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Chemically synthesized CuO nanostructures for non-enzymatic glucose sensor: effect of deposition time

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ABSTRACT

In the present work, the chemical bath deposition technique was used to synthesize CuO electrodes. Their electrochemical properties were examined for non-enzymatic glucose sensors. In order to analyse, the crystallinity of prepared electrodes X-ray diffractometer (XRD) was used whereas Field Emission Scanning Microscope (FE-SEM) was for morphological study. The synthesized bundles of CuO nanosheets exhibited the monoclinic phase. For the study of electrochemical properties of prepared CuO electrodes, cyclic voltammetry and chronoamperometry techniques have been adopted. The developed CuO electrodes are the best candidates for non-enzymatic glucose sensing, showing excellent response. It shows high sensitivity 1594 $\mu AmM^{-1}cm^{-2}$ with potential of + 0.6V, active time period of approximately 5 s, and linear range 3 μm to 3 mM. The CuO electrode's selectivity toward interfering species such as ascorbic acid is also studied. The prepared electrode shows an excellent response to glucose compared to ascorbic acid.

1 Introduction

The disorder related to a high level of sugar in the blood is commonly known as diabetes mellitus. Now a day, it is a worldwide medical issue that results from insulin lack and hyperglycemia. Subsequently, the detection of glucose from the blood is getting to be critical to the patient experiencing diabetes [1, 2]. The numerous techniques like electrochemistry [3] and spectrophotometry [4] used to detect glucose in various biological fluids. The electrochemically fabricated sensors are showing favorable responses to sense the biological glucose due to excellent characteristics like selectivity, sensitivity and simplicity [5–7]. The numerous glucose detectors are developed using electrically conducting material [8, 9] composites [10, 11] and metallic nanoparticles [12, 13]. Conversely, these electrodes may have disadvantages like lower sensitivity, costliness and experiences poisonous effects of chloride ions [14, 15]. Thus, their application is extraordinarily restricted. In this manner, there is the necessity of the development of an enzyme-free glucose sensor for commercial use [16].

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