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Electrochemical determination of the antidepressive drug, Nitrazepam using Poly(3,4-ethylenedioxythiophene) modified glassy carbon electrode

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Abstract: - PEDOT was obtained by the electrooxidation of the 0.01M EDOT solution in 0.1M p-toluene sulphonic acid and used for the determination of nitrazepam. One well-defined reduction peak was observed at -1.04V in the cyclic voltammograms. Effect of pH was studied and pH 4.0 was found to be best for the determination of Nitrazepam. The two electron transfer reduction mechanism was proposed from Coulometric studies. Differential pulse stripping voltammetric studies was carried out and optimized conditions which yield maximum peak current were arrived. Determination studies were carried out in the range 83-178ppb and LOD was found to be 10ppb. The reproducibility of the stripping signal was also high. Hence this method can be an alternate to other spectrophotometric and chromatographic studies

INTRODUCTION

Nitrazepam (9-nitro-6-phenyl-2,5-diazabicyclo [5.4.0] undeca-5,8,10,12-tetraen-3-one) is a type of benzodiazepine drug. It is a hypnotic drug used in the treatment of insomnia, anxiety, amnesia and neurological disorder. It is one of the largest classes of abused pharmaceutical. Hence its determination becomes essential. Analytical methods like spectrophotometry[1-5], HPLC[6,7], GC[8],flow injection analysis[9], gas-liquid chromatography[10], polarography [11,12,13], colorimetry[14] were already reported. Electrochemical detection methods are very advantageous over other methods in terms of simplicity, sensitivity, selectivity and cost. However, these methods have not become as popular as other methods due to certain unavoidable problems such as electrode deactivation, with the necessity of frequent pretreatment and other procedures to reactivate the solid electrodes. Glassy carbon (GC), one of the widely used electrodes for electrochemical detection, due to its relatively wide potential window and low cost, is very susceptible to contamination and fouling. Therefore, a stable electrode material with sensitive detection capabilities is a prime requirement for wider application of electrochemical detectors. Polymer modified electrodes proved to be a better candidate for being used as the modified electrode material [15-18]. In this work we have electrochemically determined Nitrazepam using poly3,4-ethylenedioxythiophene (PEDOT) modified GCE.

Experimental

Apparatus and Reagents

Electrochemical workstation (CH instruments, USA) was employed for all electropolymerization studies presented in this work. The stock solutions were made up in ultra pure water (SG,International,Germany). Stock solution of 0.001M of Nitrazepam was prepared in ethanol. For the electrochemical studies, Buffer tablets (4,7,9.2, Merck) H_2SO_4 and NaOH were used as the medium for the analysis. 3,4-ethylenedioxythiophene (EDOT) (Aldrich) and p-toluenesulphonic acid (Sigma) were used for electropolymerization.

Preparation of PEDOT modified electrode

PEDOT was obtained by the electrooxidation of the 0.01M EDOT solution in 0.1M p-toluene sulphonic acid by cycling the potential between -0.6 and +1.0V (Versus Ag/AgCl) at the scan rate of $0.05Vs^{-1}$. Thickness of the films was controlled by the number of segments. After polymerization was over the electrode has been repeatedly washed with ultrapure water and used for further studies.

Result and discussion

Electrochemical Studies

The cyclic voltammetric behaviour of Nitrazepam was studied at different scan rates, concentrations and pH using glassy

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