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Modification of glassy carbon surface using L-cysteine-capped Mn-doped ZnS quantum dots and multi wall carbon nanotube nanocomposite: application to determine hydrazine in water samples

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ABSTRACT

Mn-ZnS QDs synthesized by hydrothermal method and modified by L-cysteine for better stability emit phosphorescence at 590 nm. The characterization of L-cysteine-capped Mn-Doped ZnS quantum dots were studied by transmission electron microscopy (TEM), phosphorescence, fluorimetry and UV-Vis absorption spectroscopy. To fabricate a new electrochemical sensor, L-cysteine-capped Mn-Doped ZnS quantum dots and multiwall carbon nanotube (MWCNT) were placed on the surface of glassy carbon electrode (ZnS/MnQDs-MWCNTs/GCE). Then, it was applied for the determination and detection of environmental pollutant hydrazine in water samples. The electrooxidation behaviors and the effective stepwise assembly procedure of the modified electrode were confirmed by electrochemical impedance spectroscopy (EIS), scanning electron microscopy (SEM), cyclic voltammetry (CV) and differential pulse voltammetry (DPV). Based on the findings, ZnS/Mn QDs-MWCNT composite can be considered a suitable candidate for hydrazine electrooxidation. The linear rang, detection of limit (DL), limit of quantification (LOQ) and sensitivity were 90–1,200 nanomolar, 28 nM, 95 nM and 0.001 μA nM^{-1}, respectively. The repeatability in the presence of hydrazine (100 μM) was studied and the variation coefficient (R.S.D) was 2% for five consecutive tests. The proposed sensor shows many advantages such as very low detection of limit, high sensitivity, stability and it can be used for detection of hydrazine in real samples.

Keywords: Hydrazine; ZnS/Mn quantum dots; Multi wall carbon nanotube; Pollutant

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