Determination of amphetamine-type psychostimulants in hair samples using MEPS as sample clean-up and gas-chromatography coupled with mass spectrometry

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Numerous protocols for the analysis of amphetamine-type psychostimulants (ATS) in hair have been employed over the years. Microextraction by packed sorbent (MEPS), a downsized version of solid-phase extraction (SPE), has been effectively applied in hair drug analysis, including substances like opiates, cocaine, and ketamine. However, concerning ATS, MEPS has primarily been used to the determination of amphetamine (AMP) and methamphetamine (MAMP) in hair[1-4].

The main objective of this study was to develop and validate a method using MEPS as a sample clean-up, for the determination of AMP, MAMP, 3,4-methylenedioxyamphetamine (MDA), 3,4-methylenedioxymethamphetamine (MDMA), 1-(1,3-benzodioxol-5-yl)propan-2-yl(ethyl)amine (MDE), and N-methyl-1-(1,3-benzodioxol-5-yl)-2-aminobutane (MBDB) in hair.

The extraction procedure involved incubating 50 mg of hair with 1M NaOH at 45 ºC overnight, followed by neutralization with 10M HCl and centrifugation[5]. A Design of Experiments (DoE) approach was employed to optimize MEPS clean-up process, encompassing conditioning, loading, and elution steps. The eluted extract underwent derivatization and was analysed using gas chromatography coupled to mass spectrometry (GC-MS).

The developed MEPS method yielded recoveries ranging from 8 to 52% for the different analytes in hair samples and linearity was obtained between 0.2 (cut-off proposed by SoHT) and 5.0 ng/mg. The precision and accuracy were in accordance to international method validation standards.

This study introduces the first analytical method integrating MEPS with GC-MS for the detection of these specific amphetamines in hair samples. Notably, this method offers a viable alternative to conventional procedures, characterized by its speed, eco-friendliness, and cost-effectiveness.

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