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Highly Selective, Sensitive and Fast Determination of Folic Acid in Food Samples Using New Electrodeposited Gold Nanoparticles by Differential Pulse Voltammetry

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A novel method was initially developed for the activation of a gold electrode modified with gold nanoparticles by applying a high potential in the presence of sodium hydroxide. In a second stage, the selective oxidation of folic acid was investigated on the gold electrode described above. The effects of chemical and instrumental parameters such as NaOH concentration, scan rate, activation potential, and the duration of high potential application were investigated and the parameters were optimized. The results showed that 1.0 mol L^{-1} NaOH solution at a scan rate of 100 mV s^{-1} and with an applied potential of 4.50 V for 60 s produced the best results. The optimized sensor was then used to measure folic acid by differential pulse voltammetry. A good linear correlation was found between the peak current of folic acid and its concentration in the range of 1.0×10^{-8} to 1.0×10^{-6} mol L^{-1} with a detection limit of 7.50×10^{-9} mol L^{-1}. The effects of potential interfering compounds on the determination of folic acid were studied. The proposed method is highly selective and sensitive to folic acid. Finally, the new sensor was used to measure folic acid in real samples such as folic acid tablets, wheat flour, fortified wheat flour, and spinach.

Keywords: Gold nanoparticles; Electrodeposition; Folic acid determination; Voltammetry.

1. INTRODUCTION

Folate includes folic acid and derivatives that occur in nature and that are required in the single-carbon metabolism such as amino acid [1] and nucleic acid biosynthesis [2] as well as in cell division and growth. This vitamin is essential for rapid cell growth like blood production, especially during pregnancy [1]. Folic acid is commonly measured using such methods as HPLC–MS,