International Journal of Current Pharmaceutical Research

ISSN- 0975-7066 Vol 8, Issue 4, 2016

Original Article

ELECTROANALYSIS OF IBUPROFEN ON CONDUCTING POLYANILINE NANOFIBER COATED GLASSY CARBON SURFACE

E. SURESH[1], K. SUNDARAM[1], B. KAVITHA*[2], N. SENTHIL KUMAR*[3]

[1]Department of Chemistry, Karpagam University, Karpagam Academy of Higher Education, Coimbatore 641021, Tamil Nadu, India, [2]Department of Chemistry, Sri Ranganathar Institute of Engineering and Technology, Coimbatore 641110, Tamil Nadu, India, [3]Department of Chemistry, Arignar Anna Government Arts College, Cheyyar 604407, Tiruvannamalai (Dt.), Tamil Nadu, India
Email: ootykavi@gmail.com

Received: 18 Jul 2016, Revised and Accepted: 20 Aug 2016

ABSTRACT

Objective: Voltammetric procedure for analysis of pharmaceutical formulation of ibuprofen on conducting polyaniline nanofiber modified glassy carbon electrode was explored.

Methods: The effect of pH was studied at different medium such as acidic, neutral and basic. The cyclic voltammetric behavior of ibuprofen was studied between−0.5 V and 1.8 V *versus* Ag/AgCl at modified glassy carbon surface.

Results: The electroanalytical parameters of the detection are highly dependent on their configuration and dimensions of the electrode. The scan rate and concentration effect of ibuprofen were studied. The best limit of detection was 100 ppb and the linear range from 200 to 400 ppb on the modified electrode surface. The determination was successfully applied for the detection of drugs in several pharmaceutical drug formulations. The Atomic force microscopic (AFM) image shows the surface morphologies of polymer modified surface; compound adsorbed surface, particle distribution graphs and surface roughness values, which are in good agreement.

Conclusion: The anodic peak was observed at 1.63 V, assigned for the oxidation of ibuprofen, which is not accompanied by corresponding cathodic reduction. This behavior suggested that the irreversibility of the electrode process.

Keywords: Ibuprofen, Voltammetry, Nanostructure, Nanofiber, Polyaniline, Differential Pulse Voltammetry, AFM

DOI: http://dx.doi.org/10.22159/ijcpr.2016v8i4.15276

INTRODUCTION

Electrode surface modification is a field of paramount importance in the modern electrochemistry, especially due to the various application possibilities of modified electrodes. In recent years, chemically modified glassy carbon electrodes have received increasing attention due to their potential applications in various analyses and also due to its relative ease of electrode preparation and regeneration [1]. Electrode surfaces coated with electropolymerized conducting polymer films have been paid great attention in the past, due to their unique physical and chemical properties and some possible applications in electrocatalysis, organic batteries, and microelectronic devices. Studies have indicated that surface coated polymer films exhibit enhanced analytical response for the quantification of various biological and clinical analytes. The thickness, permeation and charge transport characteristics of the polymeric films can be controlled by the potential and current applied [2–15]. Research on surface modified electrode has involved studies of the electrochemistry of the attached molecules, the catalysis and inhibition of various electrochemical processes and specific applications to such widely varying areas as photoelectrodes and analytical determinations [16, 17].

In recent years, modification of electrode surfaces has been an important research area in electrochemistry. Compared with other electrode concepts in electrochemistry, the distinguishing feature of a chemically modified electrode is that generally a thin film of a selected chemical is bonded or coated onto the electrode surface to endow the electrode with the chemical, electrochemical, optical, electrical, transport, and other desirable properties of the film in a rational, chemically designed manner [18, 19]. One of the methods used for the modification of electrode surfaces is electropolymerization. Electropolymerization can accelerate transmission of electrons onto the surface of the electrode; it has high selectivity and sensitivity due to the film homogeneity in electrochemical deposition, and it has strong adherence to the electron surface and large surface area [20, 21]. Researchers have employed polymeric film modified electrodes to detect organic and inorganic molecules in recent years. Electrochemical methods, such as differential pulse polarography (DPP), stripping voltammetry (SV), differential pulse voltammetry (DPV) and square-wave voltammetry (SWV) have been widely applied for the determination of pharmaceuticals [22–38]. In the present investigation, a simple, effective and sensitive electrochemical method for the determination of ibuprofen on polyaniline nanofiber modified electrodes is explored.

Experimental

Chemicals and apparatus

All reagents were of AR grade purchased commercially. Solutions were prepared using deionized double distilled water. Stock standard solution of ibuprofen was prepared in 50% ethanol. A standard stock solution of ibuprofen (1000 ppm) was prepared. The voltammetric studies were carried out in exploratory and determination mode on a software connected CH Instruments Electrochemical Workstation (model CH 650C). The voltammetric cell consisted of a three electrode assembly with polymer modified glassy carbon electrode as a working electrode, a platinum wire as an auxiliary electrode and Ag/AgCl electrode as a reference electrode. Nitrogen gas was purged through the solution for 5 min. A Hanna instrument pH/ORP meter was used for pH measurements.

Modification of the electrodes

A GCE (3-mm diameter) was polished using 1.0 and 0.05 mm alumina slurry and rinsed thoroughly with Milli-Q water. Ultrasonic agitation for 30 min of 2.0 mg of chemically prepared nanostructured polyaniline in 2 ml of water gave a homogeneous green solution. 20 μL of this solution was placed on the GCE surface. The electrode was then dried at room temperature to obtain a polymer modified GCE.