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Nonenzymatic uric acid electrochemical sensor based on graphene-modified carbon fiber electrode

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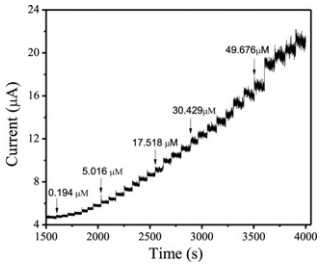
HIGHLIGHTS

- A facile and cost effective electrode, graphene modified carbon fiber electrode (GE/CFE), was used for UA detection.
- The GE/CFE shows high electron transport capacity due to the perfect structure and package effect between GE and CFE.
- The GE/CFE shows high selectivity, good responsiveness and fast response for UA detection.

GRAPHICAL ABSTRACT



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ABSTRACT

A facile and cost effective approach has been developed towards electrochemical fabrication of graphene-modified carbon fiber electrode (GE/CFE) to determine the content of uric acid (UA) via cyclic voltammetry (CV) and potentiostatic (i–t) methods. The combined merits of GE and CFE endow the electrode with large specific surface area and high electrical conductivity. The advantage of thus obtained GE/CFE for UA detection is supported by its higher peak current intensity and lower oxidation potential compared with those of bare glassy carbon electrode (GCE), bare carbon fiber electrode (CFE), and graphene-modified glassy carbon electrode (GE/GCE). Further amperometric study gives a wide liner range from 0.194 μM to 49.68 μM and a low detection limit of 0.132 μM ($S/N = 3$) with fast response time for the determination of UA on GE/CFE. The determination of UA with GE/CFE is highly selective and reproducible, within a relative standard deviation of 2.8%.

1. Introduction

Uric acid (UA) is the final product of purine metabolism in human body. In general, the concentration of UA contained in blood or urine is related to the physical condition of a person. Abnormal UA may cause several diseases such as goa, hyperuricemia or Lesch–Nyan syndrome [1]. Therefore, it is of utmost importance to be able to detect the content of UA in a bio-system with desired sensitivity and accuracy at low cost. Recently, many methods, such as liquid chromatography and isotopic dilution mass spectrometry [2], chemiluminescence [3], and uricase immobilization methods [4] etc., have been explored for the detection of UA. However, these methods are complicated and expensive. Electroanalytical techniques are relatively advantageous because of many merits, such as high sensitivity and selectivity, low cost and ease miniaturization. Due to the electroactive nature of UA, its determination by electroanalytical methods has been established recently [5–9]. An electrochemical sensor for UA determination was constructed with a chitosan–graphene modified electrode [10].

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