Selective Iron(III) ion uptake using CuO-TiO2 nanostructure by inductively coupled plasma-optical emission spectrometry

By: Rahman, MM (Rahman, Mohammed M.)[1,2] ; Khan, SB (Khan, Sher Bahadar)[1,2] ; Marwani, HM (Marwani, Hadi M.)[1,2] ; Asiri, AM (Asiri, Abdullah M.)[1,2] ; Alamry, KA (Alamry, Khalid A.)[2]

View ResearcherID and ORCID

CHEMISTRY CENTRAL JOURNAL
Volume: 6
Article Number: 158
DOI: 10.1186/1752-153X-6-158
Published: DEC 17 2012
View Journal Impact

Abstract

Background: CuO-TiO2 nanosheets (NSs), a kind of nanomaterials is one of the most attracting class of transition doped semiconductor materials due to its interesting and important optical, electrical, and structural properties and has many technical applications, such as in metal ions detection, photocatalysis, Chemi-sensors, bio-sensors, solar cells and so on. In this paper the synthesis of CuO-TiO2 nanosheets by the wet-chemically technique is reported.

Methods: CuO-TiO2 NSs were prepared by a wet-chemical process using reducing agents in alkaline medium and characterized by UV/vis., FT-IR spectroscopy, X-ray photoelectron spectroscopy (XPS), powder X-ray diffraction (XRD), and field-emission scanning electron microscopy (FE-SEM) etc.

Results: The structural and optical evaluation of synthesized NSs were measured by XRD pattern, Fourier transform infrared (FT-IR) and UV-vis spectroscopy, respectively which confirmed that the obtained NSs are well-crystalline CuO-TiO2 and possessing good optical properties. The morphological analysis of CuO-TiO2 NSs was executed by FE-SEM, which confirmed that the doped products were sheet-shaped and growth in large quantity. Here, the analytical efficiency of the NSs was applied for a selective adsorption of iron(III) ion prior to detection by inductively coupled plasma-optical emission spectrometry (ICP-OES). The selectivity of NSs towards various metal ions, including Au(III), Cd(II), Co(II), Cr(III), Fe(III), Pd(II), and Zn(II) was analyzed.

Conclusions: Based on the selectivity study, it was confirmed that the selectivity of doped NSs phase was the most towards Fe(III) ion. The static adsorption capacity for Fe(III) was calculated to be 110.06 mgg(-1). Results from adsorption isotherm also verified that the adsorption process was mainly monolayer-adsorption onto a surface containing a finite number of CuO-TiO2 NSs adsorption sites.

Keywords

Author Keywords: CuO-TiO2 nanosheets; Wet-chemical process; Optical property; Structural property; Adsorption isotherm; Iron(III) ion detection

KeyWords Plus: SOLID-PHASE EXTRACTION; ATOMIC-ABSORPTION-SPECTROMETRY; MULTIWALLED CARBON NANOTUBES; MODIFIED ACTIVATED CARBON; ELECTROCHEMICAL PERFORMANCE; WATER SAMPLES; METAL-IONS; FUNCTIONALIZED SILICA; ELECTRODE MATERIALS; SOLVENT-EXTRACTION

Author Information

Reprint Address: Rahman, MM (reprint author)

King Abdulaziz Univ, CEAMR, POB 80203, Jeddah 21589, Saudi Arabia.

Addresses:

[1] King Abdulaziz Univ, CEAMR, Jeddah 21589, Saudi Arabia

[2] King Abdulaziz Univ, Fac Sci, Dept Chem, Jeddah 21589, Saudi Arabia

Organization-Enhanced Name(s)

King Abdulaziz University

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

Funding

Funding Agency	Grant Number
Deanship of Scientific Research (DSR), King Abdulaziz University, Jeddah	130-025-D1433

View funding text

Publisher

BIOMED CENTRAL LTD, 236 GRAYS INN RD, FLOOR 6, LONDON WC1X 8HL, ENGLAND

Categories / Classification

Research Areas: Chemistry

Web of Science Categories: Chemistry, Multidisciplinary

Document Information

Document Type: Article

Language: English

Accession Number: WOS:000314945300001

PubMed ID: 23244218

ISSN: 1752-153X

Other Information

IDS Number: 089YG

Cited References in Web of Science Core Collection: 70

Times Cited in Web of Science Core Collection: 20