B17 The Detection of Explosive Residue on Gloves Exposed to Environmental Conditions

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Learning Overview: After attending this presentation, attendees will understand the viability of different swabbing methods in detecting explosives from gloves exposed to a range of environmental conditions.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a comparison of methods of recovering explosive residue from glove materials and the effect of exposure to environmental conditions.

This research will impact the forensic science community by providing a comparison of methods to recover explosive residue from glove materials and the effect of exposure to environmental conditions.

Homemade improvised explosive devices (IEDs) are commonly used across the world. It is important to identify the type of explosive used and determine the perpetrator. If gloves are worn while creating an IED, explosive residue could be present on the gloves and this can then be used as evidence to link the criminal to the device and to the explosion site. The topic of this research project is the detection of explosive residues removed from various glove materials after exposure to a range of environmental conditions. This novel research will be used to determine how well different explosive compounds can be detected from these surface types and to determine if this changes with different environmental exposure.

Specifically, the detection limits of the explosives TNT, PETN, and TATP using Gas Chromatography/Mass Spectrometry (GC/MS) retrieved from nitrile gloves, leather working gloves, cotton gloves, and mechanic gloves were investigated to determine how well each explosive can be detected on the different gloves. The explosive standards were deposited onto the gloves, then different swabbing methods were tested to determine what method is best able to extract the explosive residues from the gloves. The swabbing methods tested included rayon swabs, cotton balls, alcohol wipes, a flooding method using a solvent, and direct extraction from the glove itself. These swabbing methods were tested with two different extraction solvents; methanol and acetonitrile. The samples were then analyzed using GC/MS and the peak areas from the chromatograms were compared to determine which swabbing method was best by determining the extraction efficiency for each swabbing method. Preliminary results appear to indicate that using an alcohol wipe or a rayon swab are efficient methods to obtain TNT from cotton gloves. However, several unidentified peaks were also present in the chromatogram when using the rayon swab to extract TNT. These peaks could be trace material that was already present on the glove before the explosive was added, indicating that the rayon swab method is an extremely efficient extraction technique. However, this is still under continued investigation. Preliminary results indicate that using acetonitrile as an extraction solvent yields slightly higher recoveries of TNT than methanol.

Finally, these gloves were then exposed to environmental conditions including simulated wind, rain, shaking/movement, contamination, time, and mixing with cleaning products to determine any changes in the detection limits of the explosive compounds and to identify any changes to the compounds that may occur, including degradation or the presence of adducts. Preliminary results lead to the discovery of new unidentified peaks present in mixtures of explosive compounds with Simple Green cleaning solutions. These unidentified peaks warrant further investigation to determine if they are fragments from the cleaning product or the explosive compounds, or a cleaning agent adduct that may have formed from a reaction of the cleaner with the explosive compound when mixed.

The results of this research indicate the optimal swabbing method for different explosive compounds on a variety of gloves as well as how various conditions affect how well they are detected. These results can provide useful information in cases involving explosive residue on gloves, or similar fabric.

Explosive Residue, GC/MS, Environmental Conditions