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Chemical Engineering Journal

Amphiphilic compounds enhance the dechlorination of pentachlorophenol with Ni/Fe bimetallic nanoparticles

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A B S T R A C T

Pentachlorophenol (PCP), a general ionized chlorinated aromatic contaminant, was treated with Ni/Fe nanoparticles (NPs). An increase in the Ni/Fe dosage enhanced the removal of PCP. The most effective nickel percentage was 0.5%. Among the selected surfactants including carboxymethyl cellulose, Triton X-100, and cetyl trimethylammonium bromide (CTAB), CTAB markedly enhanced the removal of PCP by Ni/Fe. From removal kinetics, increased sorption of PCP onto Ni/Fe surfaces with CTAB was observed when compared to that without CTAB. This is the result of the small particle size of Ni/Fe-CTAB and the electrostatic interaction between an electronegative phenolate group of PCP and the electropositive Ni/Fe-CTAB. The increased sorption of PCP onto Ni/Fe surfaces by CTAB accelerated the reduction of PCP. In addition, with CTAB, the observed bulky and soft surface of Ni/Fe NPs allows enhanced electron transfer from the zerovalent iron core. The removal mechanism of PCP is dechlorination for Ni/Fe-CTAB but, for bare Ni/Fe, adsorption is mainly responsible for the removal. The dechlorination pathways of PCP with Ni/Fe-CTAB were investigated. The ortho position of chloride can be more easily reduced than other positions. Ni/Fe-CTAB NPs have a high potential to treat polychlorinated aromatics.

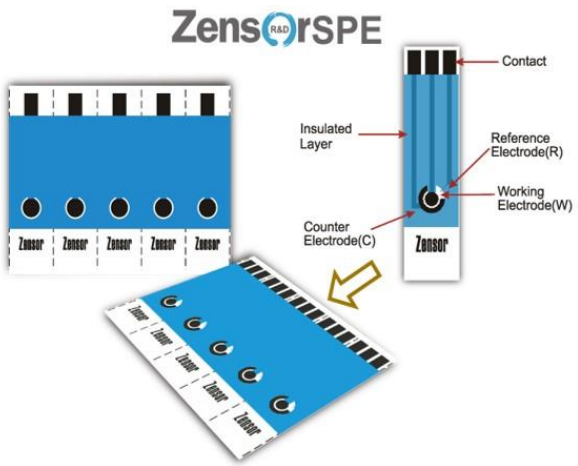

Fig. 3. Effect of different surfactants on the removal of PCP with surfactant on the Ni/Fe nanoparticles (CTAB was 0.92 mM; TX-100 was 0.20 mM; CMC was 0.067 mM).

Int. J. Electrochem. Sci., 10 **(2015)** 4173 - 4182

International Journal of
ELECTROCHEMICAL
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An Amperometric Nitrobenzene Electrochemical Sensor Based on Electrochemically Activated Graphite Modified Screen Printed Carbon Electrode

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Received: 9 February 2015 / *Accepted:* 11 March 2015 / *Published:* 23 March 2015

In the present study involves the fabrication of amperometric sensor for the detection of nitrobenzene (NB) using electrochemically activated graphite (EAG) modified screen printed carbon electrode (SPCE). The EAG modified SPCE was prepared by a simple electrochemical activation of graphite in PBS containing KCl solution at an applied potential of 2.0 V for 300 s. The EAG modified SPCE showed a good electrocatalytic reduction behavior towards NB with a lower overpotential than that of other modified SPCEs. Amperometric results reveals that the reduction peak current of NB was linear over the concentrations from 0.3 to 374.5 µM. The response time of the sensor was calculated as 5 s. The sensitivity was found as 1.445 $\mu A \mu M^{-1}$ cm^{-2} with the detection limit of 0.06 µM for NB. In addition, the fabricated electrode showed a good selectivity for NB in the presence of nitroaromatic and phenolic compounds with good operational stability.

