A99 Comparative Analysis of Condom Lubricants in Pre- and Post- Coital Swabs by Accurate Time-of-Flight – Direct Analysis in Real Time

Lesley A. Huggings, BS, John Jay College of Criminal Justice, 445 West 59th Street, #4405, New York, NY 10019; and Gloria Proni, PhD, John Jay College of Criminal Justice, Science Department, 445 West 59th Street, 10019, New York, NY 10019*

After attending this presentation, attendees will understand how a commercially available time-of-flight instrument, a very sensitive and accurate state-of the-art mass spectrometer, may be used to analyze vaginal swab and condom residues obtained by volunteers before and after intercourse. In particular, this study uses *in vivo* samples for the analysis (vaginal swabs after intercourse) in order to mime a rape situation.

This presentation will impact the forensic science community because this analysis put the basis for the application of this instrumentation to analyze biological samples obtained in rape cases. The implementation of this technique in forensic analysis is also a key point of this work.

In the last several years the number of sexual assaults in which the perpetrator used a condom has dramatically increased. Condom lubricants can be polyethylene glycol (PEG)-based or silicone-based. Polyethylene glycol is a non-ionic water-soluble polymer of ethylene oxide whose viscosity depends on the chain length. The compound is water-soluble and can therefore easily pass across mucous membranes, limiting its forensic detection. Silicone-based lubricants are found on most lubricated condoms, they are not absorbed into the skin or across membranes, thus staying on the surface to provide lasting slipperiness. It is this characteristic that makes it of great forensic value. Its major ingredient is PDMS (polydimethylsiloxane), a silicone-based organic polymer, which is a mixture of oligomeres ranging in molecular weights up to 20,000 amu. The oligomeres have a limited number of monomer units while polymers can have an unlimited number of monomer units. The spermicide most commonly found in condom lubricants is the detergent nonoxynol-9. It is a non-ionic surfactant and is typically a harsh detergent, but is found in condom lubricants at concentrations ranging from 5% to 10%. In sexual assault cases, lubricants and polymers recovered from the crime scene may provide useful information for the investigation, particularly when DNA evidence is not available. Individuals, generally, use condoms to be protected by sexually transmitted diseases and to prevent identification from the deposited semen. Several techniques have been used in the past to analyze traces left by condoms: Raman spectroscopy,[1] gas chromatography – mass spectrometry,[2] infrared spectroscopy,[3] nuclear magnetic resonance,[4] and capillary electrophoresis.[5] In this research, the instrument has been used to determine differences between commercially available condoms. The lubricant from condoms sold in the United States were collected using a specially designed glass apparatus and analyzed directly, without any manipulation, with the instrument in order to obtain pre-coital data and to differentiate between the condoms. Data obtained from vaginal swabs obtained before sexual activity will be presented: these data were used in the study as a blank. The traces obtained from vaginal swabs in post- coital conditions were also analyzed by means of the same technique. Due to interference from the background in the post-coital vaginal swabs and an overall low sample yield, the vaginal swab samples were also extracted using different polar and non-polar solvents in an attempt to increase signal power. Data derived from the extraction step will be also presented. Volunteers have been recruited to obtain the vaginal swabs before and after intercourse and several brands of condoms were used in the analysis. The overall goal of the project was to be able to individualize the condoms and consequently be able to discriminate between the brands and consequently collect useful information that could be used in sexual assault cases.

References:

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Time-of-Flight, Vaginal Swab, Condom's Residue

 ** Presenting Author*