WP-821

DIRECT DETERMINATION OF 12 DRUGS OF ABUSE IN SALIVA USING NEW LDTD ION SOURCE AT 8 SECONDS PER SAMPLE

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OVERVIEW

Purpose

- Optimization of the parameters of the new LDTD ion source for direct analysis of drugs of abuse in saliva.

Method

- Saliva collection with swab and transferred directly in Domino LazWell plate.
- Samples dried and analyzed by LDTD-MS/MS

Quantification

- Precision results were lower than 20% CV using swab spotting.
- Samples analyzed with a runtime of 8 seconds using LDTD-MS/MS technique

INTRODUCTION

Obtaining rapid drug screening results can be crucial in certain situations. Whether for hospital triage during a case of overdose or following an incident on the road that may involve the influence of drugs, rapid analysis of biological samples is essential. Using mass spectrometry for the identification of drugs in biological matrices makes it possible to analyze several drugs at once, to achieve lower detection limits and shorter analysis times. Axino Ion Source allows sample collection and analysis, all in less than 1 minute for the complete process for a drugs of abuse panel. This technology can be implemented in the emergency care area in the hospital or in a police station allowing on-site analysis of the samples collected.

Axino Ionization Source:

The Axino Ion Source (**Figure 1**) is the new generation of sample introduction and ionization source based on the LDTD technology for mass spectrometry. The Axino Ion Source uses a Laser Diode to obtain unmatchable thermal uniformity giving more precision, accuracy and speed.

LDTD coupled to the Uplyft flow process begins by shaping a cone out of the well of a Domino LazWell plate and the dry samples which are rapidly evaporated using indirect heat. The cone shape improves the flow of the neutral molecules that were thermally desorbed from the surface into the corona discharge region. High-efficiency protonation and strong resistance to ionic suppression characterize this type of ionization and is the result of the absence of solvent and mobile phase. This thermal desorption process yields high-intensity molecular ion signal in a few seconds sample-to-sample and allows for very small volumes to be used.

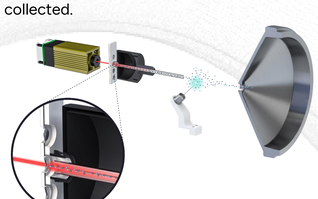

***Figure 1** Axino Ion Source process*

***Figure 2** Axino Ion Source*

METHOD

Standard preparation

A stock solution of 12 drugs (amphetamine, methamphetamine, MDA, MDMA, PCP, Morphine, Codeine, Cocaine, Oxymorphone, Oxycodone, 6-MAM and THC) is prepared in methanol then spiked in negative saliva. Saliva collection swabs are dipped in a spiked saliva solution to simulate mouth saliva collection. The saliva sample is then transferred directly to a Domino LazWell plate, dried, then inserted into the instrument. Blank, STD-0.5X, STD -1X (Cut-off standard) and STD-2X are used for the validation.

Saliva collection kit

Saliva collection kit contains FLOQSwabs (**Figure 3**) and Domino LazWell plate (**Figure 4**). Sample is collected according to the procedure shown in **Figure 5**. The saliva sample is then transferred directly to a Domino LazWell plate (swipe swab directly in Domino LazWell plate), dried then transferred to the shipping bag.

***Figure 3** FLOQSwab*

***Figure 4** Domino LazWell plate*

***Figure 5** Sample collection procedure*

Instrumentation

- Ion source: Phytronix Axino Ion Source
- Mass spectrometer: Sciex Q-Trap 5500

Axino Parameters

- Laser power pattern:
  - Increase laser power to 65% in 3 s
  - Hold for 2 seconds
  - Carrier gas flow: 3 L/min

MS Parameters

- APCI (+)
- Time: 20 msec
- MRM mode

***Table 1** Positive MRM transitions parameters*

Compound	Q1 (m/z)	Q2 (m/z)	CE (eV)
Amphetamine	136	119	12
Methamphetamine	150	119	12
MDA	180	133	25
MDMA	194	133	25
PCP	244	159	20
MOR / HYM	286	152	70
COD / HYC	300	152	70
Oxymorphone	302	227	40
Cocaine	304	182	25
THC	315	193	25
Oxycodone	316	241	32
6-MAM	328	165	48

RESULTS

Saliva collection optimization

Two different collection swabs are evaluated: Polyurethane foam clean room swabs (tips: 3/16" X 11/16") and FLOQSwabs. FLOQSwabs are selected based on their Domino LazWell reproducibility results and the device is already used for saliva collection in different countries. Saliva volume absorption is 200 µL for FLOQSwabs.

