

Drugs of abuse in hair, a straightforward chromatographic method using the MassTox® kit from Chromsystems

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INTRODUCTION

- ✦ Hair analysis offers an extended detection window (weeks to months) versus blood and urine testing
- ✦ This study presents the development and validation of a straightforward LC-MS/MS method for simultaneous detection of 26 drugs of abuse and metabolites in hair

METHODS

Purpose

- ✦ Streamlined sample preparation
- ✦ Reduce costs and facilitate routine laboratory application

Sample Preparation¹

- ✦ Hair decontaminated, pulverized, and 20 mg of sample extracted overnight
- ✦ Centrifugation and filtration using filter vials
- ✦ Injection into LC-MS/MS

Calibration & Controls

- ✦ Based on MassTox® Kit (urine), an IVDR ready kit from Chromsystems
- ✦ Arvecon controls (authentic hair)

Optimization

- ✦ Column, mobile phase, gradient, MRM transitions



Figure 1. Schematic overview of the sample preparation

RESULTS

Validation (per ICH M10)²

- ✦ Specificity
- ✦ LOQ
- ✦ Linearity
- ✦ Within-run (4 levels)
 - ✦ Precision: 0,66-18,90 %RSD
 - ✦ Accuracy: 0,12-18,28 %bias
- ✦ Between-run (4 levels)
 - ✦ Precision: 0,71-16,84 %RSD
 - ✦ Accuracy: 0,02-19,18 %bias
- ✦ Carry-over assessment
- ✦ Calibration curves in hair & water
- ✦ Successful proficiency test participation

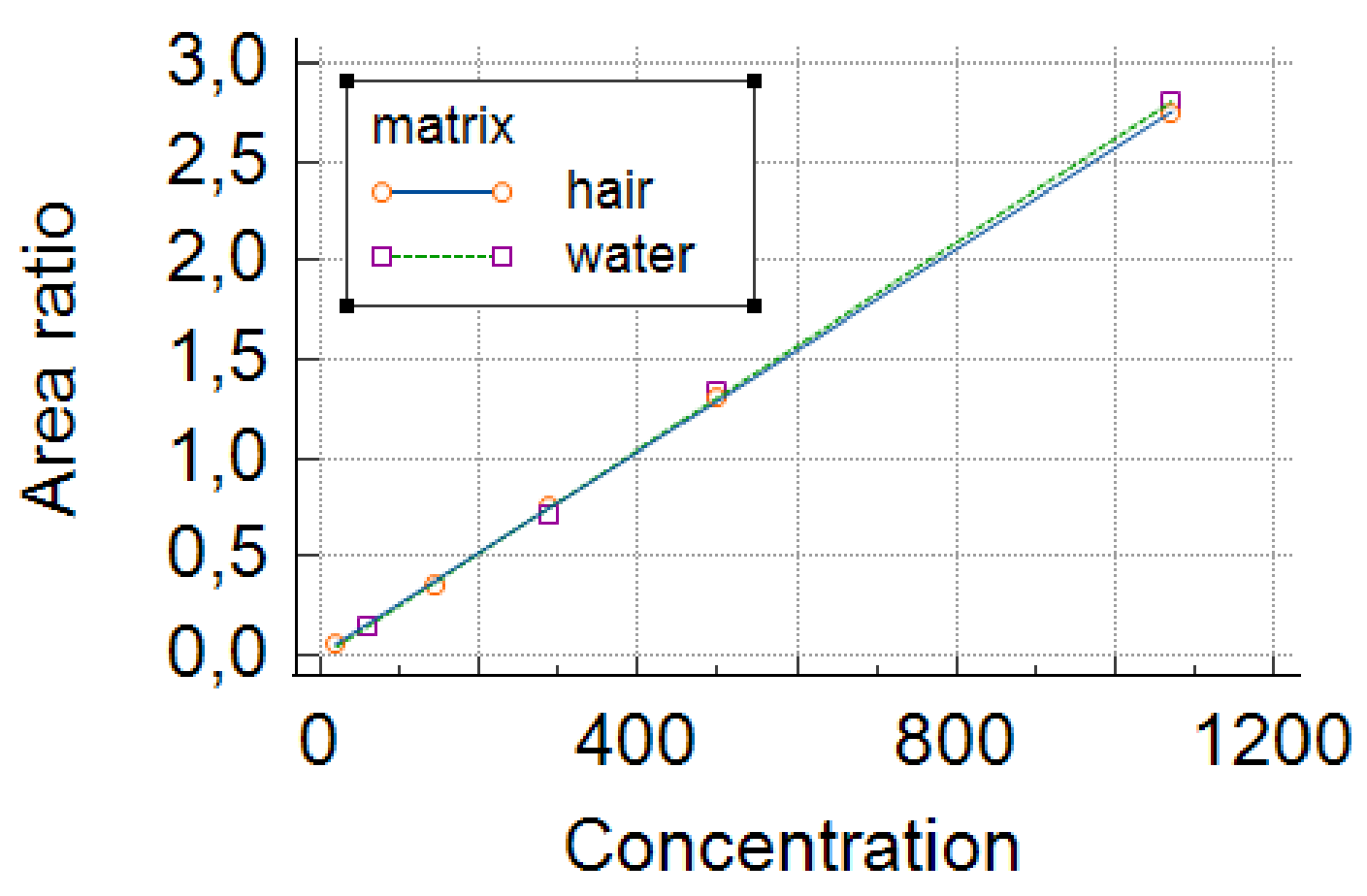


Figure 2. Comparison of the calibration curves in water and hair for benzoylecgonine

