## B104 Revisiting the Recovery of Defense Sprays From Fabrics

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**Learning Overview:** After attending this presentation, attendees will be able to describe a new extraction method for the recovery of defense sprays from clothing.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by showing attendees how they could easily implement and verify a method for the analysis of trace amounts of defense sprays in casework.

Recent mass gathering events have resurged an interest on the forensic analysis of defense sprays. On the one hand is the interest of individuals to sustain the claim of exposure; on the other, the interest from law enforcement to sustain the claim that a defense spray was used before escalating force. Previously published work on the extraction of defense spray from clothing used a variety of solvents for liquid solvent extraction such as hexanes, methanol, ethyl acetate, diethyl ether], chloroform, and dichloromethane, as well as Solid-Phase Micro Extraction (SPME).[1-5] For the analysis, Gas Chromatography/Mass Spectrometry (GC/MS) or Liquid Chromatography/Mass Spectrometry (LC/MS) have been the techniques of choice.[1-5] When using direct liquid solvent extraction, the recoveries of capsaicin and dihydrocapsaicin reported were less than 60% on unwashed cotton samples and less if the fabrics were manipulated (e.g., washed).

For this study, a method using liquid extraction with toluene was developed to recover residues of capsaicin and dihydrocapsaicin from fabrics followed with the analysis by GC/MS. For all experiments, pieces of 3x5cm of different fabric types such cotton, polyester, and nylon were used. For the recovery study, the fabric pieces were spiked with standards of capsaicin and dihydrocapsaicin at different concentrations and were allowed to dry in the laboratory. All fabric pieces were extracted with toluene using a rotating mechanical shaker for at least two periods of one hour. An aliquot of the extracts was transferred to GC vials and *n*-tetracosane-$d_{50}$ was added as internal standard. The samples were then derivatized with N,O-Bis(trimethylsilyl)trifluoroacetamide (BSTFA) for about 24h at a mild temperature of 45°C in an aluminum block heater. When it was not possible to begin the analysis within that 24h window, the samples were stored in a deep freezer (-20°C). The method was also implemented for the analysis of ten defense sprays, neat and on different fabrics of cotton, polyester, and nylon. The results of the analysis of the neat sprays were compared with each other and with the results from spiked fabrics. The study was completed with a small persistence study of the target compounds on the spiked fabrics for a period of two months.

The prevalence of the non-volatile fraction in the neat defense spray content made discrimination using their composition profile a challenge. Nevertheless, the method rendered high recoveries of capsaicin and dihydrocapsaicin of >90% with small limit of quantitation in the order of 4ng. These results were observed across fabrics and within two weeks before extraction, with some decrease thereafter.

**Reference(s):**

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2. Oliver Spice,r Jr. and Jose R. Almirall. Extraction of capsaicins in aerosol defense sprays from fabrics. *Talanta* 67 (2005):377-382.
3. Christopher A. Reilly, Dennis J. Courch, Garold S. Yost, and David M. Andrenyak. Detection of pepper spray residues on fabrics using liquid chromatography-mass spectrometry. *J. Forensic Sci* 47, 1(2002):37-43.
4. Christopher A. Reilly, Dennis J. Courch, and Garold S. Yost. Quantitative analysis of capsaicinoids in fresh peppers, oleoresin capsicum and pepper sprays products. *J. Forensic Sci* 46, 3(2001):502-509.
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**Defense Sprays, Pepper Spray, Capsaicin**