K44 Stereoselective Determination of Methamphetamine From Urine Using Purge and Trap GC/MS

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After attending this presentation, attendees will be familiar with a stereoselective and sensitive methodology for the determination of methamphetamine in urine samples. Attendees will be familiar with this novel technique for separating methamphetamine isomers using PT- GC/MS. An indirect chiral separation using the optically pure chiral derivatizing reagent TPC is presented to the attendee. Attendees will understand the pre- concentration capabilities of dynamic headspace sampling and how pivotal it can be when analyzing biological fluids containing analytes at low concentrations. The attendee will be presented with analytical figures of merit for this technique and comparisons will be made with more traditional techniques such as SPE- GC/MS.

This presentation will impact the forensic community and/or humanity by providing the forensic community with a new analytical tool capable of identifying the individual isomers of methamphetamine in urine with minimal sample preparation. Such capabilities would not only assist forensic toxicologists, but would also provide a new technique capable of identifying enantiomeric ratios which provide pivotal information regarding the method and origin of clandestine methamphetamine synthesis.

Quantitative and stereoselective determination of methamphetamine from urine using purge and trap gas chromatography- mass spectrometry (PT-GC/MS) is described. Methamphetamine is an optically active sympathomimetic amine existing in two isomeric forms. The dextrorotatory [d-(+)] form of methamphetamine which is often prepared from ephedrine, induces central nervous system (CNS) stimulant effects and as a result is more widely abused than its legally available levorotatory [l-(-)] form. Although both enantiomers are considered controlled substances under United States regulations, there is still a need to develop enantioselective methodologies capable of distinguishing the illicitly manufactured d-isomer from the legally available l-isomer in various matrices. A wide variety of optically pure pre-column derivatizing agents have allowed for the enantioselective determination of many isomers in biological fluids using achiral chromatography. The method described here utilizes a rapid pre-column derivatization of the methamphetamine isomers using trifluoroacetylprolyl chloride (TPC), allowing subsequent separation of the diastereoisomers on an achiral GC column employing MS detection. In recent years, both direct and indirect chiral separations have utilized a wide variety of instrumentation including GC/MS, HPLC, CE, SFC, TLC, and CEC to successfully separate the isomers of many chiral drugs. Such methodologies are necessary due to the large number of drugs possessing chiral centers which are either used therapeutically or abused, and whose individual enantiomers induce varying degrees of therapeutic implications, side effects, or in the case of methamphetamine, CNS stimulation. New techniques capable of optically resolving these drugs on an analytical scale would allow analysts to further understand the pharmacokinetics associated with individual enantiomers of drugs known to undergo stereoselective disposition following administration. Methamphetamine is synthesized clandestinely with average purities ranging between 50-70%, and, although it is well documented that the d-isomer is responsible for the CNS stimulant effects, quantitative analysis of individual isomers can indicate the route and origin of synthesis. Although stereoselective determination of methamphetamine from urine has been achieved prior to this study, significant sample cleanup and/or derivatization techniques have resulted in time consuming and challenging methodologies. Concentrations of methamphetamine in urine can vary significantly depending on the dose and whether or not the subject is a regular abuser. As a result there is often a need for sample extraction/pre-concentration from complex matrices. Solid-phase extraction (SPE) followed by pre- column derivatization has proven to be a successful preparative technique for the separation of methamphetamine isomers in urine using GC/MS; however there is a need for more convenient, time efficient techniques. The current methodology describes the stereoselective quantification of methamphetamine isomers in urine samples while reducing the degree of sample preparation. Rapid pre-column derivatization allowed for the subsequent extraction and pre- concentration of the diastereoisomers using dynamic headspace sampling followed by GC/MS.

Methamphetamine, Stereoselective, GC/MS

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