



### **E6 Distinguishing Condom Lubricants From Personal Hygiene Products (PHPs) Using Direct Analysis in Real Time-Time-of-Flight/Mass Spectrometry (DART®-TOF/MS)**

*Yasmine Moustafa, BS\*, National Center for Forensic Science, PO Box 162367, Orlando, FL 32816-2367; and Candice Bridge, PhD, National Center for Forensic Science (UCF), PO Box 162367, Orlando, FL 32816*

After attending this presentation, attendees will understand the capabilities of analyzing and identifying samples from sexual assault evidence using DART®-TOF/MS. The power of this technique to differentiate between condom lubricants and PHPs, such as shampoos and lotions, is demonstrated through statistical treatments such as Principle Component Analysis (PCA), Analysis of Variance (ANOVA), and Linear Discriminant Analysis (LDA).

This presentation will impact the forensic science community by serving as a supplemental method that can analyze samples using mass spectrometry that cannot not be analyzed using traditional instrumentation such as a Gas Chromatograph/Mass Spectrometer (GC/MS).

Due to the increased awareness that DNA can be recovered from seminal fluid testing in sexual assault cases and used to identify the assailant, condoms have been used extensively to conceal and prevent conviction. From this, condom lubricants were tested in sexual assault investigations; however, residuals from such components can sometimes resemble common hygiene products found on the skin, such as lotions and soaps. Thus, the purpose of this study is to be able to differentiate condom lubricants from personal hygiene products.

DART®-TOF/MS is a rapid non-destructive method in which the sample is softly ionized and the analyte molecules are desorbed by excited-state helium gas stream. This technique can be operated in either positive or negative mode with protonation of the analyte via reaction with protonated water clusters or electron capture via reaction with oxygen radicals, respectively. This instrument is capable of giving the user a full mass profile within seconds of sampling, with little to no destruction to the sample itself. Sampling is simply done via a glass capillary tube with merely a small coat of the sample on the tip. Thus, for multiple sample analysis and ease of comprehension of data, DART®-TOF/MS is an excellent method for the rapid and non-intrusive evaluation of sexual assault evidence. Unlike traditional GC/MS techniques, coelution issues of and the inability to analyze silicone-based samples are not a mitigating factor in DART®-TOF/MS as there is no column present. Samples are analyzed via direct mass analysis.

In this study, 30 samples consisting of 12 lubricants, 10 PHPs, and 8 different condom types were analyzed. The 12 lubricants were divided further into three distinct groups-corresponding to water, silicone, and oil-based lubricants. The PHPs included shampoo, lotion, sunscreen, soap, petroleum jelly, and oils. Samples were analyzed in both positive and negative mode to obtain a cumulative chemical profile for each sample. Samples were diluted to 1:1 and 1:10 ratios, where the solvents used were methanol for water, oil, and PHPs and hexane for silicone-based lubricants. The diluted samples were analyzed to simulate low-quantity samples that might typically be recovered from the victim. Following sample collection and analysis, PCA, ANOVA, and LDA treatments were performed to visualize and discriminate lubricant samples versus normal hygiene products and to determine if the correct classification can be attributed to an unknown sample.

The goal of this study is to differentiate lubricants from PHPs to further aid in the analysis of sexual assault evidence using the rapid features of DART®-TOF/MS. The ultimate goal is to create a protocol in which lubricants can be examined as common pieces of evidence in a sexual assault case.



## General - 2017

---

### DART®-TOF/MS, Lubricants, Personal Hygiene Products

Copyright 2017 by the AAFS. Unless stated otherwise, noncommercial *photocopying* of editorial published in this periodical is permitted by AAFS. Permission to reprint, publish, or otherwise reproduce such material in any form other than photocopying must be obtained by AAFS.