Electrochemical Studies of Potassium Ferricyanide in Acetonitrile-Water Media (1:1) using Cyclic Voltammetry Method

Nkunu[1] Z. N., Kamau[1] G. N., Kithure[1] J. G., Muya[2] C.N.

[1]Department of Chemistry, University of Nairobi

[2]Department of Environmental Sciences, Technical University of Kenya

Email:

nkunuzach@gmail.com **(Z.N.Nkunu),** gnkamau@uonbi.ac.ke **(G.N. Kamau),** jkithure@uonbi.ac.ke **(J.G. Kithure),** muyacatenjambi@yahoo.com **(M. C. Njambi)**

Abstract

Cyclic Voltammetry is a versatile electroanalytical technique for the study of electroactive species. This method monitors redox behavior of chemical species within a wide range potential. The current at the working electrode is monitored as a triangular excitation potential is applied to the electrode. The resulting voltammograms was analyzed for fundamental information regarding the redox reactions. Cyclic voltammetry are the electrochemical equivalent to the spectra in optical spectroscopy. The number of electrons involved in the redox reaction for a reversible couple is related to the difference in peak potential by 59mV/n. The formal reduction potential is the mean of Peak anodic potential and peak cathodic potential (Epc) and peak anodic current (Epa) and peak cathodic current are close in magnitude. The absolute ratio of peak anodic (ipa) and peak cathodic current (ipc) for both scan rate and concentration studies proved unity for a reversible redox reaction. The mean peak voltage separation value for scan rate and concentration study was found to be 0.0617 and 0.070V respectively. Their standard deviation was found to be ± 0.00493 and ± 0.0003082 respectively. The calculated value for peak voltage for scan rate study and concentration study were found to be slightly higher than the theoretical value of 0.059V/n. The peak anodic current and peak cathodic current versus scan rate graphs and peak anodic current and peak cathodic current versus concentration curves found to exhibit a high R^2 values close to unity at a temperature of 25±1°C.

Key Words: *Ferricyanide, Cyclic Voltammetry, acetonitrile-water media and Potentiostat.*

1.0 Introduction

Potassium ferricyanide is a bright red salt with a chemical formula $K_3Fe(CN)_6$. The salt contains theoctahedrally coordinated $[Fe(CN)_6]^{3-}$ ion (*Sharpe, 1976).* It is soluble in acetonitrile-water media (1:1) and its solution show some green yellow fluorescence.Like other metal cyanides, solid potassium ferricyanide has a complicated polymeric structure. The polymer consists of octahedral $[Fe(CN)_6]^{3-}$ centers crosslinked with K^+ ions that are bound to the CN ligands (*Figgis,; Gerloch,; Mason,1969).* The K^+---NCFe linkages break when the solid is dissolved in water-acetonitrile media.The $Fe(CN)6^{3-}$/ $Fe(CN)6^{4-}$ redox couple is used