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A novel electrochemical sensor for chlorophenols based on the enhancement effect of Al-doped mesoporous cellular foam

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Abstract: Al-doped mesoporous cellular foam (Al-MCF) was prepared and characterized using scanning electron microscopy, transmission electron microscopy, X-ray diffraction, nitrogen adsorption-desorption isotherms and pore size distribution plots. An Al-MCF modified carbon paste electrode (Al-MCF/CPE) was developed, and both cyclic voltammetry and electrochemical impedance spectroscopy were employed to study the electrochemical properties of the Al-MCF/CPE. The electrochemical behaviors of pentachlorophenol (PCP) at different electrodes were investigated by cyclic voltammetry. Compared to bare CPE and mesoporous cellular foam (MCF) modified CPE (MCF/CPE), the Al-MCF/CPE showed a stronger enhancement effect on the electrochemical oxidation of PCP. Consequently, the determination of PCP was achieved via a convenient electrochemical method. Under optimal conditions, the oxidation peak current was linearly proportional to PCP concentration in the range of 0.10–5.0 mg L⁻¹, while the detection limit was 0.080 mg L⁻¹ (signal-to-noise ratio = 3). The proposed method was found to be a convenient way for the determination of the total amount of chlorophenols (CPs).

Keywords: Al-doped mesoporous cellular foam; chlorophenols; pentachlorophenol; modified electrode; electrochemical sensor

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