic Sciences*, Vol. 29, No. 1, Jan. 1984, pp. 55-63.

[5] Grieve, M. C. and Garger, E. F., "An Improved Method for Rapid and Accurate Scanning of Fibers on Tape," *Journal of Forensic Sciences*, Vol. 26, No. 3, July 1981, pp. 560-563.

[6] Grieve, M. C., "Discussion of 'Fiber Evidence: Laboratory Methods and Observations from Casework'," *Journal of Forensic Sciences*, Vol. 29, No. 4, Oct. 1984, pp. 955-956.

[7] Fong, W., "Author's Response to 'Discussion of Fiber Evidence: Laboratory Methods and Observations from Casework'," *Journal of Forensic Sciences*, Vol. 29, No. 4, Oct. 1984, pp. 957-959.

[8] De Forest, P. R., Gaensslen, R. E., and Lee, H. C., *Forensic Science: An Introduction to Criminalistics*, McGraw-Hill, New York, 1983, pp. 146-152.

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