

A simple strategy to fabricate electrochemical sensor based on nickel nanoparticles modified glassy carbon electrode for the determination of glucose in urine

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ABSTRACT

A non-enzymatic electrochemical sensor has been successfully fabricated using nickel nanoparticles as catalyst. Nickel nanoparticles were electrochemically deposited on a glassy carbon electrode surface by amperometric technique. Nickel nanoparticles modified glassy carbon electrode exhibited high catalytic activity for oxidation of glucose. The morphology of nickel nanoparticles was characterized by scanning electron microscopy (SEM). Electrochemical behaviors of glucose were investigated by cyclic voltammetry and chronoamperometry in alkaline aqueous solution. At the optimum conditions, the calibration curve for glucose determination was linear in the range of 0.05 – 5.00 mM and 5.00 – 17.5 mM and a low detection limit (S/N = 3) of 36 μ M. Furthermore, the proposed sensor was successfully applied to analyze glucose level in human urine samples when compared with clinical laboratory measurements. The glucose sensor showed a strong potential as a sensitive non-enzymatic and may be used in the future for the clinical diagnostic tool.

Keywords: *glucose sensor, nickel nanoparticles, electrodeposition, non-enzymatic*

INTRODUCTION

Glucose determination has gained great attention as a result of its wide application in many areas such as biotechnology, food industry, and clinical diagnostics (Rahman *et al.*, 2010; Fang *et al.*, 2011; Zhu *et al.*, 2012; Wang *et al.*, 2013; Guo *et al.*, 2015). Especially, glucose plays an important analyte in clinical diagnostics because high levels of glucose in the blood (over 6 mM) will increase the risk of diabetes. Diabetes is a serious health care problem, which is a familiar disease and one of the main causes of disability and death in the world. According to the World Health Organization, almost 350 million people are living with diabetes in the world and in 2030, it is estimated that diabetes will be the 7th leading cause of death. (Shaw *et al.*, 2010; alwan, 2011; Baghayeri *et al.*, 2016) Blood glucose level has been measured as an effective clinical biomarker for diabetes risk. Nevertheless, drawing blood from fingertip or vein force causes a painful prick. On the other hand, urine is another instructive body liquid, which has been a useful indicator for diagnosis. The glucose level in urine is as well a good pointer for preliminary screening of patients with high level diabetes or having renal glycosuria (Kim *et al.*, 2014; Fan *et al.*, 2015; Baghayeri *et al.*, 2016) However, blood or urine has the complex matrices, therefore, glucose measurement is an analytical challenge.