K12 An Analysis of Illicit Substances From Postmortem Samples Using Biocompatible Solid-Phase Microextraction (BioSPME)

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After attending this presentation, attendees will have a better understanding of how BioSPME can be used as an extraction method for the detection of illicit substances from postmortem samples such as blood.

This presentation will impact the forensic science community by providing a new procedure for postmortem toxicological testing that is faster than current analytical methods. The use of BioSPME coupled with Gas Chromatography/Mass Spectrometry (GC/MS) and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) allows for minimal sample collection, preparation, and analysis for illicit substances in a shorter period of time.

Forensic pathologists are responsible for collecting postmortem samples for toxicological testing. These samples may include bile, vitreous humor, urine, blood, liver, gastric contents, brain, and kidney. The forensic toxicology laboratory is then responsible for analyzing the samples for common drugs and poisons, which for a criminal investigation may be time consuming and could cause analytical backlogs. Over the past couple of years, the application of *in vivo* SPME has grown due to its ability to be directly injected into a biological matrix without the removal of sample. BioSPME fibers have been developed to absorb any drugs present without the interference of macromolecules that are present in a biological sample. The application of the BioSPME fiber to postmortem samples will allow for faster analysis time.[1-3]

In this study, a BioSPME extraction and LC/MS/MS method have been developed to analyze 6-monoacetylmorphine, codeine, fentanyl, hydrocodone, hydromorphone, methadone, morphine, oxycodone, and oxymorphone in a blood matrix. Two types of BioSPME fibers have been explored when developing this method, C-18 and mixed-mode coated fibers. These fibers are conditioned, directly injected into a biological matrix (blood) for extraction of possible drugs, desorbed into solution, screened by GC/MS, and finally analyzed by LC/MS/MS. Extraction variables included extraction time, desorption time and volume, drying time, and reconstitution volume and solvents. This procedure utilized a screening method comprised of an HP 6890 Series GC system coupled with an HP 5973 Mass Selective Detector using splitless injection. Gas chromatography was performed using a Rxi-5Sil MS (29.0m x 0.25mm, 0.25µm). The quantitation method was comprised of AB SCIEX™ 3200 Qtrap® triple quadrupole mass spectrometer with an electrospray ionization (ESI) source operated in the positive ion mode. Liquid chromatography was performed on a Shimadzu® LC system using an Ascentis® Express Biphenyl Column (50cm x 2.1mm, 2.7µm) with the weak mobile phase consisting of 0.1% (v/v) formic acid in water and the strong mobile phase consisting of 0.1% (v/v) formic acid in acetonitrile. The flow rate was 0.3mL/min, column temperature was set to 30ºC, and injection volume was 1µL. A gradient curve was used over a run time of five minutes per sample. This method is being first optimized using bovine blood and then being applied to postmortem blood samples provided by the Lehigh County Coroner's Office.

In conclusion, the use of BioSPME in an extraction procedure allows for minimal postmortem sample preparation and collection. BioSPME coupled with the use of the LC/MS/MS would require less amount of time to analyze for drugs that may be present. Forensic toxicology laboratories would benefit by employing a method that would be able to decrease the problem of long extraction and analysis.

Reference(s):

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3. Mirnaghi FS, Pawliszyn J. Reusable solid-phase microextraction coating for direct immersion whole-blood analysis and extracted blood spot sampling coupled with liquid chromatography-tandem mass spectrometry and direct analysis in real time-tandem mass spectrometry. Anal Chem 2012;84:8301-9.

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