B121 Analysis of Nonoxynol-9 in Condom Lubricants via Pyrolysis Gas Chromatography-Mass Spectrometry (PGC-MS)

Christopher R. Bommarito, MS, Michigan State Police Forensic Science Division, 7320 North Canal Road, Lansing, MI 48913; Elaine Dougherty, BS, School of Criminal Justice, Michigan State University, 560 Baker Hall, East Lansing, MI 48823*

After attending this presentation, attendees will understand the use of pyrolysis gas chromaography mass spectrometry for presence of condom lubricants in sexual assault cases.

This presentation will demonstrate new techniques for detection of condom lubricants.

Many sexual offenders are now utilizing condoms in sexual assaults. Because of this fact, forensic examiners increasingly need to examine swabs for condom lubricants in criminal sexual conduct cases in which no sperm is detected.

Examination of condom lubricants is problematic due to both contamination issues and the nature of the chemical constituents of the lubricants. Due to the presence of bodily fluids and other lubricants commonly present on vaginal swabs it is preferable to utilize a chemical separation technique such as gas (GC) or liquid chromatography (LC) in examination of the swabs. The high molecular weight and chemical nature of the surfactants, however, make introduction and examination of samples by these instruments problematic.

One of the most common lubricant components, the spermicide nonoxynol-9 is a harsh detergent composed of a nonylphenol with a polyoxyethylene chain of varying lengths. It has a range of molecular weights differing by 44 amu, the weight of one ethylene oxide ($-OCH_2CH_2-$) group. The analysis of this detergent by traditional electron impact (EI) ionization GC-Mass Spectrometry is not useful. It is an extremely viscous liquid that is not volatile enough get through the injector and into the column. Its large molecular mass (average 616 amu) and both hydrophilic and hydrophobic ends also contribute to difficulties in analysis by GC-MS.

Several other methods for detection of nonoxynol-9 have been explored, including thin layer chromatography (TLC), desorption chemical ionization mass spectrometry (DCI-MS), matrix-assisted laser desorption/ionization (MALDI), Fourier transform infrared spectroscopy (FT-IR), electrospray ionization mass spectrometry (ESI-MS), nanoelectrospray ionization mass spectrometry (nanoESI-MS) and liquid chromatography/electrospray ionization mass spectrometry (LC-MS). All of these methods have shortcomings; several are non-specific, some are not suitable for nonoxynol-9 in mixtures and most involve techniques that are not readily available in most forensic laboratories.

In this presentation, we will demonstrate a reproducible method for detecting nonoxynol-9 using pyrolysis gas chromatography (PGC), an instrument found in most forensic laboratories. Coupled with a mass spectrometer (PGC-MS), examination and identification of nonoxynol-9 pyrolysis products in spermicidal lubricants is possible. Pyrolysis and GC-MS conditions were varied using standard nonoxynol9 to optimize the method. Extraction methods and sample requirements will also be discussed.

Pyrolysis, Condom, Nonoxynol-9

 ** Presenting Author*