3.1 Flow injection analysis

Sensing Good Life

3.1 Flow injection analysis

Flow injection analysis is a technique to detect the flowing analyte in an appropriate device where carries a zone of sample toward the surface of working electrode. It simply divided two types of flowing, wall jet and flow through, which the flow direction is perpendicular or parallel to the electrode. (see Figure 1,2) The design of flow cell must be satisfied with the high signal to noise ratio, low dead volume, high mass transfer rate, well defined hydrodynamics, small ohmic drop, and ease of construction and maintenance.[1] The attractive solution is to develop a flow cell for disposable screen printed electrode or a disposable lab-on-chip.

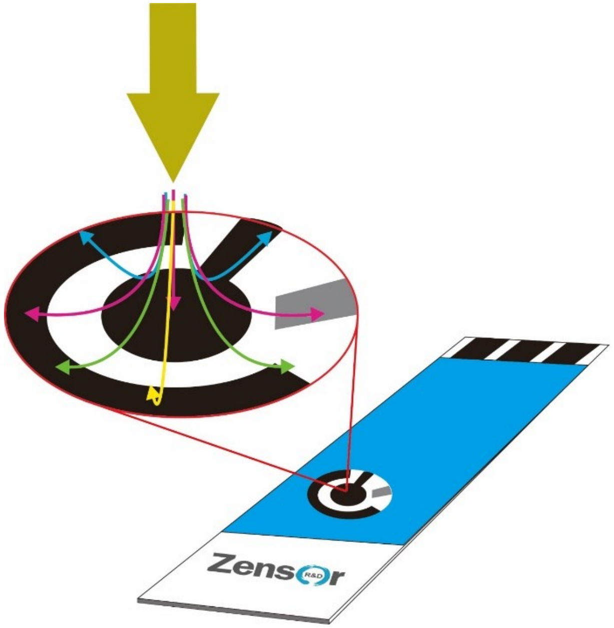

Figure 1. Wall jet type

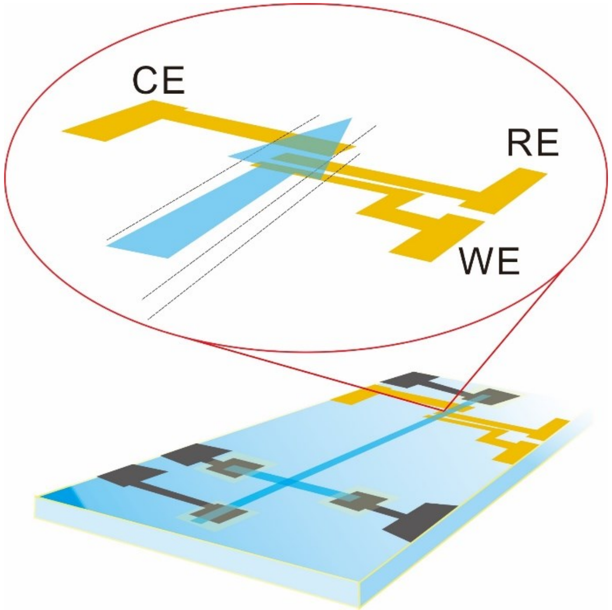

Figure 2. Flow through type

References
(1)Joseph Wang, Analytical Electrochemistry 2nd ed., 2000

3.1.1 An electrochemical cell coupled with disposable screen electrodes for use in flow injection analysis

An electrochemical coupled with disposable screen printed electrodes (SPEs) that is specifically designed for flow injection analysis (FIA) is illustrated as shown in Figure 3. The cell is made of foldable polyoxymethylene thick platelets with the bottom portion consisting of a cavity track to drag the SPEs in position and the top portion having predrilled T like holes to arrange the Ag/AgCl reference electrode and stainless steel inlet and outlet. An O ring is suitably fixed on the top of the working electrode to form a thin layer space where the electrochemical reaction can take place.

