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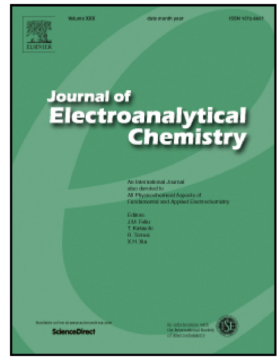

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Novel bimetallic nanoporous Pd-Cu-SBA-16/CPE as a highly sensitive sensor for determination of formaldehyde

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Abstract

The incorporation of catalysts in mesoporous materials with high surface area is an interesting approach to improve the efficiency of them. Also, the formation of bimetallic nanocatalyst is a new way to decrease the amount of precious noble metal catalyst. In this work, the nanoporous SBA-16 is successfully synthesized from stem sweep as a silica source and characterized by X-ray diffraction, scanning electron microscopy, transition electron microscopy, Furrier transform infrared spectroscopy and Brunauer-Emmett–Teller techniques. The synthesized SBA-16 is applied as a nanoporous support to fabricate novel SBA-16-supported bimetallic Pd-Cu nanoparticle electrochemical sensor for determination of formaldehyde. This sensor is simply prepared using galvanic replacement method and without using any linking agent. The elemental composition of as-prepared electrochemical sensor is investigated by energy dispersive spectrometry. Also, the electrochemical performance of prepared sensor toward formaldehyde oxidation is studied by cyclic voltammetry, amperometry and chronoamperometry methods. The cyclic voltammetry results show improved electrocatalytic activity including high current density and low overpotential for oxidation of formaldehyde. Moreover, the amperometric measurements show that this sensor can detect formaldehyde in the linear range of 1.79 mM to 121.86 mM with detection limit of 16 µM at a signal-to-noise ratio of 3 and response time of 3 s. Furthermore, this sensor shows good stability, repeatability, reproducibility and selectivity.

Keywords:

SBA-16, Bimetallic Pd-Cu nanoparticles, Formaldehyde, Amperometric detection, Electrocatalysis.

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