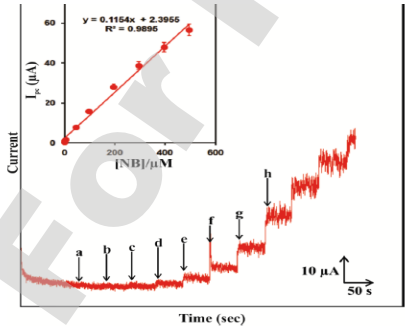
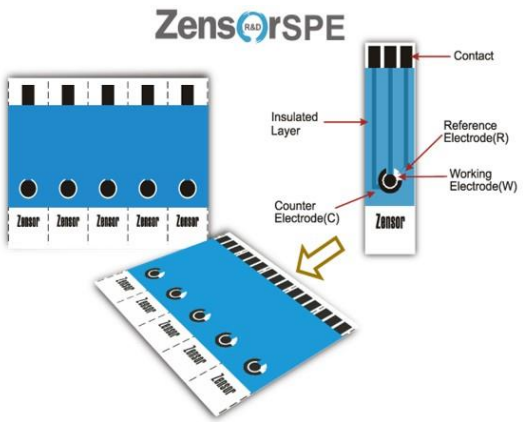


Figure 5. A) Amperometric *i-t* response obtained at EAG/SPCE for the addition of 0.3 µM (a), 0.5 µM (b), 1 µM (c), 3 µM (d), 5 µM (e), 10 µM (f), 20 µM (g) and 50 µM NB (h) into the PBS. Applied potential: –0.624 V. B) Calibration plot for amperometric current response vs. [NB].



DOI: 10.1002/elan.201500255

Potentiostatic Electrochemical Preparation of Bismuth Nanoribbons and its Application in Biologically Poisoning Lead and Cadmium Heavy Metal Ions Detection

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Abstract: A simple and elegant electrochemical potentiostatic method has been described for the preparation of highly stable and electrocatalytically active bismuth nanoribbons (BiNRs). The average length and width of the BiNRs were of 100±50 nm and 10±5 μm, respectively. Here, disodium ethylene diamine tetraacetate was employed as a scaffold for the growth of BiNRs. The formation of BiNRs was confirmed by surface morphological, elemental and cyclic voltammetric analyses. The BiNRs exhibited excellent electrocatalytic ability in detecting biologically poisoning heavy metal ions such as lead and cadmium. The described BiNRs based sensor presents good linear dependence on lead and cadmium ions in the concentration range of 1–50 μg/L for both metal ions with a detection limit of 0.104 μg/L for lead and 0.145 μg/L for cadmium.

Keywords: Bionanotechnology · Bismuth nanoribbons · Potentiostatic · Lead · Cadmium · Electrocatalysis

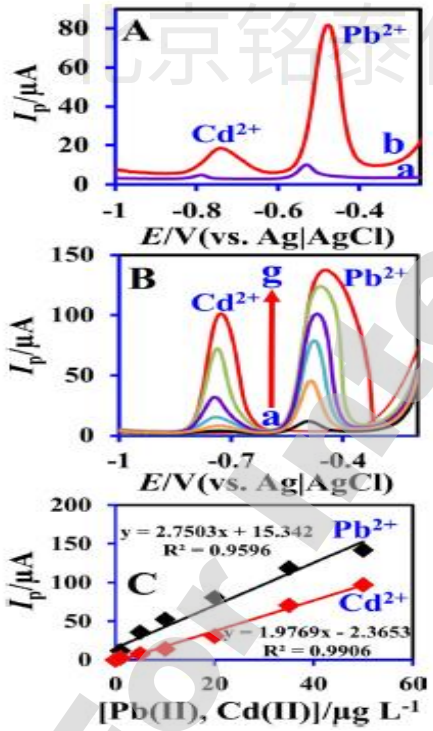

Fig. 3. (A) SWASV responses of bare (a) and BiNRs (b) modified SPCE in 0.1 M acetate buffer (pH 5) containing 20 μg/L concentration of Pb(II) and Cd(II) at the scan rate of 50 mV s^{-1}. The deposition potential was held at −1.20 V, while the deposition time was 200 s. (B) SWASV response of BiNRs/SPCE for the simultaneous detection of Pb(II) and Cd(II) in 0.1 M acetate buffer (pH 5). The concentrations of metal ions (Pb(II) and Cd(II)): curves a to g are 0, 1, 5, 10, 20, 35 and 50 μg/L. The deposition potential was held at −1.20 V, while deposition time was 200 s. (C) The corresponding linear calibration plots between peak currents and concentrations of Pb(II) and Cd(II).

