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Direct Analysis of Pharmaceutical Drugs in Biofluids using Miniature Mass Spectrometry System

Spencer Chiang, Yue Ren, Zheng Ouyang
Weldon School of Biomedical Engineering, Purdue University

ABSTRACT

Miniature mass spectrometry (MS) system is key for establishing MS as a point-of-care chemical and biological analysis within clinical settings. In order to provide point-of-care diagnostics, ionization methods for direct analysis of biofluids are required. We have previously introduced paper spray and developed the cartridges for direct MS ionization and sampling. Our goal of this research is to identify a viable way to improve the spray efficacy of paper spray for its coupling with miniature MS. As a result, paper capillary spray (PCS) was developed. PCS utilizes ET31 paper with a fused-silica capillary fixated to the tip. The design was optimized through investigations on capillary length, blood deposition and paper coating. Further experiments were done to compare the efficiency of paper capillary spray and paper spray utilizing Q-Trap 4000 and Mini 12. These methods were tested through direct analysis of different pharmaceutical drugs such as amitriptyline, imatinib, verapamil, and methamphetamines. The resulting spectra showed good signal to noise ratios and peak intensities for spray with Grade 1 paper or capillary with ET31 Paper. ET31 paper spray provided a lower abundance of target ions as well as decrease signal to noise ratios. It was concluded that larger droplets generated by the ET31 paper resulted in a less efficient desolvation with the atmospheric pressure interface. By applying the fused silica tubing to the tip of the ET31 paper as a spray emitter, the desolvation was greatly improved. In the future this study can contribute to develop commercial products for point-of-care MS analysis.

KEYWORDS

Mass spectrometry, paper spray, capillary spray, amitriptyline, imatinib, verapamil, methamphetamines.