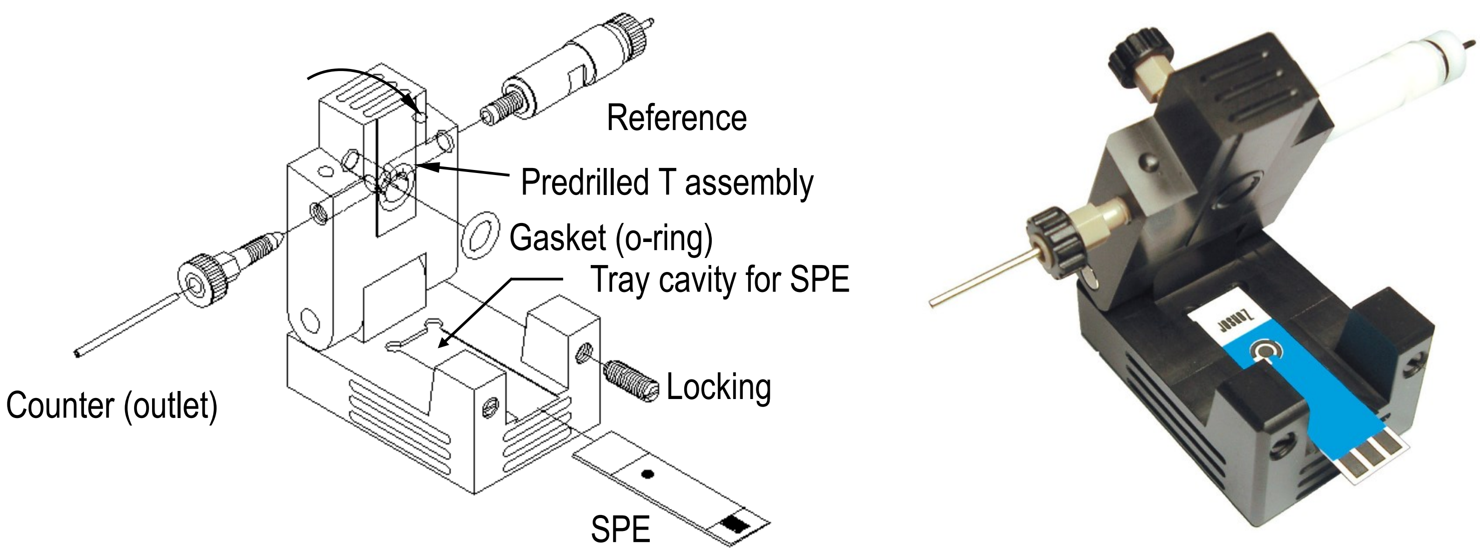

Figure 3. Flow cell design and its picture

References
(1)Cheng-Teng Hsu, Hsieh-Hsun Chung, Huieh-Jing Lyuu, Dong-Mung Tsai, Annamalai Senthil Kumar, Jyh-Myng Zen, Analytical Sciences, 22, 2006, p35-38

3.1.2 Selective Determination of Arbutin in Cosmetic Products Through Online Derivatization Followed by Disposable Electrochemical Sensor

The integration of a ColeParmer microprocessor pump drive and a manual injector with Zensor SF-100 thin-layer detecting electrochemical cell was successfully achieved for the determination of arbutin (AR) in cosmetic products. The sample of arbutin was pumped through the MnO_2 reactor to be oxidized, and then the oxidized AR flowed toward the screen printed carbon electrode to undergo the electrochemically reduced reaction. (see Figure 4) The resulting signal was obtained with the amperometric method as shown in Figure 5.

