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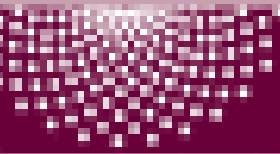

3rd International Seminar on Chemistry 2014

Editors:

Hideo Hayashi
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Voltammetric determination of Cr(VI) using gold nanoparticles-modified glassy carbon electrode

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Abstract

Gold nanoparticles-modified glassy carbon electrode was utilized in the present study to determine trace amount of Cr(VI). The steps employed in the present study were fabrication of gold nanoparticles colloids, modification of glassy carbon electrode using the gold nanoparticle colloids, and voltammetric determination of Cr(VI) using the modified electrode. The results of the present study indicate that 290 µL of 0.1 M $NaBH_4$ was required to form gold nanoparticles colloids. Self assembly process was found to give better gold nanoparticles binding onto glassy carbon electrode compared to adsorption process as indicated by more gold nanoparticles attached onto the glassy carbon electrode. Modification of the glassy carbon electrode using gold nanoparticles increase sensitivity as indicated by good limit of detection (2.38 ng/L) with an acceptable linearity range within 0.050 – 0.250 µg/L. The correlation coefficient and precision of the method were 0.9948 and 99.14%, respectively.

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Keywords:chromium(VI); Voltammetry; glassy carbon electrode; gold nanoparticles

Nomenclature

AuNP	Gold nanoparticles
GCE	Glassy carbon electrode
AuNP-GCE	Gold nanoparticles-modified glassy carbon electrode
UV	Ultraviolet
SEM-EDS	Scanning electron microscope – energy dispersive X-ray spectroscopy
DPV	Differential pulse voltammetry

1. Introduction

Naturally occurring chromium has two valencies, Cr(III) and Cr(VI). In term of their toxicity and reactivity, these two chromium species have very distinct properties[1]. Cr(VI) has high toxicity while Cr(III) is less toxic and the later is also known to be one of essential ion for human, which required in particular amount in the diet. Due to their opposite nature in toxicity, it is important to distinguish between Cr(III) and Cr(VI). Therefore, specific and sensitive determination methods to distinguish both of the species are required. Since Cr(III) belongs to essential nutrition ion required for maintaining normal physiological function, thus trace amount determination of Cr(VI) become very important to avoid toxic intake in diet[2]. There has been several sensitive methods used for Cr(VI) determination including atomic absorption spectrophotometry (AAS)[3,4], plasma-mass spectroscopy[5], spectrofluorimetry[6], chemiluminescence[7], spectrophotometry[8], and electrochemical methods [9-11].

Electrochemical methods for Cr(VI) determination are time efficient, has high sensitivity and specificity, and also the instrument is easy to use[12]. Glassy carbon electrode modified by gold nanoparticles (AuNP-GCE) has been applied to detect Cr(VI) by adsorption stripping voltammetry to increase analytical performance and

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