Fe₃O₄-CuO Bimetallic Composite/Functionalized CNTs Modified Carbon Paste Electrode for Determination of Dexamethasone as a Doping Agent in Sports

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This study was carried out to fabricate bimetallic composite of Fe₃O₄-CuO nanoparticles and functionalized CNTs modified carbon paste electrode (Fe₃O₄-CuO@f-CNTs/CPE) for determination of dexamethasone (DXM) as a doping agent in sports. For synthesis of the modified electrode, Fe₃O₄ NPs and CuO NPs were synthesized using the hydrothermal method. The structural characterization of Fe₃O₄-CuO@f-CNTs/CPE using XRD and SEM showed that Cu NPs and Fe₃O₄ NPs were randomly entrapped on a porous structure of f-CNTs. The electrochemical studies using CV and amperometry exhibited that the wide range, sensitivity, stable and selective electrocatalytic responses to DXM were observed for Fe₃O₄-CuO@f-CNTs/CPE that related to high specific surface area nanocomposite, numerous active sites' exposure and synergetic effect of Fe₃O₄ and CuO NPs and f-CNTs. The linear range, sensitivity and limit of detection of sensor were obtained 0 to 3100 μM, 0.8665 μA/μM and 0.003 μM, respectively. The accuracy and applicability of Fe₃O₄-CuO@f-CNTs/CPE for determination of DXM was examined in medicinal and human body fluid samples and results showed the acceptable value of recovery (≥94.35 %) and RSD (≤3.71 %), indicating the prepared sensor can be used as a reliable DXM sensor in clinical specimens.

Keywords: Functionalized CNTs; Fe₃O₄-CuO nanoparticles; Dexamethasone; Clinical samples; Amperometry

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