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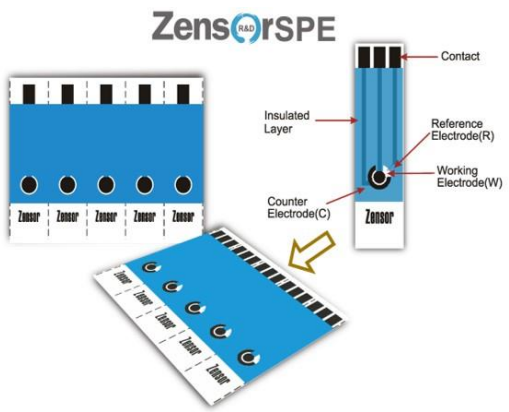

Electrochemical Detection of Phenol in Industrial Pollutant Absorbed Molecular Sieves by Electrochemically Activated Screen Printed Carbon Electrode

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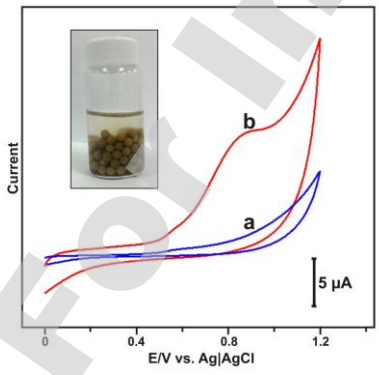
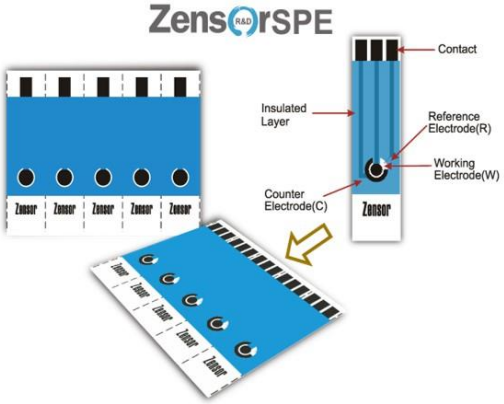
Received: 17 December 2014 / *Accepted:* 20 January 2015 / *Published:* 24 February 2015

An electrochemically activated screen printed carbon electrode (EASPCE) was used for the electrochemical detection of phenol in the industrial pollutant absorbed molecular sieves. GC-MS analysis had identified 15 organic compounds and found that phenol was the most abundant one among these indentified organic compounds in the industrial pollutant absorbed molecular sieves. In addition, the phenol was also detected at modified electrodes by using the electrochemical methods such as cyclic voltammetry and differential pulse voltammetry. The surface morphology of the bare screen printed carbon electrode (SPCE) and EASPCE was investigated by scanning electron microscopy. The result of EASPCE showed a good oxidation peak response to phenol in the presence of industrial pollutant absorbed molecular sieves, while the bare SPCE showed a very week response to phenol compared with EASPCE. The electrochemical behaviours of phenol implied that the oxidation of phenol is one electron and one proton transferred electrochemical reaction.





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Cite this: *RSC Adv.*, 2015, **5**, 94591

Electrochemical fabrication of gold nanoparticles decorated on activated fullerene C60: an enhanced sensing platform for trace level detection of toxic hydrazine in water samples†

