

Electrochemical Sensor Based on Poly(Pyrogallol) for the Simultaneous Detection of Phenolic Compounds and Nitrite in Wastewater

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Abstract : Phenolic compounds are chief environmental contaminants on account of their hazardous and toxic nature on human health. The preparation of sensitive and potent chemosensors to monitor emerging pollution in water and effluent samples has received great consideration. A novel and versatile nanocomposite sensor based on poly pyrogallol is presented for the first time in this study, and its electrochemical behavior for simultaneous detection of hydroquinone (HQ), catechol (CT), and resorcinol (RS) in the presence of nitrite is evaluated. The physicochemical characteristics of the fabricated nanocomposite were investigated by emission-scanning electron microscopy (FE-SEM), energy-dispersive X-ray spectroscopy (EDS), and Brunauer-Emmett-Teller (BET). The electrochemical response of the proposed sensor to the detection of HQ, CT, RS, and nitrite is studied using cyclic voltammetry (CV), chronoamperometry (CA), differential pulse voltammetry (DPV), and electrochemical impedance spectroscopy (EIS). The kinetic characterization of the prepared sensor showed that both adsorption and diffusion processes can control reactions at the electrode. In the optimized conditions, the new chemosensor provides a wide linear range of 0.5-236.3, 0.8-236.3, 0.9-236.3, and 1.2-236.3 μM with a low limit of detection of 21.1, 51.4, 98.9, and 110.8 nM ($S/N = 3$) for HQ, CT and RS, and nitrite, respectively. Remarkably, the electrochemical sensor has outstanding selectivity, repeatability, and stability and is successfully employed for the detection of RS, CT, HQ, and nitrite in real water samples with the recovery of 96.2%-102.4%, 97.8%-102.6%, 98.0%-102.4% and 98.4%-103.2% for RS, CT, HQ, and nitrite, respectively. These outcomes illustrate that poly pyrogallol is a promising candidate for effective electrochemical detection of dihydroxybenzene isomers in the presence of nitrite.

Keywords : electrochemical sensor, poly pyrogallol, phenolic compounds, simultaneous determination

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