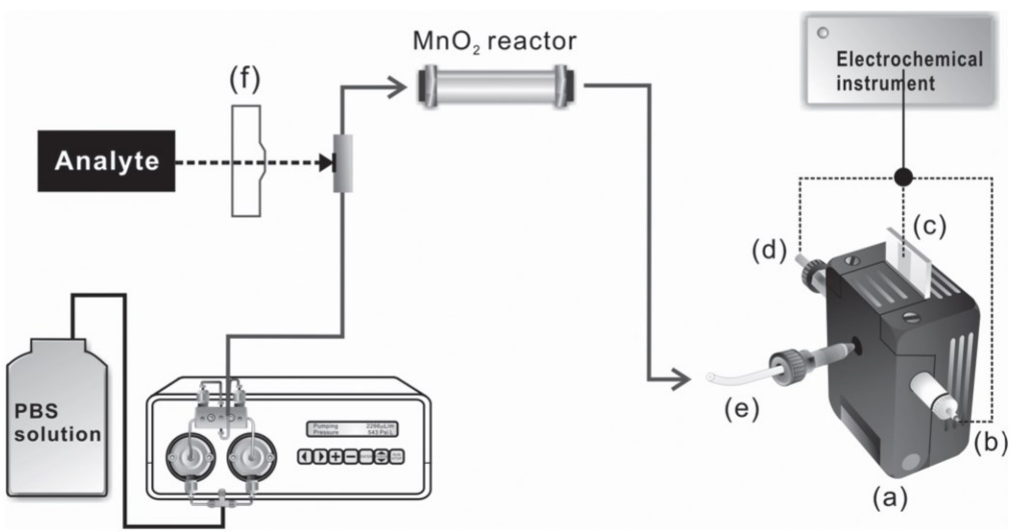

Figure 4. Schematic representation of the setup of the equipment.

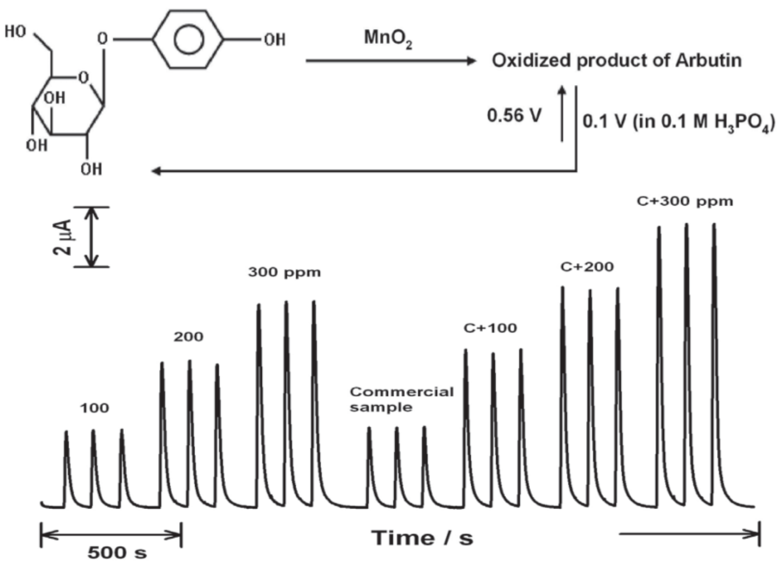

Figure 5. Reaction mechanism for the proposed system and its amperometric signal of arbutin in real sample analysis.

Reference

(1)Jyh-Myng Zen, Hsueh-Hui Yang, Mei-Hsin Chiu, Chao-Hsun, Ying Shih, Journal of AOA C International Vol. 94, N o. 3, 2011

3.1.3 Simultaneous detection of NADH and H_2O_2 using flow injection analysis based on a bifunctional poly(thionine)-modified electrode

Simultaneous detection of NADH and H_2O_2 has been successfully developed based on bifunctional poly(thionine)-modified screen printed carbon electrode with flow injection analysis. It is designed a poly(thionine)-modified ring disk electrode for detection of NADH at disk electrode and H_2O_2 at ring electrode with good sensitivity and limit of detection by using Zensor SF100 flow cell system.

