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Cyclic voltammetry study of the electrochemical behavior of vanadyl sulfate in absence and presence of antibiotic

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Abstract

The cyclic voltammetry technique was used to study the electrochemical behavior of vanadyl sulfate in absence and presence of antibiotic (cefazolin) in 0.1M KCl under different pH values at 300.15 K. The redox behavior of vanadyl sulfate has been studied by using glassy carbon electrode, Ag/AgCl as a reference electrode and Pt wire as a counter electrode under potential from +1500 mV to -1000 mV. One anodic peak and one cathodic peak are observed in cyclic voltammograms. Peak current ratio and peak potential separation (ΔE) was calculated, the higher values of them gave an indication about systems under study are quasi-reversible. The effect of pH, scan rate and concentration of electroactive species on the interaction between vanadyl sulfate and antibiotic were studied. Charge transfer coefficients (α), the heterogeneous electron transfer rate constants (k_s) and the diffusion coefficients (D) involved in the redox reaction were evaluated.

Keywords: Cyclic voltammetry. Vanadyl sulfate. Quasi-reversible. Heterogeneous electron transfer rate constant. Diffusion coefficient. Cefazolin

1. Introduction

Cyclic voltammetry is one of the most popular electrochemical technique, which gives qualitative information about an electrochemical process. It is carried out by measuring the resulting current as a function of the applied potential. It is called cyclic due to the current is measured as a response of the applied potential, starting at the initial potential (E_i) and the potential value varying in a linear manner up to the end value (E_f). At the end value of the potential, the direction of the potential scan is reversed and the scan takes place in the opposite direction at the same potential range. This technique is accomplished with a three-electrode arrangement. the potential is applied to the working electrode with respect to a reference electrode while an auxiliary (or counter) electrode is used to complete the electrical circuit by conducting electricity from the signal source to the others electrodes in solution. Cyclic voltammetry used in determination mechanism of reactions, a number of electrons transferred through oxidation or reduction process, formal potential, the stoichiometry of a system, heterogeneous rate constants and diffusion coefficient of electroactive species. Cyclic voltammetry is simple, rapid and high sensitive technique, so it used to study the compound such as vanadium with

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