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Three-dimensional molecularly imprinted electrochemical sensor based on Au NPs@Ti-based metal-organic frameworks for ultra-trace detection of bovine serum albumin

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Abstract: A novel three-dimensional molecularly imprinted electrochemical sensor (MIECS) was fabricated for ultra-trace detection of biomacromolecules bovine serum albumin (BSA), which was based on 3D porous electrocatalytic framework materials (AuNPs@NH_2-MIL-125(Ti) composites) and graphene modified glassy carbon electrode. The AuNPs supported amino-functionalized Ti-benzenedicarboxylate porous metal-organic frameworks (Au/NH_2-MIL-125(Ti)) was prepared by a simple and rapid ultrasonic method. The stable proteins molecularly imprinted polymers (MIPs) films were fabricated by electropolymerization using L-cysteine (L-Cys) as functional monomers and BSA as templates. The monomer L-Cys interact with AuNPs by Au-S bonds and interact with BSA by hydrogen bonding and electrostatic interaction, which was characterized with UV-vis spectra. The morphology of the MIP modified electrode was characterized by scanning electron microscopy, transmission electron microscopy and atomic force microscope. Under the optimal conditions, the 3D MIECS exhibited a wide linear range of 10^{-18} g ml^{-1} to 10^{-12} g ml^{-1} of BSA and a extremely low detection limit of 4.147×10^{-19} g ml^{-1}. The 3D MIECS has been applied to the assay of BSA in liquid milk samples with satisfying results.

Key words: Molecularly imprinted electrochemical sensor; Au nanoparticles; metal-organic frameworks; bovine serum albumin; L-cysteine

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