Forensic Chemistry Section

Fiber Analysis Method

1. Scope

This document outlines the general analysis scheme for fiber examinations.

2. Safety

2.1 The examiner will wear a disposable laboratory coat and disposable gloves as needed when handling evidence for fiber examinations.

2.2 The examiner will wear cryogenic gloves and protective goggles when handling liquid nitrogen.

3. Examination

3.1 Fiber examination will generally proceed in the following order until a point where the examiner concludes that questioned and known fibers are dissimilar. If no such conclusion is reached, the examiner will determine the fibers to be similar.

- macroscopic examination
- microscopy (stereomicroscope, compound microscope, polarized light microscope, comparison microscope)
- microspectrophotometry
- FTIR microspectroscopy

3.2 The analyst will note the macroscopic qualities, which may include but are not limited to amount of sample, texture, color, etc.

3.3 A microscopic examination is performed using a microscope with a minimum magnification of 100X and a Fiber Worksheet will be completed.

3.4 Microscopic characteristics of natural fibers to be considered will be type of fiber (animal, vegetable, etc.), color, color distribution, and thickness.

3.5 Microscopic characteristics of synthetic fibers to be considered will be color, color distribution, thickness, luster and degree of luster, and optical cross section. A polarized light microscope will be used to determine optical properties including parallel and perpendicular relative refractive indices, sign of elongation and birefringence.

3.6 The fibers will be examined side by side on a comparison microscope. The examiner will consider color, thickness, cross section, and overall appearance of each fiber.

3.7 The comparison will be documented in the examiner's notes. The examiner may choose to also include color printouts or photographs.

4. Cross Sectioning

4.1 If enough sample is present, and the examiner prefers, a physical cross section may be made of synthetic fibers.

4.2 The examiner will place a small (approximately 1cm^2) piece of polypropylene on a glass slide.

4.3 A fiber will be placed on the polypropylene and covered with another piece of polypropylene of comparable size.

4.4 The polypropylene will be covered with another glass slide.

4.5 The slides will be heated enough to melt the polypropylene, but being careful not to melt the fiber.

4.6 One of the glass slides will be removed.

4.7 The polypropylene will be loosened from the other slide.

4.8 A scalpel or razor blade should be used to cross section the fiber into very thin slivers. A stereomicroscope is useful for this step.

4.9 The cross section portions should be mounted for further microscopic examination.

5. Instrumental Analysis

5.1 If the fibers have sufficient color, an instrumental comparison of the color of the known and unknown samples will be performed using a microspectrophotometer. Spectra will be included in the case notes.

5.2 If sufficient sample is present, synthetic fiber samples will be analyzed for chemical composition using an FT-IR. The fiber may need to be de-mounted as follows:

5.2.1 Under the stereomicroscope, locate the fiber(s) to be removed.

5.2.2 Use a carbide tipped scribe and press a hole in the cover slip just to the side of the fiber.

5.2.3 Add a small amount of solvent (xylene or xylene substitute) to the hole in the cover slip.

5.2.4 Use forceps to gently chip away the cover slip to reveal the fiber.

5.2.5 Briefly wash the fiber in the solvent and allow to dry.

5.3 Samples that need interpretation, i.e. subgeneric class determination, will be compared to spectral libraries present in the software.

5.4 When a sample is determined to be of a particular fiber class, the examiner may choose to prepare a known fiber sample and obtain a spectrum for comparison purposes. These types of samples will be treated as the other types of known and unknown samples.

5.5 Spectra will be included as part of the examiner's case notes including reference spectra used to identify fiber class.