CAPSULES
notes and applications from Bioanalytical Systems, Inc.
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Determination of Ciprofloxacin in Tablets

Purpose

Ciprofloxacin (I, F1) is a broad spectrum antibiotic that is active against gram-positive and gram-negative bacteria, including those resistant to amino glycosides and cephalosporin antibiotics. In this study, the electrochemical properties of I were studied in order to develop an electrochemical assay for ciprofloxacin concentrations in tablets.

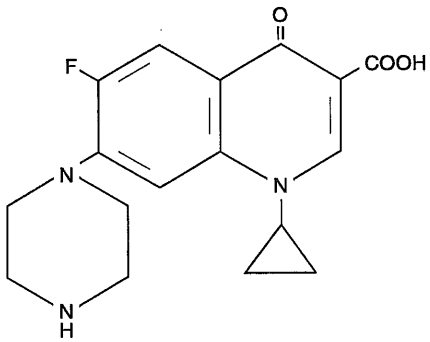

Figure 1. Structure of ciprofloxacin.

Method

Cyclic voltammetry was used for the initial redox characterization of I, but differential pulse polarography was used for concentration measurements, due to its lower detection limit. One advantage of using electrochemical techniques for the analysis of dosage forms is the simplicity of the sample preparation; in this case, the tablets were ground to a fine powder, dissolved in water, filtered, then added to the buffered supporting electrolyte. After the sample analysis, 3 standard additions were made and the concentration of I in the tablets was measured using the standard addition plot.

Results

Many redox processes of organic molecules in aqueous media involve proton transfer. Hence, the pH dependence of the various redox processes is an essential part of the investigation of the electrochemical activity of such molecules. At pH = 2.0, the cyclic voltammogram of I shows one reversible process (F2), whereas at pH = 8.5, there are many more processes in the voltammogram, only one of which is reversible (F3). The number of processes observed when using differential pulse polarography in aqueous media again depended on the specific pH. Two processes were observed at pH = 8.5 (F4), and this pH was chosen for the electrochemical assay since it gave the highest peak currents and the best discrimination against the background current.

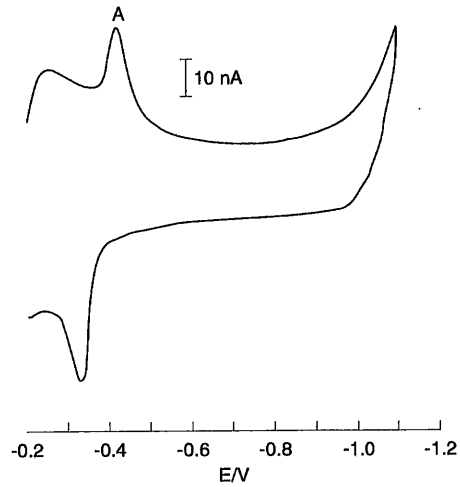

Figure 2. Cyclic voltammogram of ciprofloxacin (0.04 mM) in Britton-Robinson buffer (pH 2.0). Scan rate = 100 mV s^{-1}. Figure adapted from Reference.

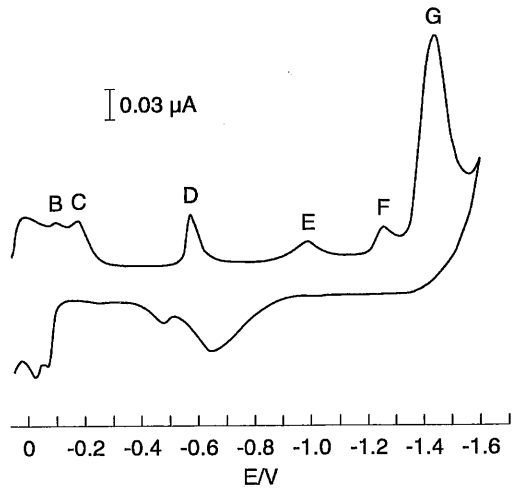

Figure 3. Cyclic voltammogram of ciprofloxacin (0.04 mM) in Britton-Robinson buffer (pH 8.5). Scan rate = 100 mV s^{-1}. Figure adapted from Reference.

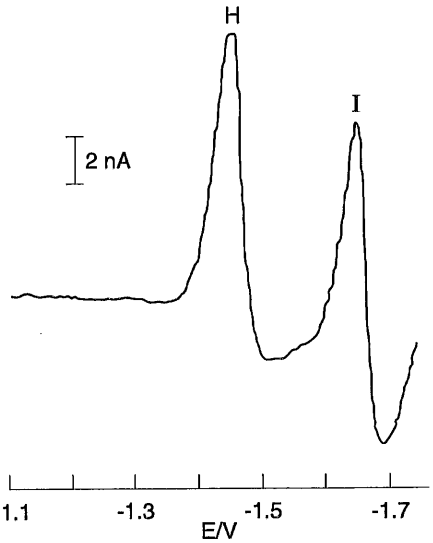

Figure 4. Differential pulse voltammogram of ciprofloxacin (0.01 mM) in Britton-Robinson buffer (pH 8.5). Figure adapted from Reference.

The properties of both the redox processes shown in F4 were investigated. Plots of peak current vs. concentration were linear over the range of 5×10^{-7} to 3×10^{-5} M and 5×10^{-7} to 5×10^{-5} M for peaks A and B, respectively. The detection limit for both peaks was 2×10^{-7} M. However, the results of the tablets were more reproducible when using peak A (standard deviation of 0.34 % for five measurements) rather than peak B (standard deviation of 7.8% for five measurements).

Reference

1) *Determination of Ciprofloxacin by Differential Pulse Polarography, P. O'Dea, A.C. Garcia, A.J.M. Ordieres, P.T. Blanco and M.R. Smyth, Electroanalysis, 2 (1990) 637-641.*