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Determination of Drugs of Abuse in Hair by UPLC-MS/MS: View from Brazil

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For forensic toxicology use only.

This is an Application Brief and does not contain a detailed Experimental section.

Abstract

Here we describe a robust UPLC-MS/MS method for the analysis of various drugs of abuse in hair that can be used in routine testing to allow the granting of commercial driving licenses in Brazil.

Benefits

A robust and sensitive UPLC-MS/MS method for the determination of a panel of drugs of abuse in hair.

Introduction

The use of hair as a biological matrix for forensic toxicology testing has increased in popularity over the last decade. In contrast to traditional matrices, such as blood and urine, hair offers another means of detection and can be used to provide a chronological history of drug exposure over several months to years, if segmental analysis is performed. Human hair is known to grow at approximately one centimeter per month. Drugs can be incorporated into the hair by several mechanisms including passive diffusion from the blood supply at the follicle into the growing hair matrix, diffusion into the hair shaft from sweat or sebum, and through external contamination such as smoke or contaminated hands. Hair collection is a non-invasive technique and can be achieved without the privacy and adulteration issues associated with urine collection and, in contrast to blood samples, hair does not require medically trained staff to collect the sample. Furthermore, hair samples can be easily stored.

In certain geographies, such as Brazil, the granting of commercial driving licenses is linked to the applicant being able to prove that they have not taken any of the drugs of abuse that are on the government sanctioned list. This list includes opiates, amphetamines, cocaine, and tetrahydrocannabinol (THC) and their metabolites. In Brazil, it is estimated that this leads to more than one million tests per year. To ensure that this extremely large volume of tests can be carried out, a very fast, robust analytical method is required which can also conform to the guidelines recommended by the Society of Hair Testing (SoHT).[1]

Results and Discussion

Control hair was collected from volunteers, and following decontamination with methanol, it was finely cut into 1–2 mm segments using scissors. The minced hair was stored at 4 °C until required.

Ten milligrams of chopped hair (spiked or real samples) was placed into polypropylene tubes containing methanol. The sample was pulverized and incubated at 50 °C for 15 hours. Following incubation, the sample was centrifuged, and the supernatant simply transferred to a Waters Total Recovery Vial.

To achieve the very fast separation required, an ACQUITY UPLC I-Class (FTN) System was used and the analytes of interest were separated using a gradient of formic acid/acetonitrile on an ACQUITY UPLC BEH C_{18} Column (p/n: 186002349). At least two MRM transitions were monitored for each analyte using the Xevo TQ-S micro Mass Spectrometer. Where available, equivalent deuterated internal standards were added to the samples at a concentration of 0.4 ng/mg to ensure robust quantitation. The run time for the chromatographic method was 1.2 minutes and provided separation of all analytes including the isobaric norcocaine and benzoylecgonine. A chromatogram of the separated analytes is shown in Figure 1. The figure shows the smoothed and integrated quantifier MRM trace for the analytes of interest spiked at concentrations equivalent to the confirmation cut-off concentration recommended by SoHT.

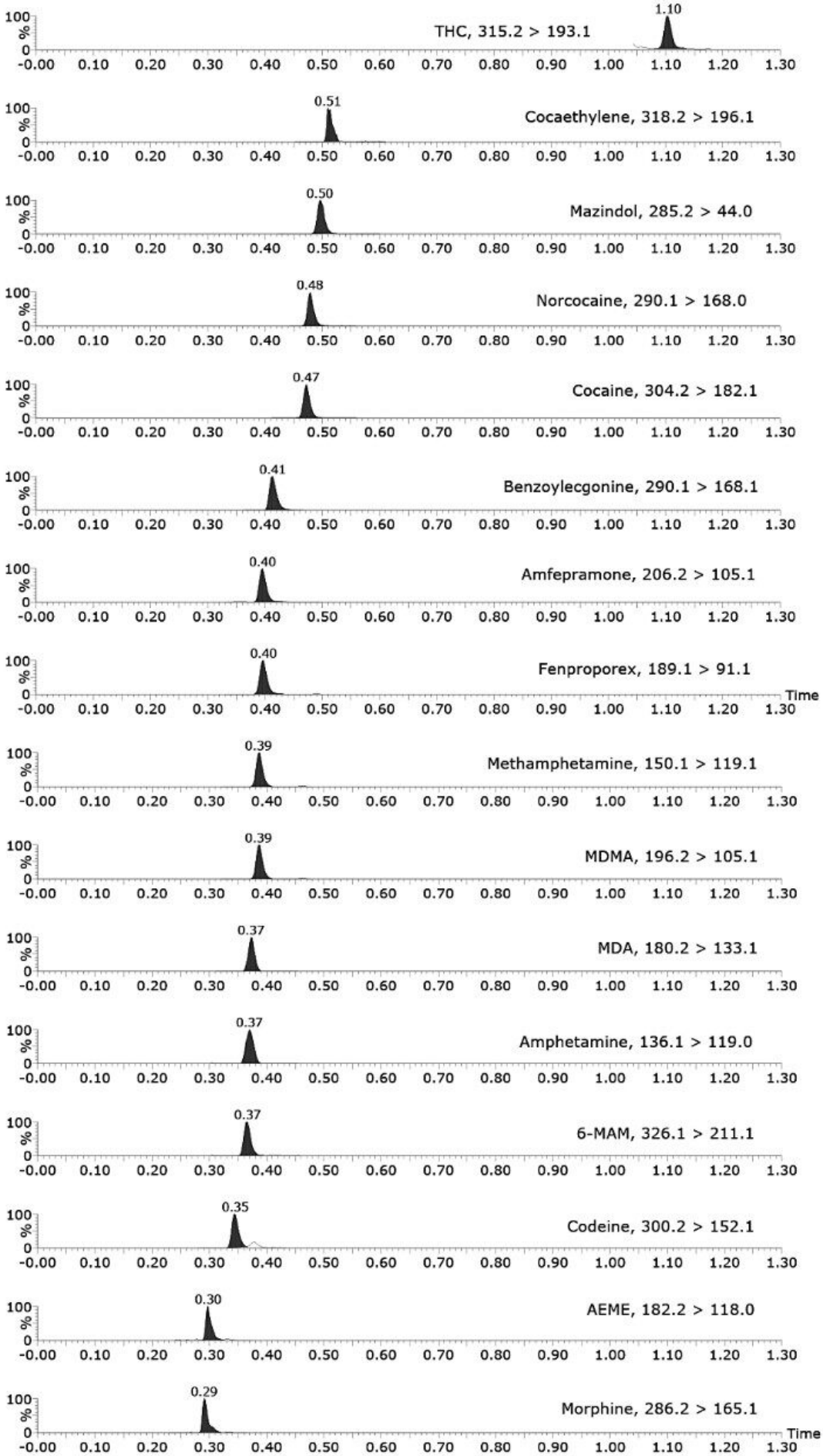

Figure 1. Smoothed and integrated chromatogram showing the analytes spiked into control hair

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