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RESEARCH PAPER

Nickel ferrite: synthesis and application for voltammetric determination of uric acid

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Abstract In this paper, the synthesis of nickel ferrite and its use for voltammetric determination of uric acid (UA) are presented. Nickel ferrite was synthesized via a hydrothermal process using spherical carbons as hard template followed by calcination at 500 °C. It was found that iron and nickel compositions in nickel ferrite can be controlled by the initial Fe/Ni molar ratio. The stoichiometric nickel ferrite ($NiFe_2O_4$) with hollow spherical morphology was obtained from a reaction mixture with Fe/Ni molar ratio of around 1.2–1.5. Glassy carbon electrode modified with nickel ferrite was employed to quantitatively determine UA by different pulse voltammetric method. Under the optimum conditions, the anodic peak current was linearly proportional to UA concentration in the range of 0.398 to 6.761 μM. The detection limit (3σ) was found to be 0.15 μM. The proposed method has been employed to determine UA in human urine samples with acceptable recoveries of 95.15–104.8%. On the other hand, the results obtained from this method were also compared with that from standard HPLC method, showing no statistical difference.

Keywords Uric acid · Nickel ferrite · Voltammetric determination · Nanomaterials

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Introduction

Uric acid (UA), 2,6,8-trihydroxypurine, is one of the major end products of purine nucleotide catabolism in the human body, which usually presents at a concentration range of 2.5–8.8 mg/100 mL in serum for normal humans (Popa et al. 2000). High UA levels in serum are a sign of many diseases and physicological disorders such as kidney damage and cardiovascular disease (Mazzali et al. 2000). Increased levels of UA are also symptomatic of diabetes, gout, hyperuricemia, and Lesch–Nyan disease and renal failure (Wang et al. 2002). On the other hand, low UA concentrations may be associated with a molybdenum deficiency and copper toxicity, and abnormally low uric acid levels may manifest that the patient suffers from Fanconi's disease and Wilson's disease (Pagana Deska and Pagana 2002). Thus, the determination of UA concentration in human blood or urine is a critical task as it is an important indicator in disease diagnosis and health assessment and monitoring.

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