Efficient 2-Nitrophenol Chemical Sensor Development Based on Ce2O3 Nanoparticles Decorated CNT Nanocomposites for Environmental Safety

By: Hussain, MM (Hussain, Mohammad M.)[1,2] ; Rahman, MM (Rahman, Mohammed M.)[1,2] ; Asiri, AM (Asiri, Abdullah M.)[1,2]

View ResearcherID and ORCID

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Abstract

Ce2O3 nanoparticle decorated CNT nanocomposites (Ce2O3. CNT NCs) were prepared by a wet-chemical method in basic medium. The Ce2O3. CNT NCs were examined using FTIR, UV/Vis, Field-Emission Scanning Electron Microscopy (FESEM), X-ray electron dispersive spectroscopy (XEDS), X-ray photoelectron spectroscopy (XPS), and powder X-ray diffraction (XRD). A selective 2-nitrophenol (2-NP) sensor was developed by fabricating a thinlayer of NCs onto a flat glassy carbon electrode (GCE, surface area = 0.0316 cm 2). Higher sensitivity including linear dynamic range (LDR), long-term stability, and enhanced electrochemical performances towards 2-NP were achieved by a reliable current-voltage (I-V) method. The calibration curve was found linear (R-2 = 0.9030) over a wide range of 2-NP concentration (100 pM similar to 100.0 mM). Limit of detection (LOD) and sensor sensitivity were calculated based on noise to signal ratio (similar to 3N/S) as 60 +/- 0.02 pM and 1.6x10(-3) mu A mu M-1 cm(-2) respectively. The Ce2O3. CNT NCs synthesized by a wet-chemical process is an excellent way of establishing nanomaterial decorated carbon materials for chemical sensor development in favor of detecting hazardous compounds in health-care and environmental fields at broad-scales. Finally, the efficiency of the proposed chemical sensors can be applied and utilized in effectively for the selective detection of toxic 2-NP component in environmental real samples with acceptable and reasonable results.

Keywords

KeyWords Plus: SILVER-OXIDE NANOPARTICLES; CARBON NANOTUBES; ELECTROCHEMICAL DETECTION; 4-NITROPHENOL REDUCTION; CATALYTIC-REDUCTION; AG2O NANOPARTICLES; OXIDATION; ELECTRODE; ZNO; TEMPERATURE

Author Information

Reprint Address: Rahman, MM (reprint author)

King Abdulaziz Univ, Fac Sci, Dept Chem, Jeddah, Saudi Arabia.
Organization-Enhanced Name(s)
King Abdulaziz University

Reprint Address: Rahman, MM (reprint author)

King Abdulaziz Univ, Ctr Excellence Adv Mat Res CEAMR, Jeddah, Saudi Arabia.
Organization-Enhanced Name(s)
King Abdulaziz University

Addresses:

[1] King Abdulaziz Univ, Fac Sci, Dept Chem, Jeddah, Saudi Arabia
Organization-Enhanced Name(s)
King Abdulaziz University

[2] King Abdulaziz Univ, Ctr Excellence Adv Mat Res CEAMR, Jeddah, Saudi Arabia
Organization-Enhanced Name(s)
King Abdulaziz University

E-mail Addresses: mmrahman@kau.edu.sa

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