Fibre Information

Fibre Examination
In some forensic cases the only fibre examination required is one of fibre identification (e.g. fire investigations). In other cases, fibre identification and comparison are done to investigate a possible association between two or more sources.

Fibre Identification
The generic class/sub-class of a fibre is determined using bright field microscopy and, if needed, one or more of the following methods:
- polarized light microscopy
- solubility tests
- melting point determination
- natural fibre tests (staining and physical tests)
- Fourier Transform Infrared Microspectroscopy (FTIR)

The identification of natural fibres is not always conclusive. In particular, extensively processed fibres may be difficult to identify.

Ancient or rare fibres, which are not in our reference collection, may not be considered in our fibre evaluation.

Fibres are unequivocally identified by testing them to the point where no other fibre type would give the same combination of results.

Fibre Comparison
Transferred fibres are removed from evidentiary items via taping or direct removal.

Unknown fibres are screened from tapings and selected for comparison to known samples based on stereomicroscopic appearance. No association or conclusion can be made about the remaining unknown fibres on the tapes since they do not relate to any known comparison sample.

Occasionally, numerous fibres of the same apparent fibre type/colour are detected on tapings from one individual/object, which are not similar to any known sample submitted in the case. These fibres may be used for comparison with fibres on tapings from another individual/object. These would be reported as “extraneous fibres in-common, of no known source”.

Fibre comparison is done using one or more of the following methods (in addition to identification of chemical composition):

- bright field comparison microscopy
- fluorescence comparison microscopy
- microspectrophotometry (MSP)
- thin layer chromatography (TLC)

The particular methods used for fibre identification/comparison will depend upon sample size and suitability. Usually, TLC and/or MSP are only performed on a representative number of fibres that are microscopically indistinguishable.

**Significance Of Fibre Evidence**

Sample of reported Result when no differences are found between fibres:

“fibres were indistinguishable in microscopical appearance (e.g. configuration, diameter, delustrant, colour), composition (e.g. cotton, polyester), by microspectrophotometry and thin layer chromatography (when applicable)”

Sample of reported Conclusion when no differences are found between fibres:

Since textile materials are usually mass-produced, it generally cannot be said that a fibre came from one particular garment and no other. If in all tests performed, the unknown fibre is indistinguishable from fibres comprising the known source, a sample report conclusion would be:

“the unknown fibres originated from the known source OR originated from another source with indistinguishable fibres”

Textile fibres can be transferred between individuals, or between individuals and objects, or between objects. The number of fibres transferred and retained (persistence) is dependent on various factors (e.g. nature of recipient fabric/surface, time since transfer, etc.)

There may be factors which increase the significance of unknown fibres being indistinguishable from the fibres of a comparison sample (e.g. the fibres are of an uncommon type).

There may be factors which decrease the significance of unknown fibres being indistinguishable from the fibres of a comparison sample (e.g. few fibres found, or the fibre type is very common).

There may be factors which decrease the significance of a fibre association between two individuals (e.g. previous legitimate contact between the parties involved).

There may be factors which increase the significance of a fibre association between two individuals (e.g. cross transfer involving several fibre types).

Finding no fibre association between individuals may or may not be significant, depending upon the circumstances.

**Glossary**

*bright field microscopy*
light is transmitted from below the sample and an enlarged image of its internal features are viewed from above

*comparison microscopy*
microscopy using a system of two microscopes positioned side by side and connected via an optical
bridge in which specimens may be examined simultaneously (used in bright field, fluorescence or polarized light microscopy).

*comparison sample / known sample*
sample from a verifiable source (e.g. an item of clothing, or a section of carpet from a scene)

*delustrant*
particles embedded in man-made fibres to decrease lustre

*fibre*
the smallest unit in textile production, which can be natural or man-made (short staple or continuous filament).

*fluorescence microscopy*
microscopy which employs light of specific wavelength to examine the fluorescent properties of fibres (i.e. absorption of light and emission of light of lesser energy)

*Fourier transform infrared spectroscopy (FTIR)*
the spectral analysis of the wavelengths of infrared radiation which are absorbed by a sample (the spectral results are directly related to the chemical composition of the sample)

*generic class (of fibres)*
group of fibre types with similar chemical compositions

*indistinguishable*
fibres could not be differentiated within the limits of the stated examination

*knit fabric*
fabric made by the intermeshing of loops of yarn

*macroscopical examination*
an unaided visual examination

*microspectrophotometry*
spectral analysis of the wavelengths of visible and ultraviolet light which are absorbed by a sample (the spectral results are directly related to the colour of the sample)

*ply*
an individual yarn with which other yarns are twisted together to form a plied yarn/thread or cord.

*polarized light*
light which vibrates in a single direction perpendicular to the propagation direction

*polarized light microscopy*
microscopy used to examine the effect of polarized light on a sample, characteristic of its chemical composition

*stereomicroscopy*
using a microscope which has a separate optical path for each eye, giving a magnified 3-dimensional view of the sample and its external features
**taping**
a technique used to remove extraneous trace material from the surface of an object, utilizing clear adhesive tape which is subsequently placed in a sheet protector.

**thin layer chromatography (TLC)**
a technique that separates the components of the coloured dye after it is extracted from a fibre or hair.

**trace material**
materials which may not be visible to the naked eye (e.g. hairs, fibres, botanical fragments).

**twist direction**
the twist of a yarn or thread is described as “S” or “Z” according to which of these letters has its centre inclined in the same direction as the surface elements of the yarn.

**unknown sample**
material collected from an item of evidence, and having an unknown originating source (e.g. extraneous hairs or fibres from the surface of a garment, piece of fabric in a windshield).

**warp**
the set of yarn in all woven fabrics that runs lengthwise and parallel to the selvage (finished edge) and is interwoven with the weft (filling).

**weft (filling)**
in a woven fabric, the yarn running from selvage to selvage at right angles to the warp.

**woven fabric**
fabric composed of two sets of yarns (warp and weft) interlaced perpendicularly.

**yarn**
a continuous strand of fibres with or without twist, used for thread or fabric construction.