Clinical applications of direct coupling of Bio-compatible SPME devices to MS via Open-Port Probe sampling interface

M. Tascon1, G. Gomez-Ríos1, C. Liu1, A. Roszkowska1, Nikita Looby1, N. Reyes-Garcés1, D. Arnold2, T. Covey1, B. Bojko1, J. Pawliszyn1

1Department of Chemistry, University of Waterloo, Ontario, Canada, N2L 3G1, 2SCiEX, 73 Four Valley Drive, Concord, Ontario L4K 4V8, Canada, 3SCiEX, 1201, Radio Road, Redwood City, CA 94065, USA, 4Department of Pharmacodynamics and Molecular Pharmacology, Faculty of Pharmacy, Nicolaus Copernicus University in Torun, Dr. A. Jurewicz 2, 85-091 Bydgoszcz, Poland

Abstract

We are presenting the advances achieved up to date employing a microfluidic open port that allows the coupling of biocompatible solid-phase microextraction (Bio-SPME) devices through the generation of a stagnant volume following by a three second desorption flow. In this way, an efficient desorption and very sharp peaks (0.3 seconds P),LOQ as short as 10 mm C30.

Towards the monitoring of drugs and biomarkers in the operation room, some applications were developed using this interface such as the monitoring of doxorubicin from perfusate used in vitro (IVLP) and ex vivo (EVLP) lung perfusion to treat lung cancer.

Regarding the high-throughput therapeutic drug monitoring, the aim of this work is to push down the limits of detection trying to dramatically the total analysis time in high-throughput and the individual turn-around times as well. Therefore, advances in the development of the quantitative method of testosterone from human plasma is herein presented. The concept of rapid on-fiber derivatization is gathered by using the Amplifex® derivatization. Finally, quantification of immunosuppressive drugs from 100 µL of whole blood is presented. LOQs of sub-pg levels were achieved for all the compounds with turn-around times of less than 90 minutes.

Instrumental

SCiEX QTRAP 6500
AB API 4000

Set-up and Fundamentals

Scheme of the hydrodynamic modelling of the interface

- Description volume of 4 µL
- Any kind of dispersive can be adapted.
- The desorption time can be optimized.
- The fiber can be heated or vibrated in order to increase the desorption speed.

Quantitation of Testosterone from human plasma

Desorption volume of 4 µL

10 mm C30 fiber

150 µL of plasma - Agitation for 30 minutes

5 seconds desorption - Description and ES solvent Methanol 0.1% FA

With IS correction

Without IS correction

SRM transitions

Testosterone 265/107
Testosterone 13C8 (IS) 292/132

On-fiber derivatization

Amplifex® derivatization

Estimated LOQ of 1 pg/mL

On-fiber derivatization is: a promising tool for monitoring the preliminary results with an LOQ close to 3 pg/mL

Conclusions

1. The new microfluidic open port herein presented showed to be highly sensitive interface for direct coupling of SPME to MS via ESI ionisation
2. Doxorubicin was successfully quantitated from real perfusate samples from different surgical procedures obtaining a LOQ of 1 pg/mL
3. A fast and sensitive method for the determination of immunosuppressive drugs from 100 µL of whole blood was developed. Turn-around time of individual samples is less than 90 minutes.
4. Testosterone was directly quantitated from human plasma obtaining 10 pg/mL. In order to improve this performance, an on-fiber derivatization procedure is promising giving off the preliminary results with an LOQ close to 3 pg/mL.

References


Acknowledgments