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Two-dimensional capillary electrophoresis integrating on-line sample pretreatment and mass spectrometry detection for determination of cationic drugs and their cationic metabolites in human urine

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A powerful tool for the analysis of unpretreated or diluted biological samples containing ultra-trace concentration levels of ionizable drugs and their ionizable metabolic products, based on the two-dimensional isotachophoresis–capillary zone electrophoresis (ITP-CZE) technique on-line hyphenated with the electrospray ionization–tandem mass spectrometry (ESI-MS/MS, here triple-quadrupole mass spectrometry, QqQ), was developed in our work. Analytical and application potentialities of this new approach were demonstrated on the highly reliable determination of pg-ng/mL levels of various cationic drugs (varenicline, pheniramine) and identification of their cationic metabolites (2-hydroxyvarenicline, N-desmethyl pheniramine) in directly injected (unpretreated) human urine samples taken after the administration of a usual dose of the varenicline- or pheniramine-containing commercial drugs (Champix®, TheraFlu®). The success of the proposed method is linked with the enhanced sample loadability of the used CE system, on-line electrophoresis sample pretreatment (preconcentration and sample clean-up) and separation, high compatibility of CZE and ESI electrolyte systems, and mass spectrometry detection sensitivity and selectivity. The proposed ITP-CZE-ESI-QqQ method was approved by its favorable performance parameters such as the limit of detection, limit of quantitation, linearity, linear range, precision (intra-day, inter-day), recovery/accuracy, selectivity and robustness. Practical outcome of this study could drive advanced monitoring of target drugs, their metabolites and related biomarkers in biological samples, carried out in clinical laboratories for diagnostic purpose as well as therapy optimization.

Biography

Peter Mikus has completed his PhD from Comenius University, Slovakia. He is a Researcher, University Teacher, Associated Professor and Director of the Toxicological and Antidoping Center at the Faculty of Pharmacy Comenius University in Bratislava (FPCU) as well as Head of the Department of Pharmaceutical Analysis and Nuclear Pharmacy FPCU. His one research team is focused on the development, validation and application of advanced hyphenated analytical methods, based on a combination of 2D-separation and spectral (UV-VIS, MS/MS) techniques, for pharmaceutical and biomedical research. He has published more than 60 papers in reputed CC journals.

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