Selvakumar Palanisamy, Balamurugan Thirumalraj and Shen-Ming Chen*

A novel and highly sensitive amperometric hydrazine sensor was fabricated using gold nanoparticles (AuNPs) decorated on activated fullerene C60 (AC60) modified screen printed carbon electrode (SPCE). An electrochemical method was used for the fabrication of the AC60–AuNPs modified SPCE which was characterized by scanning electron microscopy and elemental analysis. The fabricated AC60–AuNPs modified SPCE showed an enhanced electrocatalytic activity towards hydrazine over that of other modified SPCEs. Furthermore, the detection potential of hydrazine was notably lower (0.161 V) at the AuNPs decorated AC60 modified SPCE than AuNPs decorated bare (0.208 V) and C60 (0.186 V) modified SPCEs. Under optimum conditions, the amperometric response of the sensor was linear over the hydrazine concentrations from 0.13 μM to 1.21 mM with a fast response time of 1.3 s. In addition, the proposed sensor showed the lowest limit of detection (LOD) of 0.039 μM, with a high sensitivity of 0.583 μA μM^{-1} cm^{-2}. The sensor also holds its high selectivity in the presence of common metal ions and biologically active interfering species. In addition, the practicality of the fabricated sensor in tap water samples is comparable with those detected by the HPLC method.

Received 25th August 2015
Accepted 27th October 2015

DOI: 10.1039/c5ra17197k

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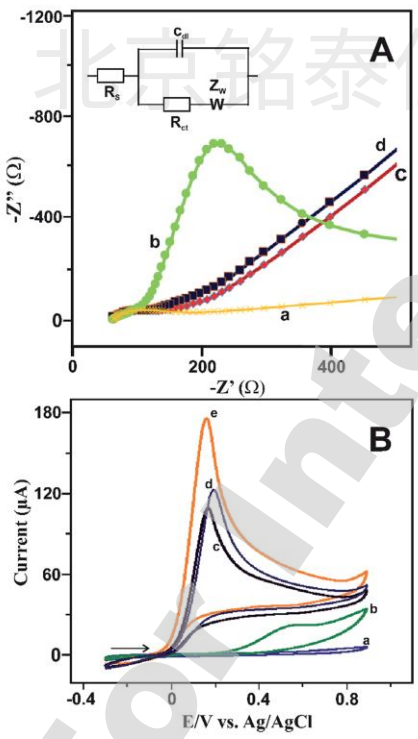
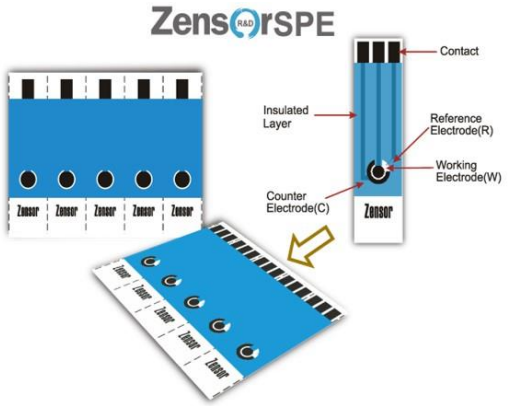


Scheme 1 Schematic representation for the fabrication of AC60–AuNPs modified SPCE and oxidation of hydrazine.



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Short Communication

Electrochemical Sensing of SF_6 Decomposition Products Based on a Screen Printed Carbon Electrode

Balamurugan Thirumalraj[1], Selvakumar Palanisamy[1], Shen-Ming Chen[1,], Pei-Shan Wu[3], Leehter Yao[2,*], Bih-Show Lou[3*]*

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Received: 1 December 2014 / *Accepted:* 22 January 2015 / *Published:* 24 February 2015

In the present work, a screen printed carbon electrode (SPCE) was used for the electrochemical detection of SF_6 decomposition products. At least 11 compounds from SF_6 decomposition gas sample were observed and identified by GC-MS. The SPCE was characterized by a scanning electron microscopy and electrochemical impedance spectroscopy. Cyclic voltammetry (CV) and differential pulse voltammetry (DPV) was used for the detection of SF_6 decomposition products. The results of GC-MS, CV and DPV reveal that SF_6 decomposition products mostly contain SO_2. The CV result shows three main peaks in 0.1 M KOH solution; a cathodic peak at –0.556 V and anodic peaks at –0.127 and 0.252 V, respectively. This is due to the reduction and oxidation products of adsorbed SO_2 on the electrode surface. The DPV also reveals three distinct peaks; one reduction peak at –0.572 V and other two oxidation peaks at –0.204 and 0.18 V. In addition, this study can also be further extended for detection of similar gases in the solution phase.