



B197 Detection of Fentanyl Analogs in Soil Via Paper Spray-Mass Spectrometry

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Learning Overview: After attending this presentation, attendees will better understand the use of paper spray-mass spectrometry to detect trace amounts of fentanyl analogs in soil.

Impact on the Forensic Science Community: This presentation will impact the forensic community because of its applicability to the ongoing opioid crisis. The analysis of soil samples would be a rapid and effective way to determine the identity and quantity of fentanyl analogs in the environment.

Synthetic opioids are potent narcotic analgesics that are only used legally as a last resort to combat extreme and often terminal pain. Fentanyl analogs are the source of tens of thousands of overdoses across the United States per year. To fuel the opioid epidemic, these analogs are being mass-produced in clandestine laboratories to be sold on the illicit drug market. These clandestine laboratories are a growing environmental concern due to their potential to have a detrimental impact to an ecosystem. There is also a significant forensic interest to be able to identify the opioids being synthesized in clandestine laboratories. Due to their hydrophobicity and large octanol-water coefficients, fentanyl analogs are likely to accumulate if introduced into soil.

In this research, paper spray ionization was utilized in conjunction with a triple quadrupole mass spectrometer and a hybrid quadrupole orbitrap mass spectrometer to detect trace amounts of fentanyl analogs in soil. Paper spray ionization is a fast and easy alternative to typical chromatographic techniques. Soil analysis would typically require advanced clean up procedures before introduction to a chromatography column. However, paper spray eliminates a majority of the sample preparation.

Three soil systems—Richfield clay loam, sassafras sandy loam, and sand, were studied due to their differing pH, organic content, and mineral composition. A mixture of fentanyl analogs was spiked into soil and allowed to interact with the matrix for approximately 24 hours. Two extraction techniques were utilized. A rapid on-cartridge extraction was established for qualitative and semi-quantitative analysis. This technique has the potential to be utilized in the field with a portable mass spectrometer. A modified Quick Easy Cheap Effective Rugged and Safe (QuEChERS) extraction was utilized for quantitative analysis. In this extraction, an acetonitrile organic phase was added to the soil along with salts that forced the analytes into the organic phase.

Analogs were monitored using parallel reaction monitoring on a Q-Exactive for the online extraction method and selected reaction monitoring on a TSQ Vantage for the QuEChERS extraction method and matrix effects study. It was determined that there were no matrix effects caused by the soil. The limits of detection of the QuEChERS extraction method will be discussed.

Fentanyl analogs are an increasing public health concern due to their potency and addictive properties. Due to their increasing prevalence in society, it is more important now than ever to be able to identify and quantify trace amounts of these deadly compounds in the environment.

Fentanyl, Soil, Paper Spray-Mass Spectrometry