Molecularly imprinted electrochemical sensor based on surface-printed polymerization and nanomaterial affinity for the selective and sensitive detection of abrocitinib

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Abstract

An electrochemical molecularly imprinted polymer (MIP) sensor was developed for the sensitive and selective detection of abrocitinib (ABR) used in the treatment of atopic dermatitis [1] on the glassy carbon electrode (GCE) surface using differential pulse voltammetry (DPV) for the first time. 4-aminobenzoic acid (4-ABA) was used as a functional monomer to form a molecularly imprinted polymer (MIP) by photopolymerization on GCE. A wide variety of nanomaterials, such as graphene, carbon quantum dots, carbon nanotubes, and metal-organic frameworks, are often used in the fabrication of electroanalytical sensors. These nanomaterials have many advantages on electrodes, including high conductivity and the effect of increasing the surface area. Moreover, when combined with selective and sensitive methods such as MIPs, since it improves electrode performance, its use was increased recently [2]. Nanoflower (NF), an organic-inorganic hybrid nanomaterial, was used in this study. It is known that NFs have a high surface area/volume ratio and show high activity in many activities [3]. A flower-shaped nanomaterial was synthesized (RME-NF) using methanol extract (RME) obtained from the roots of *Alkanna cappadocia* Boiss. et Bal. as organic structure and zinc phosphate structure as inorganic structure. Graphene oxide (GO), due to its high surface area of approximately 2600 m^2g^{-1}, exceptional chemical stability, and distinctive electronic and mechanical properties, exhibits significant potential for utilization in a diverse range of applications such as nanoelectronics, composites, and sensors [4]. Therefore, the synthesized RME-NFs were modified with GO. The MIP film was synthesized in the presence of 2-hydroxyethyl methacrylate (HEMA) and ethylene glycol dimethacrylate (EGDMA) to form the ABR/4-ABA/RME-NFs@GO@MIP/GCE sensor. The developed ABR/4-ABA/RME-NFs@GO@MIP/GCE sensor was investigated with atomic force microscopy (AFM), Fourier Transform Infrared Spectroscopy (FT-IR), scanning electron microscopy (SEM), cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). The produced ABR/4-ABA/RME-NFs@GO@MIP/GCE sensor performed a linear detection range of 0.1-1.0 pM and a limit of detection (LOD) of 0.022 pM. The selectivity studies were also shown against the possible interfering compounds in commercial serum samples. The reproducibility of fabricated MIP-based sensors obtains a relative standard deviation (RSD) of 2.86%. The practicability of the sensor was examined by determining commercial serum samples, and satisfactory results and recovery (101.04%) were achieved. These results demonstrate the molecular imprinting approach's potential as the newly developed sensor for detecting ABR.

References

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