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

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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

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