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Electrochemical magnetic imprinted sensor based on MWCNTs@CS/CTABr surfactant composites for sensitive sensing of diethylstilbestrol

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Abstract A selective and simple method for electrochemical determination of diethylstilbestrol (DES) was developed based on novel magnetic molecularly imprinted nanoparticles (MMIPs NPs) in this paper. Multilayer core-shell type superparamagnetic and water-compatible MMIPs (WMMIPs) NPs were prepared in aqueous media using 3-aminophenylboronic acid (APBA) as the water-soluble functional monomer. Moreover, WMMIPs, surfactant hexadecyl trimethyl ammonium bromide (CTABr) and a composite of multi-walled carbon nanotubes coated with chitosan (MWCNTs@CS) were stepwise modified on the surface of a magnetic glassy carbon electrode (MGCE) in order to enhance the electron transfer rate, increase electrode surface area for more loaded capture probes of WMMIPs and effectively improve the detection sensitivity of the sensor. The prepared sensor was denoted as WMMIPs/MWCNTs@CS/CTABr/MGCE. Scanning electron microscopy (SEM), ultraviolet–visible (UV–vis) spectrophotometry, Fourier transform infrared spectroscopy (FT–IR) and vibration sample magnetometry (VSM) were used to characterize the nanocomposite. Cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) were used to study the electrochemical behaviors of the modified electrode. Square wave voltammetry (SWV) was employed for the determination of DES, and the oxidation peak currents showed a well linear relationship with the logarithmic values of DES concentrations in the wide range of 1.5×10^{-9} to 1.5×10^{-4} mol L⁻¹ with correlation coefficient of 0.9986. The detection limit was 2.5×10^{-10} mol L⁻¹ (S/N = 3). The developed sensor exhibited good reproducibility, stability and selectivity, and was successfully applied to DES determination in actual milk and lake water samples.

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