B155 A Longevity Study on the Analysis of Sexual Lubricants When Stored in Different Environmental Conditions

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Learning Overview: After attending this presentation, attendees will understand the effects of storage conditions on the analysis of sexual lubricants through Direct Analysis in Real Time-High Resolution Mass Spectrometry (DART®-HRMS), Gas Chromatography/Mass Spectrometry (GC/MS), and Fourier Transform Infrared Spectroscopy (FTIR).

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing information and preliminary patterns of the longevity of sexual lubricants when stored in sexual assault kits within different storage conditions over time. This may aid in providing knowledge of the viability of trace evidence (e.g., sexual lubricants) when analyzed at different time periods post-collection.

Unfortunately, sexual assaults are a reality in today's society. Due to the understanding that DNA from seminal fluid is one of the main forms of evidence being used to connect a suspect to a victim or crime scene, there has been an increase in the use of condoms in sexual assault cases. This dilemma has led the community to research other types of trace evidence (e.g., sexual lubricants). Previous research performed at the National Center for Forensic Science has led to the development of the Sexual Lubricant Database that aids in identification of discernable groups within lubricant manufacturing types, as well as the ability to separate lubricants from personal hygiene products. The classification and characterization of lubricants is a relatively new approach in analyzing trace lubricant residue in an operational setting.

Current research is being performed to determine the length and optimal conditions appropriate for storing trace lubricant residue before the samples begin to degrade and pattern becomes unrecognizable. Prior to conducting the study, it was necessary to determine how long the storage study samples could be stored in the event that the samples cannot be analyzed on the day of collection. Therefore, a two-week study was first performed to determine the longevity of extracted lubricants when stored within solvents at -20°C. Second, a preliminary cotton swab optimization study was completed to determine which swab yielded the most effective lubricant extraction and least background noise. After these studies were conducted, sexual lubricant from a condom and a personal bottled lubricant were deposited onto respective cotton swabs to be stored and evaluated under different conditions.

This research project used previously developed DART®-HRMS, GC/MS, and FTIR protocols to analyze the stored swabs containing sexual lubricants at time points: 0 hours, 24 hours, 7 days, and 1 month. At each time point, a blank swab, a personal lubricant swab, and a condom swab were stored in different storage conditions. These storage conditions were 35°C to simulate a hot environment, 22°C at approximately 100% humidity, 22°C at approximately 50% humidity, 22°C at approximately 0% humidity, 4°C to mimic samples stored within a refrigerator, and -20°C to imitate samples stored within a freezer. Storage of swabs at these conditions allowed for the determination of lubricant degraded and adversely affected the ability to recognize classification patterns at the simulated environmental conditions. Additionally, this study permitted the determination of optimal storage conditions for swabs containing trace lubricant evidence from sexual assault kits. The blank swab, personal lubricant swab, and condom swab were extracted into methanol and were analyzed in triplicate via the DART®-HRMS, as well as FTIR, and in duplicate by GC/MS. The resulting spectra from each instrument can be used to classify unknown lubricant samples and generate investigative leads. Multivariate statistical techniques were used to compare the stored samples to the neat samples to determine if chemical breakdown for each lubricant occurred and if the pattern changed significantly. Preliminary results suggest that the general profile of the lubricant does not change; however, the concentrations of the components may decrease over time.

Analysis of stored sexual lubricants within different environments over time via DART®-HRMS, GC/MS, and FTIR may be beneficial to the forensic community by allowing investigators and forensic examiners to identify the optimal condition for storage to prevent the degradation of lubricants when samples cannot be immediately analyzed. Additionally, the ability to understand the effects of environment and time to the analysis of sexual lubricants may offer helpful information when analyzing sexual assault kits and provide a link for investigators between a suspect and crime scene.

Sexual Lubricants, Longevity Study, Mass Spectrometry