TECHNICAL NOTE

M. C. Grieve,[1] B.Sc. and E. F. Garger,[1] B.S.

An Improved Method for Rapid and Accurate Scanning of Fibers on Tape

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ABSTRACT: The use of adhesive tape to remove fibers transferred during contact between garments in criminal cases is standard forensic science practice. Problems associated with the recovery of "suspect" fibers from these tape strips are discussed. An aid to searching is suggested that eliminates these problems and provides an effective, accurate, and time-saving method for dealing with this routine task. It also allows more accurate quantitation of various fiber types present on tapes.

KEYWORDS: criminalistics, fibers, adhesive tapes, search procedures

The practice of using adhesive tape to remove loose fibers from the surface of garments submitted to forensic science laboratories for fiber contact examinations has been long established [*1-3*]. An extensive study on the efficiency of various methods of recovering such fibers was carried out by Pounds [*4*] working at the Home Office Central Research Laboratory in England. This study showed that the most practical method is to remove the fibers with low-adhesive tape. This tape removes fewer background fibers and allows easier removal of fine low-denier fibers than does high-adhesive tape, though the latter is more efficient at removal if it is expected that only very few fragments will be found [*5*].

There do not appear to be any references in the literature that discuss the scanning of the tapes under a low-power stereomicroscope to remove suspect fibers from them. It is of little use having a highly efficient collecting system if the same degree of efficiency cannot be applied to searching the tapes for the required fibers. To search a large number of tapes consecutively requires much concentration and patience and is a time-consuming and fatiguing process. These factors in themselves are likely to contribute to error on the part of the analyst who may fail to remove all fibers likely to yield a positive result after further examination. The authors believe that they have produced a very simple but remarkably effective aid to scanning fiber tapes that greatly increases efficiency and saves a considerable amount of time.

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[1]Forensic chemists, United States Army Criminal Investigation Laboratory, Frankfurt-am-Main, West Germany.

Once the fibers have been lifted onto the tapes they are conveniently stored and easily labeled after the tapes have been wrapped around 75- by 25-mm glass slides or around polycarbonate sheets[2] cut to a suitable size such as that used for the ABO absorption-elution blood grouping technique [6]. Unfortunately, one still encounters cases where tapes with attached fibers are sent to laboratories for examination after they have been folded over adhesive surface to adhesive surface. This makes separation and searching extremely difficult.

Several years ago an acceptable method of searching tapes for fibers was to flood the glass slide with benzene or toluene, thus clearing the tape and forming a temporary mount on which suspect fibers could be marked and cut out for further examination. The slides then became difficult to store for any subsequent scans as the adhesive became sticky. This method was discontinued after the discovery that benzene was carcinogenic!

Thereafter the tapes were removed from slides, turned over (fiber side up), and moved slowly by hand across the stage of a low-power binocular microscope while suspect fibers were removed after being moistened with xylene. This gives a very inaccurate search because of the inevitable tendency to deviate from the x and y axes of the tape while scanning, and because the tape does not lie flat, continual refocusing is necessary. Extra time is always used by backtracking to try to ensure that no areas of the tape are overlooked. The use of a microscope with a movable head improves the situation somewhat, but one still has to make several adjustments and the stage clips often fail to do an effective job of holding the tape flat. The situation has been much improved by the following solution.

Method

A precoated silica gel chromatography plate (F254, Merck) measuring 10 by 20 cm was completely covered on the coated side with opaque linen adhesive tape that was overlapped onto the upper surface, leaving a clear glass area across the center with a strongly reflecting white background. Two parallel horizontal lines 25 mm (1 in.) apart were drawn across this area with a fine-tipped waterproof marker. The area was then subdivided into a grid of squares each approximately 8 by 8 mm as shown in Fig. 1. This size was chosen because, with a magnification of ×16 on a Zeiss OpMi 1 low-power search microscope, one of these squares exactly fills the field of view. This size is also suitable for use with a Wild M 3 microscope.

