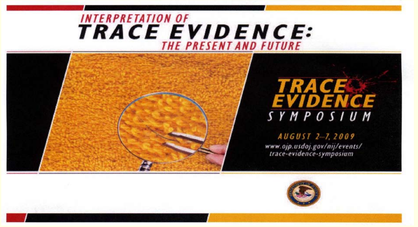

FIBER PERSISTENCE ON GARMENTS UNDER OPEN-AIR CONDITIONS

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I ABSTRACT

During daily casework forensic scientists often work with fibers recovered by taping from the clothing and from the skin of homicide victims. In these tapings they try to find fibers which originate from the clothing of the offender. If a corpse is found in the open air, the skin and the clothing will have been exposed to the elements. In this case it can be assumed that the weather has had an important influence on the persistence of the fiber material with which the corpse has been contaminated during the offence or during transport.
In the experiments textile fibers were used which show a strong fluorescence under UV-light illumination. With fine tweezers 100 specimens of each textile fiber type were evenly distributed on the surface of each recipient fabric.
The prepared pieces of material were fixed onto a horizontal board and put outdoors on the ground. At fixed time intervals the boards were put back into the laboratory and the remaining fibers were counted. The experiment lasted 42 days altogether. Meteorological observations for the area were made at a nearby weather station.
A high percentage of the fibres will persist even for weeks on garments which have been left undisturbed and exposed to the open-air. The number of persisting fibres was found to depend on the texture of the recipient garment, the fibre type and fibre length and the weather. The experiments never showed a total loss of fibres.
The probability of finding fibers originating from the offenders clothing on a homicide victim is very high, even when the corpse has been exposed to the elements for weeks.

II INTRODUCTION

The number of fibers, which have been transferred to a garment during a contact and the persistence of those fibers will determine whether or not they are likely to be found on recipient clothing. Therefore a knowledge of the mechanisms of transfer and a knowledge of the persistence of transferred fibers is very important for our investigations during our daily casework. The time elapsing before recovery of the clothes from a suspect may vary from a few hours to several months after the crime. This means that to a certain extent transferred fibers will be lost.
In our daily casework we often work with fibers recovered by taping from the clothing and from the skin of homicide victims. In these tapings we try to find fibers which originate from the clothing of the offender, even if his identity is unknown at this time. If we are successful, certain fiber types may provide useful information to the police and can be searched for in tapings taken from a suspect developed at a later date.
If a corpse is found in the open air, the skin and the clothing will have been exposed to the elements. The time of exposure can vary from hours to several months. In this case it can be assumed that the weather has had an important influence on the persistence of the fiber material with which the corpse has been contaminated during the offence or during transport. In such circumstances it is of interest to the scientist to have some idea of how many transferred fibers are likely to remain.
The aim of the present study was to investigate the persistence of three textile fiber types on different fabrics which had been exposed to the elements.

III MATERIALS AND METHODS

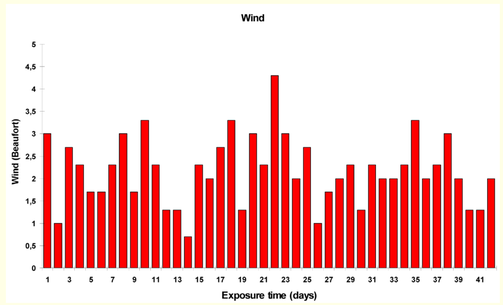
In our experiments we used yellow cotton, pink wool and yellow polyester fibers which show a strong fluorescence under UV-light illumination. The recipient garments used were selected to represent a wide range of surface textures. Square patches of material (12 cm x 12 cm) were removed from the original garments and fixed onto a horizontal board (Figure 2): T-shirt (5 surfaces / cotton), shirt (cotton / polyester), fleece (polyester), jeans (cotton), Sweater (acrylic), cord trousers (cotton).
With fine tweezers 100 specimens of each textile fiber type were evenly distributed on the surface of each recipient fabric in an area of 10 cm x 10 cm. The fibers were applied under UV-light illumination in a dark room in our laboratory (Figure 1). To avoid any unintentional loss during transportation out of the laboratory building the boards were put into a closed box. The prepared pieces of material were put outdoors on the ground, 5 meters away from our laboratory building (Figure 3). Not far away were bushes and a tree. At fixed time intervals the boards were put back into the box and transported into the dark room of our laboratory. After removal of botanical particles, snails, dirt or other contaminations the remaining fibers were counted by means of UV-light and a handcounter. Afterwards the textiles were again exposed to open-air conditions in order to continue the experiment. The experiment lasted 42 days altogether.

