One-step Synthesis of Ultrasmall Platinum Nanoparticles Supported on Amino-Functionalized Graphene to Create an Electrochemical Molecularly Imprinted Polymer Sensor for Fluxapyroxad

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In this work, a novel electrochemical molecularly imprinted polymer (MIP) sensor for fluxapyroxad (FP) was constructed. This MIP sensor was based on indole-6-carboxylic acid (6-IAA) and platinum (Pt) nanoparticles (NPs) supported amino-functionalized graphene (NH₂-r-GO). Massive and ultrasmall Pt NPs (2-3 nm) were supported on NH₂-r-GO, which was easily prepared using a simple, aqueous phase method. Pt NP was firstly generated using ascorbic acid as the reductant and hexadecylpyridinium chloride as the structure-directing agent; then, NPs were immediately loaded on the surface of the coexisting NH₂-r-GO. Loading allowed for the interreaction between the amino group and Pt to form the hybrid nanocomposite. This hybrid material was then used to modify a glassy carbon electrode (GCE) surface, resulting in a Pt-NPs-NH₂-r-GO / GCE. After this modification, FP was imprinted on the aforementioned electrode surface using cyclic voltammetry, with 6-IAA as the functional monomer. Finally, FP was eluted from the polymer, resulting in the MIP sensor. After rebinding the template molecules Fe(CN)₆^{3-/4-} was used to measure the impedance of the MIP sensor. Results indicated an excellent response for FP across a linear range of 1.0×10⁻⁹ to 1.3×10⁻⁵ mol L⁻¹; the detection limit was determined to be 1.0×10⁻¹⁰ mol L⁻¹ (S/N= 3). This sensor was also used to detect FP in real samples, with results indicating it was a reliable sensor for FP.

Keywords: Electrochemical sensor; Fluxapyroxad; Molecularly imprinted polymer; Indole-6-carboxylic acid; Pt nanoparticles; Amino group functionalized-graphene

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