Two 5-mm-wide strips of Tapeset double-sided adhesive tape produced by Letraset® are cut from a roll (a 50-mm-wide roll conveniently yields ten such strips) and carefully placed so that they lay along the top and bottom lines of the grid system. Once the backing is removed a tape with fibers can be stretched across the grid and gently pressed down onto the adhesive strips, which will hold the tape absolutely flat. In this laboratory, 25-mm (1-in.) wide Scotch® Magic Transparent acetate tape is used; it is so light that many successive tapes may be thus affixed before the adhesive strips lose their power and require renewing. On trial, 100 tapes were affixed successively with hardly any noticeable loss of adhesive power. Care must be taken to examine the adhesive strips between each fiber taping to make sure that they remain absolutely fiber-free. It is also very important to store the tape scanner while not in use in such a manner that the adhesive strips cannot become contaminated, for example in a self-sealing polyethylene bag or by reapplying the original or comparable protective backing.

As the tapes are held completely flat, no adjustments in focus are required while the scanning continues, and the tapes can be scanned very quickly and accurately along the three rows of squares without fear of error. If one prefers to use a higher magnification of ×40, each square can rapidly be scanned in quarters. The length of the plate allows a convenient

[2]Makrolon®, supplied by Makroform GmbH Chemiewerkstoffe, Frankfurt, W. Germany.

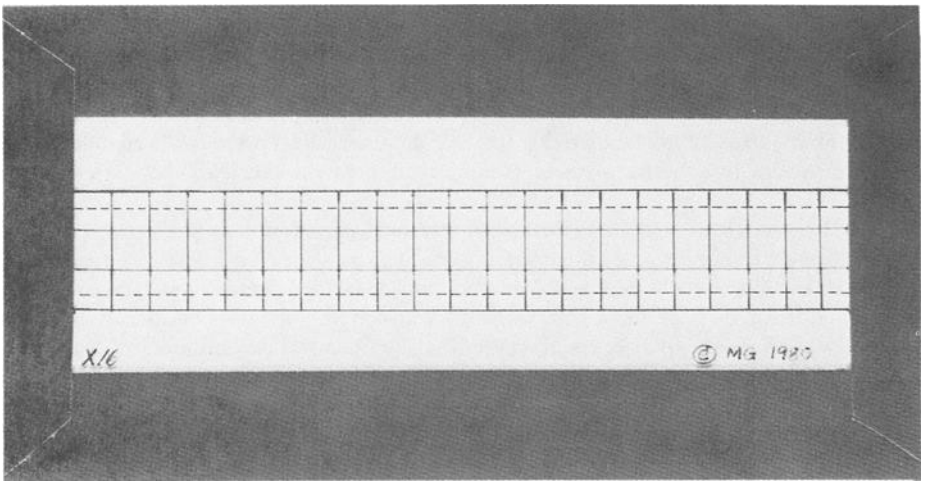

FIG. 1—*Tape scanner showing grid system. Dotted lines indicate position of double-sided adhesive tape.*

tape length of about 200 mm (8 in.) to be used: however, longer plates or alternative grids may be constructed if desired.

Apart from an increase in speed and accuracy, the fact that the tape is mounted on a larger plate allows much easier handling and maneuverability. If for any reason the examiner is interrupted while scanning a tape, he is immediately able to relocate the exact spot where he stopped. It would be possible to number the squares with the waterproof marker, and if one did not wish to remove more than one type of suspect fiber at a time, positions where other "wanted" types had been observed could be noted and swiftly returned to. It is possible to overlay control fiber microscope slides that can be immediately compared by a rapid up-and-down focusing movement in order to refresh the memory as to whether a particular fiber is worth removing for further examination. This in itself may save time at a later stage during a case. The authors have found it convenient to position the control slide so that the coverslip side faces downward on the tape, thereby requiring minimal refocusing. The grid system also has the advantage of allowing some degree of quantitation of the various fibers present on tape. For example:

Fiber Type A present in all squares
Fiber Type A present in 50% squares
Fiber Type A present only in isolated squares

or

approximately twelve fibers of Type A per square
six fibers of Type A per square
one fiber of Type A per square

This could be helpful in answering questions on whether or not any other types of fiber (apart from those being sought) were present in large numbers on the tape. It can assist in estimating the degree of "shedability" of control fibers from various garments. It may also help to overcome some of the difficulties in researching numbers of fibers transferred or already present on clothing under different sets of circumstances; for example, data are sadly lacking on the possibility of finding some of the more common fiber types already present on garments through random contacts not related to actual case work.

The principle of the suggested searching aid can be adapted to various widths and lengths of tape and to preferred magnifications, the cost is virtually nil, and it allows a tedious task to be accomplished quickly, easily, and, above all, accurately.

References

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Address requests for reprints or additional information to
Michael C. Grieve
USACIL-Europe
APO New York 09757