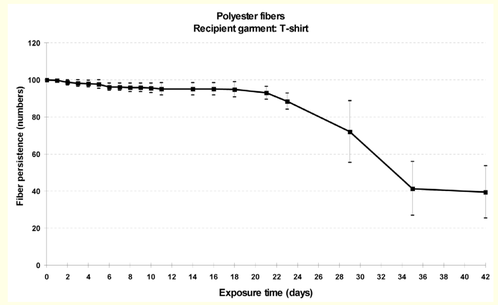
IV RESULTS

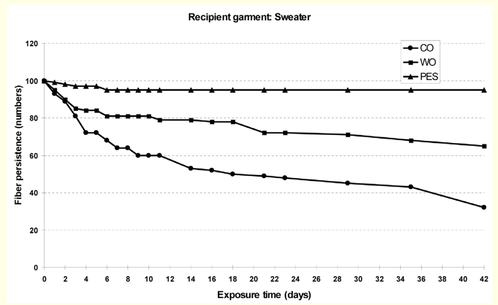
Meteorological measurements during the 42 days in March and April while the experiment was carried out were made at a weather station, which is 2.5 km away. The daily records of precipitation and of average and top wind speed were evaluated.

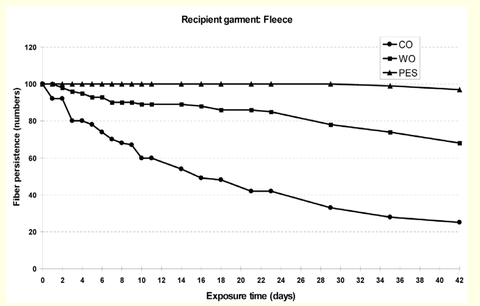
The persistence of yellow cotton, pink wool and yellow polyester fibers on a cotton T-shirt was examined. The figures show fiber loss curves with one-standard-deviation limits of five parallel experiments.

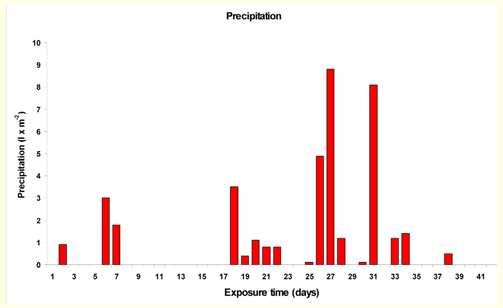
In additional experiments different recipient garments were used: Sweater, Jeans, Corduroy, Fleece, Shirt.

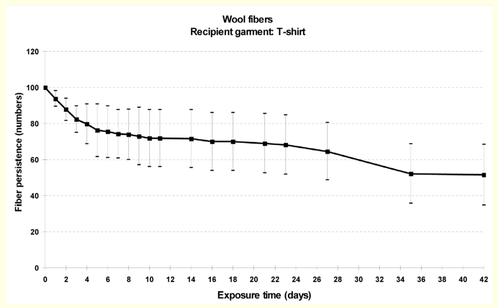


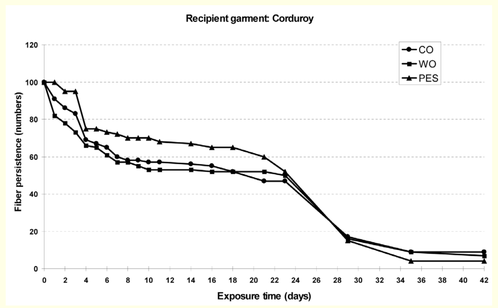












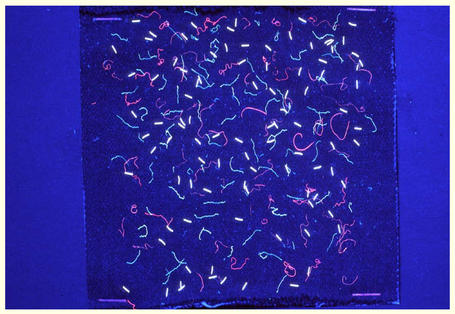


Figure 1: Yellow cotton, pink wool and yellow polyester fibres distributed on the surface of a garment (UV illumination / fluorescence)

Figure 2: Garments fixed onto a horizontal board

Figure 3: Area of exposure

V CONCLUSIONS

Summarizing the data of the experiments we can conclude that: Fibers can persist to a high extent even on garments which have been exposed to the elements for weeks. Our experiments never showed a total loss of fibers. The number of persisting fibers was found to depend on th e surface characteristics of the recipient garments. On rough surfaces (fleece or sweater) nearly all polyester fibers, 65% to 68% of the original wool fibers and 25% to 32% of cotton fibers persisted. Fiber loss was found to be higher on smooth surfaces like a T-shirt, shirt, a jeans or cord trousers. But even in these experiments around 50% of the original textile fiber material was found after three weeks of exposure. After six weeks 4% to 51% of the original fibers persisted on the recipient garments. On smooth surfaces the difference between the persistence of the three textile fiber types was not as big as on rough surfaces. Furthermore longer fibers were lost more quickly than shorter fragments.
When compared with the high fiber losses when clothing is worn, a high percentage of the fibers will persist on garments which have been left undisturbed and exposed to the open-air. Persistence depends on the fiber type and fiber length, the texture of the recipient garment and the weather. Little rainfall and wind velocity up to 17 m x s^{-1} affect fiber persistence only to a small degree, whereas high amounts of precipitation result in higher fiber losses. The probability of finding fibers originating from the offenders clothing on a homicide victim is very high, even when the corpse has been exposed to the elements for weeks. Furthermore it can be assumed that fibers from the offenders clothing will persist for a longer time on the clothing of the victim than fibers from the victim on the offenders clothing, if it has been worn after the crime.