Fabrication of an Electrochemical Biosensor Based on Nafion/Horseradish Peroxidase/Co₃O₄ NP/CILE and Its Electrocatalysis

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This paper focuses on the investigation of direct electrochemistry and electrocatalysis of horseradish peroxidase (HRP) on Co₃O₄ nanoparticles (NPs) decorated carbon ionic liquid electrode (CILE) as an electrochemical biosensor for determinations of trichloroacetic acid (TCA) and sodium nitrite (NaNO₂). Co₃O₄ NPs were served to bridge the gaps between electron transport of electrochemical active site of HRP to the electrode with the ability to enhance the loading capacity of HRP on the electrode. Various material characterization techniques such as scanning electron microscopy, transmission electron microscopy, Raman and X-ray photoelectron spectroscopy were used to check the structure, morphology and crystal form of Co₃O₄ NP. Spectroscopic data testified that no denaturation occurred in the structure of HRP. Electrochemical performances of Nafion/HRP/Co₃O₄/CILE were conducted in pH 3.0 phosphate buffer solutions, which indicated that electron communication was achieved with the appearance of one well-distinct peak couple. Low detection limits and wide linear ranges were obtained in electrocatalytic investigations for the different substrates including TCA and NaNO₂ with the real samples detected successfully.

Keywords: Carbon ionic liquid electrode; direct electron transfer; Co₃O₄ nanoparticles; horseradish peroxidase; electrocatalysis.

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