K29 Analysis of the Rate of Decay and Dispersion of Pentobarbital in Soil by Liquid Chromatography/Mass Spectrometry

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The goals of this presentation are to: (1) become familiar with the principles of extracting pharmaceuticals, specifically barbiturates, out of a complex matrix, particularly soil; (2) apply the use of this method to determine the initial concentration of the contaminated area and the focal point of contamination; and, (3) understand the significance of this method in order to determine the time of contamination based on the rate of decay and dispersion dynamics.

This presentation will impact the forensic science community by showing an effective method for extracting barbiturates out of complex matrices, specifically soil, is necessary for analytical analysis and has significant impact in the field of forensics and environmental science.

A method for detecting the barbiturate pentobarbital in soil previously developed was utilized to determine its application to the decay rate and dispersion rate of pentobarbital and similar barbituric acid derivatives in soil.

Pentobarbital is a pyrimidine derivative in a class of organic drugs called barbiturates. Several thousand derivatives of barbituric acid have been synthesized with far-reaching effects and flexible durations of action. Duration of action refers to the length of time the drug affects the target system, and in the case of humans or animals, it is the Central Nervous System (CNS). Pentobarbital is categorized as a fast-intermediate sedative-hypnotic drug. Barbiturates are highly stable organic compounds that are released into the environment via multiple pathways. Barbiturates have been extensively used throughout the United States. Euthanized animals are a growing contamination source in addition to the contribution of barbiturates from a wide array of pharmaceutical use, misuse, and abuse.

The method was developed to quantify the rate of decay of pentobarbital in contaminated soil. Pentobarbital in addition to other barbituric acid derivatives were extracted from separate soil samples, each separately spiked with the respective barbituric acid derivative. Clean-up procedures involved centrifugation, reverse-phase Solid Phase Extraction (SPE), microfiltration, and lastly, analysis by Liquid Chromatography/Mass Spectrometry (LC/MS). Concentration determination and recovery were determined utilizing a deuterated isotope method, Pentobarbital-D5, and an internal standard method. Satisfactory recoveries of the barbituric acid derivatives indicate this is an effective method for analysis and detection. Further, pre-concentration via solid phase extraction allowed for 0.001mg of barbituric acid derivative per five grams of soil (200 parts per billion) to be detectable at limits of quantification using LC/MS. This method can be suitable for larger quantities of soil and applicable for a wide range of soil types.

The development of extraction methods for pharmaceuticals out of soil has multiple applications in the scientific community. Additionally, the application of this extraction method as to the determination of the source of contamination, date of contamination, and amount of contamination has significant impact in the field of forensics.

Barbiturate, Soil, Decay

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