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Selective detection of toxic Pb(II) ions based on wet-chemically prepared nanosheets integrated CuO-ZnO nanocomposites

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Abstract

The present study describes a selective detection methodology for hazardous metal ions based on low-dimensional nanosheets (NSs) integrated CuO-ZnO composite materials. A large-scale synthesis of NSs by wet-chemical process is performed using alkaline reducing agents at higher pH medium. The prepared NSs are characterized in terms of their morphological, structural and optical properties, and efficiently applied for the toxic metal ions detection. The detailed structural, compositional, and optical characterization of NSs are evaluated by XRD, FT-IR, XPS, EDS, and UV-vis spectroscopy, which confirmed that the obtained NSs are well-crystalline CuO-ZnO and possessed good optical properties. The CuO-ZnO NS morphology is investigated by FE-SEM, which confirmed that the NS possesses microstructure shape and growth in large-quantity. The analytical application of CuO-ZnO NSs is studied for a selective extraction of toxic lead-divalent [Pb(II)] ions prior to its determination by inductively coupled plasma-optical emission spectrometry (ICP-OES). The selectivity of doped NSs phase is investigated for eight different metal ions, including Cd(II), Cu(II), Hg(II), La(III), Mn(II), Pb(II), Pd(II), and Y(III) under similar experimental conditions. From the selectivity study, it is confirmed that the composite CuO-ZnO NS phase is the most toward Pb(II) ions according to the magnitude of distribution coefficient (K-d) values, such as Pb(II) > Y(III) > Cd(II) > La(III) > Hg(II) > Cu(II) > Mn(II) > Pd(II). The uptake capacity for Pb(II) is experimentally calculated to be similar to 82.66 mg g(-1). (c) 2013 Elsevier Ltd. All rights reserved.

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