608/E2

Development of three simple voltammetric techniques for detection of theophylline

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The potential of employing the three voltammetric techniques; linear sweep voltammetry (LSV), differential pulse voltammetry (DPV) and square wave voltammetry (SWV) using pyrolytic graphite working electrode for detection of theophylline (TP), a common drug used for treatment of respiratory diseases was investigated. Phosphate buffer at the concentration of 2.0×10^{-2} mol dm^{-3} and at the pH of 6.6 were found to be the best electrolytic medium for all three voltammetric techniques. TP was found to undergo an irreversible oxidation reaction producing concentration dependent reproducible anodic peak currents at the peak potentials of +0.995 V, +0.772 V and +0.785 V with respect to $Ag_{(s)} / AgCl_{(s)} / Cl^-_{(aq)}$ reference electrode (+0.197 V vs. NHE) for the three techniques, LSV, DPV and SWV, respectively. The optimum scanning rate of working electrode potential for LSV was 100 mV s^{-1}. The optimum scanning rates of working electrode potential and pulse height for DPV were 25 mV s^{-1} and 140 mV, respectively. The optimum pulse height and frequency for SWV were 110 mV and 50 Hz, respectively.

Under optimum conditions, there were good linear relationships between anodic peak current and TP concentration for the three techniques. The linear concentration ranges for LSV, DPV and SWV were from 3.0×10^{-4} mol dm^{-3} to 1.3×10^{-3} mol dm^{-3}, 7.0×10^{-5} mol dm^{-3} to 8.0×10^{-4} mol dm^{-3} and 5.0×10^{-5} mol dm^{-3} to 1.1×10^{-3} mol dm^{-3}, respectively. The limit of detection observed with LSV, DPV and SWV were 2.5×10^{-4} mol dm^{-3}, 6.0×10^{-5} mol dm^{-3} and 4.0×10^{-5} mol dm^{-3}, respectively. The results obtained during an analysis of a commercial TP drug, theophylline sustained release uncoated tablets with the three techniques, LSV, DPV and SWV were found to exhibit percentage deviations of 4.8 %, 3.1 % and 2.7 %, respectively from the value given on the tablet. All three techniques have potentials for detecting TP in the therapeutic range of 10 to 20 mg dm^{-3}.

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