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An electrochemical sensor based on MnO_2 nanostructures modified reduced graphene oxide (rGO) for detection of dopamine

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This study was performed to fabricate the electrochemical dopamine sensor based on MnO_2 nanostructures modified reduced graphene oxide (MnO_2/rGO) electrode in the pharmaceutical sample. The GO nanosheets were synthesized using modified Hummers technique for modification of the glassy carbon electrode (GCE), and then reduced using the electrochemical technique. MnO_2 nanostructures were electrochemically deposited on rGO/GCE. The structural characterization using SEM and XRD showed the vertical growth of tetragonal crystalline of α-MnO_2nanoplates on crumpled rGO nanosheets. The electrochemical studies using CV, and DPV indicated to higher electroactive surface area of MnO_2/rGO/GCE and its higher sensitivity to the determination of dopamine than that on GCE, rGO/GCE and MnO_2/GCE because of the synergetic effect of rGO nanosheets and high porous and sharp tips of MnO2 nanoplates. The amperometric studies showed that the sensitivity, detection limit and linear range of MnO_2/rGO/GCE were obtained at 0.28808μA/μM, 0.002 μM and 0 to 1100 μM, respectively. The interference effect on the determination of dopamine showed the great selectivity of MnO_2/rGO/GCE using the amperometry technique at 0.11V. The practical feasibility of MnO_2/rGO/GCE as a dopamine sensor was evaluated in dopamine hydrochloride injection as a pharmaceutical product and results showed the good agreements between the electrochemical analysis and clinical laboratory data. Finally, the acceptable values of recovery (> 98.2%) and relative standard derivation (<3.91%) of the analytical analysis showed that the proposed dopamine sensor can be used as a precise and reliable sensor in complicated pharmaceutical samples.

Keywords: Dopamine; Electrochemical Sensor; MnO_2 nanoplates; Reduced Graphene oxide; Amperometry

FULL TEXT