	Linear range (pg/mg)	Linear coefficient (R2)	LOQ (pg/mg)	SoHT cut-off (pg/mg) ³
Amphetamine	36 - 3700	1,000	36	200
Methamphetamine	36-4000	1,000	36	200
MDA	31-4200	0,999	31	200
MDEA	31-3800	1,000	31	200
MDMA	31-3500	0,999	31	200
Mephedrone	33-3900	0,999	33	No cut-off available
Cocaine	21-2400	1,000	21	500
Benzoylecgonine	19-2100	1,000	19	The presence of benzoylecgonine should be considered to confirm use
Norcocaine	19-2200	1,000	19	The presence of norcocaine should be considered to confirm use
Cocaethylene	21-2500	1,000	21	The presence of cocaethylene should be considered to confirm use
Codeine	14-1800	0,999	14	200
Dihydrocodeine	16-1800	1,000	16	200
Fentanyl	6,7-720	0,999	6,7	No cut-off available
Hydrocodone	18-2100	0,997	18	No cut-off available
Hydromorphone	7,1-900	0,999	7,1	No cut-off available
6-MAM	3,2-440	0,997	3,2	200
Morphine	17-2000	0,999	17	200
Tilidine	33-3900	1,000	33	No cut-off available
Tramadol	32-3600	1,000	32	200
Nortramadol	32-3600	1,000	32	Confirmation of desmethyltramadol definitively proves tramadol use
Oxycodone	34-4600	0,999	34	100
Oxymorphone	18-2100	1,000	18	No cut-off available
Ketamine	32-4100	1,000	32	200
Norketamine	34-4200	0,999	34	Confirmation of norketamine definitively proves ketamine use
Methadone	36-3900	1,000	36	200
EDDP	32-3600	1,000	32	Confirmation of EDDP definitively proves use of methadone

Table 1. Validation data compared to SoHT cut-off concentrations for 26 drugs of abuse and metabolites in hair

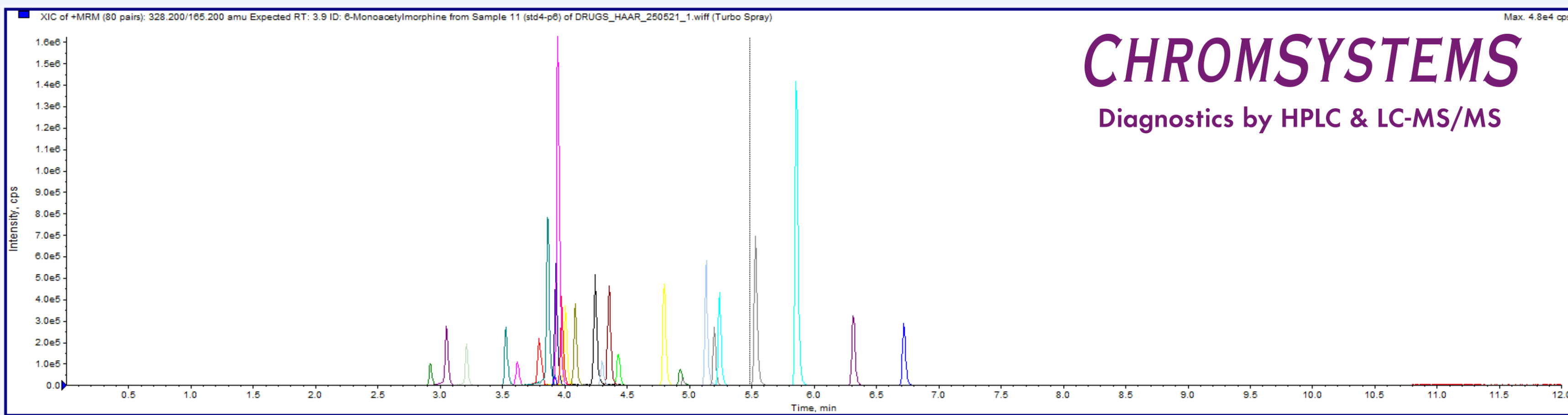


Figure 3. Chromatogram of the calibrator level 4 in hair using the MassTox® Kit. The peaks of the quantifier transitions for all compounds are shown

CONCLUSIONS

- ✦ A robust, multi-analyte LC-MS/MS method for hair testing
- ✦ Suitable for routine use: simple, reliable, cost-effective
- ✦ Critical for detecting co-use patterns of drugs of abuse
- ✦ Broad-range calibration and control materials are essential
- ✦ In routine since November 2024, with an average of 50 samples/month

CONTACT INFORMATION

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