Standard extraction and spotting

Spiked saliva solutions are prepared at Blank, 0.5X, 1X, 2X cut-off. Detection limit evaluation is reported in **Table 2.** Swabs are dipped in the spiked saliva solution for 1 minute then transferred to a Domino LazWell plate.

Precision and Detection limit evaluation

For the precision and detection limit evaluation, mean peak area signal of different concentrations are compared to the blank signal.

Following acceptance criteria are used:

- Each concentration must not exceed 20% CV.
- Mean concentration ± 2 times the standard deviation must not overlap with other concentrations at the cut-off.

Each fortified sample is extracted and analyzed (8 replicates). Area results are plotted using the ± 2 STD error bars. **Figure 5** shows the intra-run results for Morphine. No overlapping is observed for each concentration. Similar results are obtained for the other drugs in the panel.

Table 3 shows the %CV of each drug. Results below 20% are obtained.

***Table 2** Detection limit evaluation*

Compound	Conc. (ng/mL)	Compound	Conc. (ng/mL)
Amphetamine	50	COD / HYC	30
Methamphetamine	50	Oxymorphone	30
MDA	50	Cocaine	15
MDMA	50	THC	4
PCP	10	Oxycodone	30
MOR / HYM	30	6-MAM	4

***Table 3** Precision evaluation*

Compound	STD-0.5X (%CV)	STD-1X (%CV)	STD-2X (%CV)
Amphetamine	15.9	13.5	18.2
Methamphetamine	16.0	9.6	19.3
MDA	6.3	7.2	2.7
MDMA	7.6	9.8	5.1
PCP	11.1	19.1	18.3
MOR / HYM	4.8	3.9	3.4
COD / HYC	6.2	4.6	4.5
Oxymorphone	10.2	7.5	14.5
Cocaine	11.8	8.8	9.4
THC	13.5	14.3	16.5
Oxycodone	7.7	10.3	4.3
6-MAM	3.8	9.1	7.2

Dry stability evaluation

To determine the shipping delay, positive spiked samples are extracted and spotted on Domino LazWell. Plates are kept at room temperature protected from light for different periods of time. After the stability time, dry stability samples are analyzed and evaluated against the cut-off standard. After 24 hours, samples are detected positive for all drugs. Results are reported in **Table 4.**

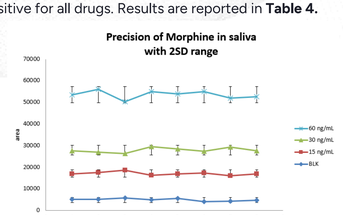

***Figure 6** Morphine precision around the cut-off level.*

***Table 4** Dry stability evaluation.*

Compound	POS / NEG	Compound	Conc. (ng/mL)
Amphetamine	POS	COD / HYC	POS
Methamphetamine	POS	Oxymorphone	POS
MDA	POS	Cocaine	POS
MDMA	POS	THC	POS
PCP	POS	Oxycodone	POS
MOR / HYM	POS	6-MAM	POS

CONCLUSION

- **Swab saliva collection followed by direct transfer to Domino LazWell plate can be successfully used for direct drugs of abuse analysis.**
- **High-throughput analysis using AXINO-MS/MS**
- **Precision within the acceptance criteria.**
- **Dry stability of drug extracts on Domino LazWell plate allows time appropriate time for sample shipping.**
- **Sample-to-sample analysis of 8 seconds**