Voltammetric Determination of Traces of Heavy Metal Pb (Ii) In Aqueous System

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ABSTRACT

The present research focuses on the determination of Pb (II) ion, a major inorganic ingredient of GSR and its electrochemical mechanism in aqueous solution. Cyclic voltammetry (CV) is employed using glassy carbon electrode for qualitative and quantitative determination of Pb (II) ion. To study electrochemical behaviour of Pb(II) ion different working parameters, such as concentration of Pb(II) ion, supporting electrolyte, nitrogen purging, scan rate, deposition potential, deposition time, pH, were varied and their effect on voltammetric current response is obtained. Voltammetric results were subjected for mechanism of redox reaction taking place in electrochemical cell. The number of electrons involved in redox reaction were determined by logarithmic interpretation of cyclic voltammogram.

Keywords: Lead, GSR, CV, ASV, voltammetry.

INTRODUCTION

Exposure of non-essential metals can produce harmful effects on human and other living organisms. Lead (Pb) a non-essential and toxic metal can be found in aqueous system and its presence can be determined using electrochemical method [1,2]. Firearm discharge can also contribute for Pb (II) contamination in environment [3]. Electrochemical methods are widely being used for the rapid and sensitive detection of inorganic substances as well as organic compounds which have tendency to redox reaction. Pb (II) is subjected to determine by using different anodic stripping voltammetry in the gun shot residue and cosmetics [4-6]. The mechanism of electrochemical determination of Pb (II) in aqueous system is suggested by studying electrochemical parameters. Recently modified electrodes are being used for stripping analysis of metal ions [7].

OBJECTIVES

The objective of current research is to identify the factors affecting most on electrochemical properties of Pb (II) ion and optimize conditions for quantitative determination.

METHODOLOGY

Optimization of electrochemical analytical method for determination of Pb is done by cyclic voltammetry. Glassy Carbon electrode was selected for the analysis of Pb. Effect of different parameters such as concentration of Pb (II), nitrogen purging, potential window, deposition time, supporting electrolyte, stirring and scan rate was studied.

Electro-analysis of Pb at trace level is subjected as for GSR samples is required.

RESULTS

Initially Pb is determined by cyclic voltammetry. Current is linearly proportion to concentration of Pb in the solution. In range $1e^{-4}$ M - $1e^{-5}$ M straight curve obtained, while for lower concentration cyclic or linear sweep voltammetry is not applicable. The lower concentrations are detectable through Anodic Stripping Voltammetry (ASV). By adding a deposition step, the detection limit of Pb is enhanced and a very small (up to micro molar) concentration of Pb is detectable. Removal of oxygen is essential as it alters the current response by producing large quantity of residual current. Usually Pb (II) is analyzed by stripping voltammetry in the presence of acetate buffer [2]. In the current research different electrolyte has been used to develop basic understanding of interaction of Pb (II) with different supporting electrolyte and their effect on voltammetric current response.

CONCLUSION

In this research Pb (II) ion was quantitatively determined in aqueous solution by cyclic voltammetry along with some qualitative parameters such as half wave potential and number of electrons transferred. Reproducible results are obtained under controlled conditions of pH, supporting electrolyte and electrode material.

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