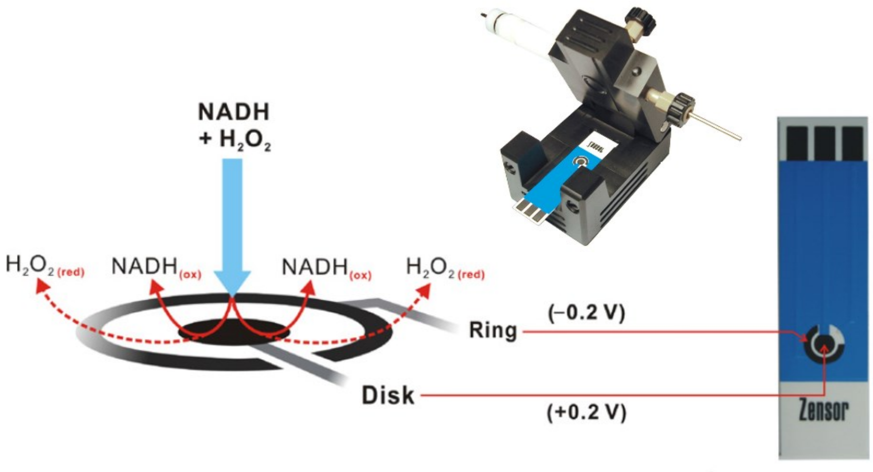

Figure 6. Schematic representation for simultaneous detection of NADH and H_2O_2 at the RDSPCE*/poly(thionine) by FIA.

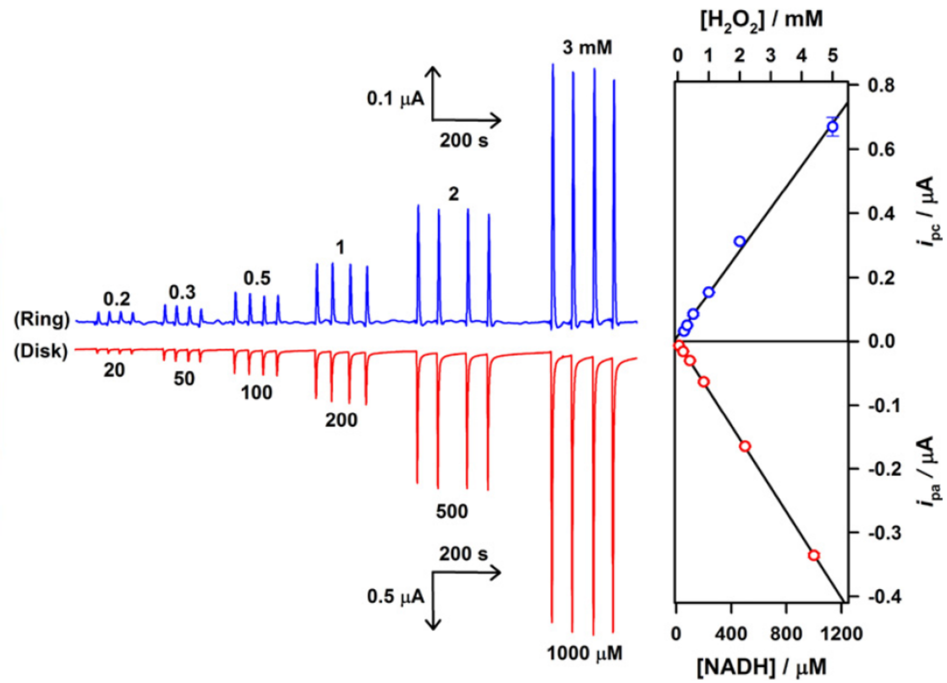

Figure 7. Typical FIA responses and the obtained calibration curves for simultaneous detection of NADH and H_2O_2 at a flow rate of 0.7 mL min^{-1} with applied potential of 0.2 V at disk electrode for NADH and −0.2 V at ring electrode for H_2O_2.

Reference
(1) Selvaraj Baskar, Jen-Lin Chang, Jyh-Myng Zen, Biosensors and Bioelectronics 33 (2012) 95– 99

3.1.4 Determination of Thioglycolic Acid in Hair-Waving Products by Disposable Electrochemical Sensor Coupled with High-Performance Liquid Chromatography

It is available to integrate the Zensor SF100 flow cell with high performance chromatography (HPLC) and disposable screen printed electrode to determine the thioglycolic acid (TGA) in commercial hair-waving products. The flow injection analysis (FIA) and LC experiments were performed with a Beckman 126 pump and a sample introduction channel auto-sampler with an injection loop of 20 μL. (see Figure 8) The high performance liquid chromatogram of TGA samples was analyzed as illustrated in Figure 9.

