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關鍵字(英)	u-TAS, u-CE chip, Electrochemical detection, Series-dual electrochemical detector, on-chip derivatization.
摘要(中)	多工、微型化與界面整合無疑是未來微全分析系統發展之必要關鍵！本研究旨在運用微機電製程，製備結合微電泳與電化學偵測晶片，使進樣、分析與檢測元件，同步縮製於一微晶片中。同時為使本系統兼具高靈敏度與良好的分離效能，除在分離管柱的結構設計加以探討外，亦引進如雙電極系統，期能有效提升檢測靈敏度與提昇複雜樣品的選擇性；另為擴大電化學檢測系統使用的廣泛性，使部分不具電活性物種，經整合衍生化反應機制後，能納入本系統所應用之範圍，企將來能整合微型數據處理與高電壓電源供應器及控制系統元件等，以發展泛用型「微電泳電化學偵測晶片」。 第二章「微電泳晶片結構設計與電化學偵測法製

	程技術之探討」主要依據筆者在微電泳分離電化學檢測晶片製備流程中，具體歸納出提昇製程良率的主要關鍵技術，包括晶片潔淨度、金屬蒸鍍、濕蝕刻、放電加工鑽孔以及晶片接合等，俾獲得較穩定的製程良率，並在完成蝕製微流道與微電極佈放及系統整合後，建立供後續檢測晶片分離效能與電化學感測系統之評估與驗證方法，如進樣時間與進樣電壓對電極訊號的增益情形以及進樣次數對電極鈍化之影響，建立可循環再生的晶片系統。 第三章「微電泳晶片結合雙電極電化學偵測技術之探討」，旨在藉由繞線式微流道的設計與序列式雙電極系統併用，藉由10 公分的大尺度繞線型微流道進行分析三種 catecholamines，得出晶片的分離效能最高可達 233,000(N/m)，偵測極限則介於 0.2~ 0.5 ?M 間，經與十字注入口之體積換算，上游電極之線上偵測極限為 1.8 amol；下游電極之偵測極限則為 1.5 amol。序列式雙電極偵測系統的收集效率則因電極電位設定模式不同而有顯著的差異，當上游電極設定為氧化電位，下游電極為還原電位時，收集效率為最佳。大尺度的繞線式微流道能延伸有效的分離流道，並能獲得極佳的解析度，對於將來複雜樣品的波峰解析，更能利用雙電極進行氧化還原物種的鑑定。 第四章「前管柱衍生化微胞電泳晶片結合電化學偵測技術之探討」則結合晶片上衍生化技術，在晶片外衍生化的先導研究發現，四種氨基酸在本系統的理論版數在 His 的部分可達 340,000 以上；而 GABA 則可達 230,000 以上達新高。透過進樣時序與電壓量的控制，可得進樣電壓 1.5 kV；進樣時間 10 秒，衍生化反應時間約 30 秒左右，可得晶片內衍生化反應的最佳化實驗參數；而結合晶片內衍生化之微電泳電化學偵測系統之線上偵測範圍介於 5~500 ?M 之間，R2 則大於 0.997 以上；偵測極限約可達 1 ?M 左右。研究過程並導入界面活性劑形成微胞電動力層析法來改善分離效能，據此增加微電泳晶片結合電化學檢測技術應用在非電活性物種的應用能力與範圍。
摘要 (英)	The micro total analytical system (u-TAS) has become a powerful platform for the study of bio/chemical measurements. Such monolithic integration had promised a variety of potential benefits in terms of speed, low cost, less reagent, versatility for custom design, and easy miniaturization. As a result of the rapid development within the field of u-TAS, there are currently focusing on the multi-function, miniaturization and integration. The ability to incorporate sample processing, separation, and detection on a single device would make a miniaturized approach to bio/chemical analysis even more attractive. Chapter 2 detailed the key points of instruction for glass microchip capillary electrophoresis using the standard photolithography, followed by chip evaluation and re-treatment procedures. Chapter 3 combined a large-sized serpentine separation channel and series-dual working electrode for u-CE chip. The detector responses for dopamine and epinephrine were found to be linear from 0.5~1000 uM with R2 greater than 0.993. The limit of detection (LOD) for upstream and downstream electrode reaches 0.25 and 0.2 uM respectively. The relative standard deviation (R.S.D) of intensity reproducibility obtained from seven successive middle concentrations were all lower than 4.85%; and the R.S.D. of migration time was lower than 1.03%. The micro separation channel with large-sized symmetrical hairpin turns

	was contributive to eliminate the band-broadening resulted from “race-track” effect. Through identification result, the theoretical plate number could reach 240,960 (N/m). When upstream electrode was set as reduction potential, oxidation potential was applied to downstream electrode to determine the collection efficiency of dual electrochemical detection. The detection response of dopamine and epinephrine had shown the increase of 12.12 and 10.65% respectively, and catechol increased 29.32%. As a whole, this device is also contributive to sensitivity. Chapter 4 were introduced a pre-column derivatization system to microchip capillary electrophoresis for the determination of amino acids using o-phthalaldehyde (OPA) and 2-mercaptoethanol (2-ME). In this system, amino acids are derivatized on-chip in a three-channel flow manifold for sample, reagent and buffer solutions. The resulting solution, which contains the amino acid derivatives, is introduced into the electrophoretic separation by means of an appropriate injection time, injection voltage and mixing time. Through identification result, the theoretical plate number for off-chip derivatization could reach 340,000 of hisdidine, and 230,000 of GABA. The detector responses for amino acids were found to be linear from 5~500 uM with R2 greater than 0.997. The limit of detection (LOD) reaches 1 uM.
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