

Direct Quantitative Analysis of Biomarkers using Mass Spectrometry

Morgan N. McLuckey, Purdue University and Zheng Ouyang, Purdue University

Point-of-care (POC) diagnostics describes a step in the medical treatment process where drugs can be monitored in a patient's body on-site and in a timely fashion. Mass spectrometry (MS) can provide a quick, efficient, and highly accurate method of analysis of patient biofluids and tissues. Developing methods to bring this diagnostic mechanism to hospitals and clinics has the potential to improve patient care through, for example, personalized medicine. Our goal was to develop a way to effectively introduce internal standard (IS), a necessary chemical for the analytical process, to low-volume biofluid samples. Additionally, the effective direct quantitation of biomarkers with MS was demonstrated using a rat model of nicotine metabolism and the detection of 3-HPMA in urine. By pre-coating silica glass capillary tubes with a fixed volume with IS, biological samples, such as blood, can be obtained in the tube through capillary action and mixed with the IS before deposition for analysis. This method was applied to several different drugs and they were analyzed using a triple quadrupole mass spectrometer. It was optimized for the detection of the metabolite cotinine through a study of solvents and elution processes. Additionally, cotinine was quantified in rat's blood using this method and the acrolein metabolite 3-HPMA was quantified in urine. Additional work is needed to expand this method for the rapid detection of other biomarkers. In the future, this can contribute to the expanded use of MS in clinical care and improved POC diagnostics.