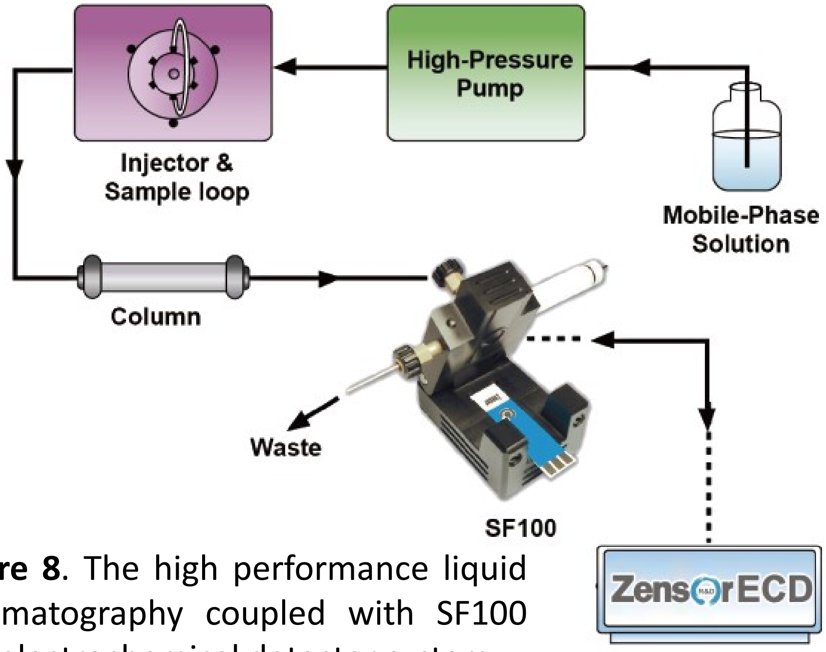

Figure 8. The high performance liquid chromatography coupled with SF100 and electrochemical detector system.

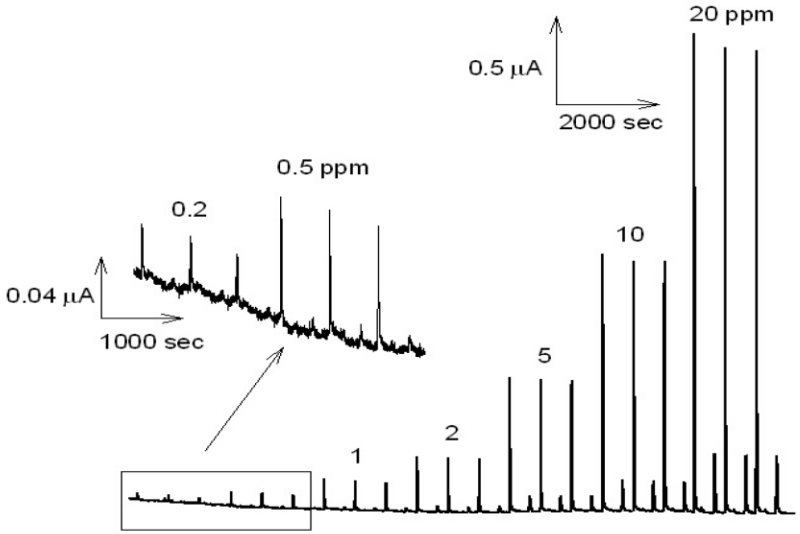

Figure 9. High performance liquid chromatograms for increasing concentrations of TGA by HPLC coupled with electrochemical detection at SPCE*

Reference

(1) Jyh-Myng Zen,Hsueh-Hui Yang,Mei-Hsin Chiu, Yu-Ju Chen, Ying Shih, JOURNAL OF AOAC INTERNATIONAL VOL. 92, NO. 2, 2009