A147 A Preliminary Study Into the Characterization and Differentiation of Synthetic Wig Fibers

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After attending this presentation, attendees will learn about the most discriminating features to characterize synthetic wigs when wig fibers are recovered as physical evidence.

This presentation will impact the forensic science community by providing information about chemical and morphological characteristics of wig fibers and their discriminating factors.

Consider a set of fibers that were recovered from the garments of a victim. The analyst will first need to verify if the recovered specimens are hair or wig fibers. If the specimen is from a wig, the analyst has to determine if the specimen has synthetic or natural origin. In having done this, the analyst must then discover identifying characteristics, such as the wig type, and ideally the manufacturer in order to aid in the investigation. The goal of this study is to determine what characteristics of wigs are polymorphs, to develop the most discriminating analytical sequence for microscopic and chemical examinations of wig fibers, and to interpret the value of the results.

Wigs are worn in a variety of settings. Subsequently, there are two main types of wigs: costume and cosmetic. Costume wigs can display a variety of colors and usually have stiff, waxy strands. Cosmetic wigs mimic the appearance of natural hair. The hair used to make wigs can be made of either synthetic fibers or human hair. Nylon, polyester, polypropylene, acrylic, and modacrylic fibers are the most commonly used fibers, with modacrylic being the most prevalent one.

In this preliminary study, a number of samples taken from dark-colored modacrylic, polypropylene, and nylon wigs were collected. These samples of synthetic wig fibers were first visualized under light microscopy using bright field illumination and double polarization. The thickness of each fiber was measured at ten randomly selected positions. Five cross sections were also created from randomly selected positions of each fiber. Various measurements, including, but not limited to, the surface area, circularity, and perimeter, were completed for each of the cross sections. By observing the data distributions through a series of histograms, it was shown that a small amount of wigs had a high degree of intra-variability in both shape and diameter. In some instances, various types and colors of fibers are blended throughout one wig so that it may appear more natural looking for cosmetic use. There was found to be important overlap in the thickness and surface area measurements between wigs. However, it was observed that the cross-sectional shape is a variable feature that can increase the discriminating power of the analytical sequence.

At least 100 different samples of dark-colored synthetic wigs are being collected in the current study. Each sample of synthetic fibers is first examined visually and microscopically. The physical properties of the fibers, such as the color, thickness, and cross-sectional shape are documented. Chemical examinations are conducted by Fourier Transform Infrared (FTIR) spectroscopy and Thin-Layer Chromatography (TLC). The former is used to determine the general polymeric class and subclass when possible (i.e., acrylics). IR data is useful to study the distribution of the fiber types in order to evaluate trends about their rarity of occurrence. The latter method, instead, is used to study the dye content. Dyes are first extracted from the individual wig fibers. This operation allows the obtaining of information about the dye type according to its application mode: acid, basic, or disperse. The consecutive dye elution then informs about the variation of dyes between different wigs. Attempts of dye identification can be made by comparing TLC data of the collected wigs with those of standard dyes. It is important to underline that wig evidence may be recovered as long fibers, about 15cm. This constitutes an advantage because the quantity of evidence will be large enough for applying destructive testing, and in the case of thin layer chromatography, the chances to extract the dye from a single wig fiber are higher.

Wigs, Fibers, Trace Evidence

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