Fabrication of Gold nanoparticles/Carbon Quantum Dots Nanocomposites for the Electrochemical Analysis of Ascorbic Acid, Dopamine and Uric Acid

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A sensitive and straightforward sensor consisting of a glassy carbon electrode (GCE) containing carbon quantum dots (CQDs), and gold nanoparticles (AuNPs), was fabricated for simultaneous detection of ascorbic acid (AA), dopamine (DA) as well as uric acid (UA). Composite AuNPs/CQDs/GCE and its components were examined using high-resolution transmission and field emission scanning electron microscopies (HRTEM and FESEM, respectively), energy-dispersive and electrochemical impedance (spectroscopies EDS and EIS, respectively), as well as cyclic voltammetry (CV). The synergetic effect, of AuNPs and CQDs provided GCE with an outstanding electrocatalytic rate and excellent selectivity towards AA, DA, and UA oxidation in 0.1M PBS. The linear response ranges of the electrodes were 300-700 and 800-3500 μM for AA, 2-32 μM for DA, and 30-100 and 120-200 μM for UA. The peak potential separation values (ΔE_p) of AA-DA, DA-UA, and AA-UA pairs were equal to 150, 130, and 280 mV, respectively. The sensitivity of AuNPs/CQDs/GCE was 0.012 and 0.0057 $\mu\text{A}/\mu\text{M}$ towards AA, 405.13 $\mu\text{A}/\mu\text{M}$ towards DA, as well as 0.148 and 0.044 $\mu\text{A}/\mu\text{M}$ towards UA. Our electrochemical sensor showed excellent stability, analysis reproducibility, and repeatability.

Keywords: Carbon quantum dots; Au nanoparticles; Ascorbic acid; Dopamine; Uric acid

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