Abstract

Present the dissertation thesis on the topic "The use of a capillary electrophoresis and electrophoresis on chip for clinical research" is divided into two separate parts. The first chapter summarizes the problems of development new method of very rapid determination of uric acid and creatinine using capillary electrophoresis in human urine and serum, when the entirely original solution has been developed for implementation of very fast electrophoretic separations in a commercial electrophoretic apparatus. The separations were performed in a laboratory made capillary formed by connecting a 9.7 cm long separation capillary with inner diameter (*d*) 25 μm with an auxiliary 22.9 cm long capillary with *d* 100 μm. The coupled capillary is characterized by the effective separation path 8.3 cm (short-end injection mode) and the high electric field intensity around 2.3 kV per cm. The coupled capillary was tested at several high-speed analysis; i) the determination of creatinine in human urine, background electrolyte - 20 mM citric acid/NaOH, pH 3.0; ii) the determination of uric acid in human urine, background electrolyte - 20 mM MES/NaOH, pH 6.0. Under these experimental conditions, migration times of 12.2 s for creatinine and 8.6 s for uric acid were achieved and the attained separation efficiency was between 1660 to 2760 theoretical plates per second for all analysis. LODs for both analytes were on submicromolar level. The theory of separation in coupled capillary and its practical applications for separation of clinical samples is discussed in the thesis. The second chapter summarizes the problems of development a new method of capillary electrophoresis with contactless conductivity detection for sensitive determination of stevioside and rebaudioside A in foods and beverages. The plant Stevia rebaudiana Bertoni has been widely cultivated in the world for the sweet diterpene glycosides. The leaves contain different diterpene glycosides arising from the same aglycone, steviol. There are eleven steviol glycosides with stevioside being the most abundant (about 300 times sweeter than saccharose), followed by rebaudioside A which is known to be even sweeter (about 450 times sweeter than saccharose). Steviol-glycoside

sweeteners are commonly used as nonnutritive and high-intensity sweeteners in food supplements and beverages. In the present time, the use of steviol glycosides is becoming increasingly widespread, leading to the requirement of controlling the content of steviol glycosides in foodstuffs to monitor possible falsification. The CE separations were performed by means of the HP^{3D} CE system with contactless conductivity detection. The fused-silica capillary was 33 cm long (18 cm to the contactless conductivity detector) with 10 μm internal diameter. The optimized background electrolyte was 170 mM boric acid/LiOH, pH 9.0, containing 0.5 % *v*/*v* INST Coating Solution. Separations were performed by applying high voltage of +20 kV and samples were injected into the capillary by pressure 50 mbar for 100 s. Samples were directly dissolved in water and diluted with acetonitrile. The migration times of the tested steviol glycosides had values 5.0 min. for rebaudioside A and 5.1 min. for stevioside, respectively. The attained separation efficiency was between 305 000 – 347 000 plates per meter in real samples.