Ultrasensitive Determination of Dopamine and Uric Acid Based on Gold Nanoparticles@Carbon Dots/Electrochemical Reduced Graphene Oxide modified glassy carbon electrode

Muyi Li, Xiang Yang, Wenjun Liu, Huixian Wang, Hongmei Jiang*, Xiaoying Liu*

School of Chemistry and Materials Science, Hunan Agricultural University, Changsha 410128, P.R. China.

*E-mail: jhmndcn@hunau.edu.cn (H. Jiang), xyliu@hunau.edu.cn, xiaoyingliu@126.com (X. Liu)

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An ultrasensitive electrochemical sensing platform based on a glassy carbon electrode (GCE) modified with electrochemically reduced graphene oxide (erGO) and gold nanoparticles@carbon dots (GNPs@CDs) was developed. The hydroxyl-rich CDs were electrochemically synthesized, and the GNPs@CDs were obtained by reducing chloroauric acid with hydroxyl-rich CDs. The electrochemical behavior of the fabricated electrode, GNPs@CDs/erGO/GCE, was explored by cyclic voltammetry and electrochemical impedance spectroscopy. The electrochemical performance of the electrode demonstrated a remarkable enhancement in the peak current toward oxidation of dopamine (DA) and uric acid (UA) with a peak potential separation of 0.15 V in the presence of ascorbic acid (AA). Under optimized conditions, the simultaneous determination of DA and UA was investigated using differential pulse voltammetry (DPV) resulting in a linear response in the concentration ranges of 0.01–5.0 μM and 5.0–20.0 μM for DA and of 0.1–20.0 μM and 20.0–50.0 μM for UA and in a sensitivity of 11.96 and 6.48 $\mu\text{A } \mu\text{M}^{-1}$, respectively. The prepared electrode also demonstrated long-term stability and good reproducibility and was successfully used for the determination of DA and UA in human serum samples with favorable recoveries.

Keywords: GNPs@CDs/erGO nanocomposite; electrochemical synthesis; simultaneous determination; dopamine; uric acid.

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