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Mechanistic investigation on the electropolymerization of phenol red by cyclic voltammetry and the catalytic reactions toward acetaminophen and dopamine using poly(phenol red)-modified GCE

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Abstract

The electrochemical properties of phenol red were investigated and the fabrication of poly(phenol red) film on glassy carbon electrode was achieved by the technique of cyclic voltammetry. The sector of quinone methide in the structure of phenol red was found electroactive in aqueous solution and is the center of redox reactions for polymerization. Cyclic voltammograms of phenol red and FTIR spectra of both phenol red and poly(phenol red) suggest that the radical cations which were generated from the scans in anodic direction first coupled to a dimer and propagated further into polymers. The modified electrode was exploited in electrochemical studies such as chronoamperometry, linear sweep voltammetry, and differential pulse voltammetry for the evaluation of the rate constant of heterogeneous catalytic reaction along with the diffusion coefficients and transfer coefficients of acetaminophen and dopamine, and simultaneous determination of the analytes of interest. Heterogeneous rate constant of 1.29×10^3 and $8.45 \times 10^2 \text{ M}^{-1} \text{ s}^{-1}$ were evaluated for the oxidative reaction of acetaminophen and dopamine by the modified electrode, respectively. The linear range for acetaminophen was evaluated to be in the range of 0.4-1.8 mM with the sensitivity of $0.026 \mu\text{A} \mu\text{M}^{-1}$ and that for dopamine is 20-160 μM with the sensitivity of $0.16 \mu\text{A} \mu\text{M}^{-1}$.

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