Designing a highly sensitive and selective molecularly imprinted polymer-based electrochemical sensor for the detection of ipratropium bromide in pharmaceutical formulation and commercial serum samples

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Abstract

A new electrochemical sensor based on molecularly imprinted polymer (MIP) film is presented for the determination of ipratropium bromide (IPR), which is used in the treatment of chronic obstructive pulmonary disease (COPD) [1]. MIP film was prepared for the first time by photopolymerization of methacrylate aspartic acid (MAAsp) as monomer and IPR as target molecule on a glassy carbon electrode (GCE). The morphological characterizations of the developed IPR/MAAsp@MIP/GCE sensor were carried out using atomic force microscopy (AFM), Fourier Transform Infrared Spectroscopy (FT-IR), energy-dispersive X-ray spectroscopy (EDX), and scanning electron microscopy (SEM) and electrochemical characterizations of the developed sensor were performed using cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). Under the optimum conditions, the calibration curve linear range was 1.0 -10.0 pM. The quantification (LOQ) and the detection (LOD) limits were calculated as 0.28 pM and 0.93 pM, respectively.
Moreover, this sensor exhibited good repeatability and reproducibility, satisfactory stability, and excellent measurement performance in commercial serum samples and pharmaceutical formulations. The IF values were determined by taking the ratio of ΔIp values of MIP to NIP, and IF' values were calculated as the ratio of IF values for MIP to NIP. The IPR/MAAsp@MIP/GCE sensor showed high IF' values for IPR, confirming that the sensor was selective for determining IPR. These results show that the molecular imprinting method for detecting IPR in the novel sensor system is very successful.

References

[1] Meng-Ting Wang, Cheng-Liang Tsai, Yu-Wen Lo, Jun-Ting Liou, Wan-Ju Lee, I-Ching Lai, International Journal of Cardiology, Volume 158, Issue 2, (2012), Pages 279-284.