



B193 A Characterization of Sexual Assault Lubricants: Lubricant Database Use in an Operational Setting

Brooke R. Baumgarten, BS*, Winter Park, FL 32792; Caterina Vadell-Orsini, National Center for Forensic Science, Orlando, FL 32816; Mark Maric, PhD, Orlando, FL 32816; Candice Bridge, PhD, National Center for Forensic Science, Orlando, FL 32816

Learning Overview: After attending this presentation, attendees will understand the value of the classification of lubricants as a novel forensic technique, as well as the value of the National Center for Forensic Science (NCFS) Lubricant Database for the analysis of sexual assault trace evidence, in contrast to current methods of solely identifying the presence of lubricant. This database will provide analytical results from Direct Analysis in Real Time-Time-Of-Flight Mass Spectrometry (DART-TOFMS), Gas Chromatography/Mass Spectrometry (GC/MS), and Fourier-Transform Infrared Spectroscopy (FT-IR).

Impact on the Forensic Science Community: This presentation will impact the forensic science community by aiding in the classification of unknown sexual lubricant samples based on components that are indicative of a certain type or class. The results will be provided in a sexual lubricants database made available to the forensic community, thus providing investigative leads by facilitating a way to classify unknown samples.

Unfortunately, sexual assaults are a reality in today's society. The increased use of condoms may be one reason why there is a potential reduction of finding DNA evidence in sexual assault cases¹ This dilemma has led to research in other trace evidence such as sexual lubricants. In the absence of DNA, the analysis of trace lubricant residue may aid in connecting the suspect to the victim and/or crime scene.² Previous research at NCFS has shown the capability of identifying discernable groups within lubricant manufacturing types, as well as the ability to separate lubricants from personal hygiene products.³⁻⁵ The classification and characterization of lubricants is a relatively new approach in analyzing trace lubricant residue in an operational setting. In this study, 115 samples from different sexual lubricant manufacturing types were analyzed: water-based, silicone-based, oil-based, organic/edible lubricants, and others (e.g., personal hygiene products). Based on manufacturing information, the tested lubricant samples may be sub-classified as regular, sensation, flavored, spermicidal, and anesthetics. However, if analyzing an unknown sample, the classification must be based on the components identified in the sample.

This research project developed DART-TOFMS, GC/MS, and FT-IR methods and protocols that can be used to analyze samples and identify components in sexual lubricants. The resulting spectra from each instrument was used to create a classification scheme, all of which can be found in the NCFS Lubricant Database and can be used to classify unknown lubricant samples and generate investigative leads. Neat lubricants as well as hexane and methanol extracts were analyzed using DART-TOFMS in both positive and negative ionization modes with a helium carrier gas at 350°C and an orifice 1 voltage of 20V. Neat lubricants and extracts were analyzed in triplicate via the DART-TOFMS as well as FT-IR, and only the extracts were analyzed by GC/MS in triplicate. Multivariate statistical techniques were used to create a classification scheme for the lubricants from the DART-TOFMS, GC/MS, and FT-IR combined results. The classes were differentiated based on unique components specific to that class and the relative intensity of commonly observed components. Additionally, components that aid in designating the sub-class of the lubricant will be presented. The classification scheme developed from this study and provided along with the database will allow analysts to classify unknown lubricants and lubricant residues found at a crime scene using one of the aforementioned instrumentation. A brief overview of this database, classification scheme, and its applicability will be presented.

Reference(s):

1. O'Neal, E. N.; Decker, S. H.; Spohn, C.; Tellis, K., Condom use during sexual assault. *Journal of Forensic and Legal Medicine* 2013, 20 (6), 605-609.
2. Musah, R. A.; Cody, R. B.; Dane, A. J.; Vuong, A. L.; Shepard, J. R. E., Direct analysis in real time mass spectrometry for analysis of sexual assault evidence. *Rapid Communications in Mass Spectrometry* 2012, 26 (9), 1039-1046.
3. Maric, M.; Bridge, C., Characterizing and classifying water-based lubricants using direct analysis in real time@-time of flight mass spectrometry. *Forensic Science International* 2016, 266, 73-79.
4. Moustafa, Y.; Bridge, C. M., Distinguishing sexual lubricants from personal hygiene products for sexual assault cases. *Forensic Chemistry* 2017, 5, 58-71.
5. Baumgarten, B.; Marić, M.; Harvey, L.; Bridge, C. M., Preliminary classification scheme of silicone-based lubricants using DART-TOFMS. *Forensic Chemistry* 2018, 8, 28-39.

Sexual Lubricants, Database, Classification