B24 Forensic Analysis of Human Autopsy Tissue for the Presence of Polydimethylsiloxane (Silicone) and Volatile Cyclic Siloxanes Using Macro Fourier Transform Infrared (FTIR) Spectroscopy, Micro-FTIR Spectroscopic Imaging, and Headspace/Gas Chromatography With Mass Spectrometric Detection (HS/GC/MS)

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After attending this presentation, attendees will see the advantages of using HS/GC/MS, in addition to those offered by FTIR spectroscopy, to provide complementary data yielding a strong indication for the presence of silicone in human autopsy tissue.

This presentation will impact the forensic science community by showcasing effective and minimally labor-intensive primary FTIR and secondary HS/GC/MS methods for the detection of silicone in human autopsy tissue.

The United States Food and Drug Administration's Forensic Chemistry Center (FCC) has received multiple requests over the past 15 years to examine hypodermic needles, syringes, and unknown liquids for the presence of polydimethylsiloxane (PDMS) (silicone); however, in the past five years, due to the rise in silicone injection popularity including "pumping parties," the FCC has been tasked with analyzing human tissue samples for PDMS. In these cases, PDMS was allegedly injected into patients' lips, face, breasts, buttocks, and/or other areas of the body for cosmetic enhancement by unlicensed individuals. The practice has led to several serious health complications, including death. In the event of a death, the medical examiner often requests that the victim's autopsy tissues be examined for the presence of PDMS in order to help determine the extent to which the PDMS has migrated in the body, which may ultimately help the medical examiner determine the cause of death.

Benefits of FTIR and Raman methods, both point mode and imaging mode, include the ability to provide PDMS-specific, solid-state (morphological), *in situ* examinations of biological tissue inclusions. The disadvantage is that prior to analysis, these studies required the tissue to be rinsed with an organic solvent, cross-sectioned with a microtome, and carefully mounted to an IR-reflective substrate, which is not typically how autopsy tissue samples are received by the FCC. Furthermore, this approach can be unnecessary and prohibitively time consuming for applications that do not require morphological information via an *in situ*, nondestructive approach (i.e., simply answering the question of whether or not PDMS is present in autopsy tissue). As a result, it was of interest to develop a straightforward primary PDMS-specific method using FTIR spectroscopy and/or FTIR spectroscopic imaging for the analysis of human autopsy tissue received directly from the medical examiner with little or no treatment or preparation.

GC/MS was considered as a secondary technique because of the low detection limit and high selectivity/sensitivity of this method for detecting Volatile Cyclic Siloxanes (VCSs). The drawback to this approach is that the GC/MS method required significant sample preparation and the results may yield a broad peak manifold for silicone. On the other hand, HS/GC/MS, which, as far as this study could determine, has not yet been utilized for the determination of VCS impurities as marker compounds for PDMS in human autopsy tissue, offers several advantages compared to conventional GC/MS methods. First, HS/GC/MS requires less sample preparation because the sample can often be analyzed neat. Even if the sample cannot be examined neat due to low VCS concentrations, minimal sample preparation is required; the tissue sample is extracted with hexane and the extract is analyzed. Second, regardless of whether the tissue sample is examined neat or as an extract, the HS/GC/MS analysis yields a cleaner chromatogram because the broad silicone peak observed using GC/MS is not observed in the HS method since PDMS has a much lower vapor pressure than the VCSs and therefore will remain in the tissue sample or extract liquid.

Effective and minimally labor-intensive primary and secondary methods have been developed for the detection of silicone in human autopsy tissue. The primary method is PDMS-specific and employs either macro Attenuated Total Reflection/Fourier Transform Infrared (ATR/FTIR) spectroscopy (for samples with a relatively high PDMS concentration) or micro FTIR spectroscopic imaging in a reflection/absorption modality (for samples with a relatively low PDMS concentration). Although the secondary method is not PDMS-specific, it is a novel approach and employs HS/GC/MS for the detection of VCSs, which are characteristic marker compounds for PDMS.

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These techniques and methods have been successfully employed in 11 cases involving the examination of various types of human tissues for the presence of PDMS. To date, the offenders have been found guilty of felonies including third-degree murder, depraved heart murder, and criminally negligent homicide with convictions ranging from several months to life in prison.

Silicone, Human Autopsy Tissue, HS/GC/MS

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