

SN003 - Automated Forensic Toxicology Solutions: Assurance of High Quality Lab Data When Evidence and Truth Matter

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Summary

A robust and reproducible fully automated on-line solution was tested for the GC-MS determination of opiates in spiked horse blood, using smart SPE clean-up. A similar set-up can be used for other methods involving the extraction of drugs of abuse from a range of biological matrices (with a solvent switch for some methods).

Initial lab evaluations have shown it is possible to automate many of the hair sample preparation steps including the wash procedure.

Introduction

Many forensic toxicology service labs face increasing casework, with limited numbers of staff. There is pressure to reduce case turnaround times (TATs) and produce highly reproducible, accurate data which is worthy of evidential consideration in a Court of Law.

Automation of the sample preparation workflow offers faster TATs, excellent repeatability of results, and can also free-up analysts for thinking tasks such as data analysis, method development and reporting. With the constant evolution and growth in numbers of Novel Psychoactive Substances (NPSs), for example, it could be highly advantageous to guide the focus of experienced analysts from repetitive manual sample preparation onto important and more rewarding tasks such as developing and validating methods to aid in the identification and quantitation of NPS and NPS metabolites.

Instrumentation



Figure 1: Anatune solution for fully automated opiates analysis in blood

The system in Figure 1 was successfully evaluated as a solution for opiates in blood. The modules fitted can be used to run a range of methods in blood, urine, oral fluid and hair.

Methods

The Maestro software can cover a range of toxicology sample preparation tasks including:

- Preparation of calibrators and QCs by spiking drug and internal standards

- Addition of extraction buffer/solvent
- Vortex mixing
- Centrifugation
- Solid phase sample clean-up
- Evaporation of eluent
- Heating and mixing for GC-MS derivatisation
- Vial agitation for LC-MS reconstitution in initial mobile phase conditions
- Washing of hair segments

Attractive software features for forensic analysts include:

- Barcode label reader for accurate sample identification
- Compliance tools for data acquisition, audit trails and data integrity purposes
- The ability to work on several samples at the same time

Results – Blood

An example of the linearity achieved for morphine extracted from blood using the GERSTEL automated sample preparation workstation is in Figure 2 ($R^2 > 0.99$). The limit of detection (LODs) was calculated for a S/N of 3 on a single quadrupole GC-MS was 6 µg/L.

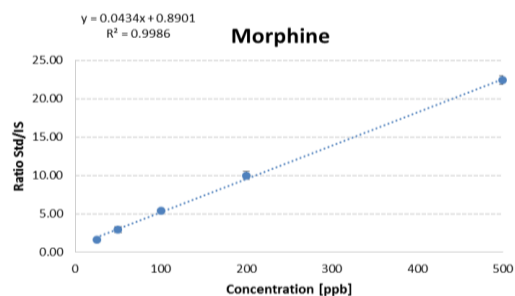


Figure 2. Morphine linearity

Results – Hair

Hair testing can be a time consuming process. With the exception of strand alignment, segmentation and cutting, the GERSTEL workstation has the capability to automate the washing of hair segments and extraction of alcohol markers, drugs of abuse and their metabolites from the hair matrix, with a significant reduction in both analyst time and cost per sample.

Figure 3: An example of the use of the Prep Ahead function in the GERSTEL Maestro software to carry out a hair wash procedure

