Voltammetric Investigation of Cu(II), Ni(II) and Co(II) Complexes of Sulfamethazine

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Sulfamethazine (4-amino-N-(4,6-dimethyl-2-pyrimidinyl)benzenesulfonamide, (smz), (Scheme 1) is clinically the most used sulfo drug in veterinary medicine as an antibacterial compound to treat livestock diseases[1]. The transition metal complexes containing sulfonamide have also draw considerable attention due to more effective and desirable drugs than sulfonamide itself [2, 3]. This has attracted many scientist to study the metal-smz interactions in details a number of techniques have been used [4] but no voltammetric studies. Many of the most important biological processes are based on redox processes and there are similarities between electrochemical and biological reactions concerning electron transfer. Therefore, electrochemical studies may provide evidence regarding the mechanisms of biological processes.

All the chemicals were of analytical-reagent grade. The voltammetric measurements were recorded with an EG&G PAR Model 384 B polarographic analyzer coupled with a Houston Instrument DMP-40 plotter (Austin, TX, USA). The working electrode was an EG&G PARC Model 303 A static mercury drop electrode (SMDE) equipped with a platinum auxiliary electrode and an Ag/AgCl/ saturated KCl reference electrode. Electronic spectra were recorded on a Unicam V2-100 UV-Vis spectrophotometer in the range of 200-900 nm with 1 cm cell length.

Cyclic and square-wave voltammetry have been employed to examine the electrochemical behaviour of sulfamethazine (smz) (Scheme 1) in the presence of some metal ions (Co(II), Ni(II), Cu(II)) at a static mercury drop electrode (SMDE) in 0.04 M Britton-Robinson buffer. Cu(II)-smz complex was recognized by a cathodic peak at -0.38 V, Ni(II)-smz complex was reduced at more positive potential (-0.77 V) than that of the hydrated Ni(II) ions (-1.08 V). Co(II)-smz complex is investigated at pH 7 and 8. The Co(II) complex at pH 7 is appeared as a shoulder at -1.19 V, whereas this peak becomes a well-separated form at pH 8. The electrochemical studies of smz clearly indicated the formation metal-smz complexes in presence of Co(II), Ni(II) and Cu(II) metal ions. The study also indicated that the smz serves as a catalyst in the reduction of Co(II) and Ni(II) ions. From electronic spectra data of the complexes, their stoichiometries of 1:2 (metal:ligand) in aqueous medium are determined. The stability constants of the complexes are in agreement with the Irving-Williams series (Co<Ni<Cu).

Scheme 1. Sulfamethazine (4-amino-N-(4,6-dimethyl-2-pyrimidinyl)benzenesulfonamide

Kaynaklar: