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Carbon-Nanodots Modified Glassy Carbon Electrode for the Electroanalysis of Selenium in Water

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Abstract : We report a simple and cheaper method for the electrochemical detection of Se(IV) using carbon nanodots (CNDTs) prepared from oat. The carbon nanodots were synthesised by green and facile approach and characterised using scanning electron microscopy, high-resolution transmission electron microscopy, Fourier transform infrared spectroscopy, X-ray diffraction, and Raman spectroscopy. The CNDT was used to fabricate an electrochemical sensor for the quantification of Se(IV) in water. The modification of glassy carbon electrode (GCE) with carbon nanodots led to an increase in the electroactive surface area of the electrode, which enhances the redox current peak of $[Fe(CN)_6]_{3-/4-}$ in comparison to the bare GCE. Using the square wave voltammetry, the detection limit and quantification limit of 0.05 and 0.167 ppb were obtained under the optimised parameters using deposition potential of -200 mV, 0.1 M HNO_3 electrolyte, electrodeposition time of 60 s, and pH 1. The results further revealed that the GCE-CNDT was not susceptible to many interfering cations except Cu(II) and Pb(II), and Fe(II). The sensor fabrication involves a one-step electrode modification and was used to detect Se(IV) in a real water sample, and the result obtained is in agreement with the inductively coupled plasma technique. Overall, the electrode offers a cheap, fast, and sensitive way of detecting selenium in environmental matrices.

Keywords : carbon nanodots, square wave voltammetry, nanomaterials, selenium, sensor
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