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Facile synthesis of CuO nanostructures for non-enzymatic glucose sensor by modified SILAR method

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Abstract
The authors developed CuO nanorice, using a modified SILAR method for non-enzymatic glucose sensing. The copper oxide was deposited onto the substrate of stainless steel and distinguished by various characterization techniques. A monoclinic structure that is substantially functional for enzyme less glucose sensors have been deposited with polycrystalline CuO. The rice-like morphology of CuO confirms FE-SEM. The electrochemical efficiency of CuO electrodes is calculated by the adoption of cyclic voltammetry (CV) and chronoamperometry (CA) in a 0.1 M NaOH solution with a potential of + 0.6 V (vs. Ag/AgCl). This sensor offers a linear response from 0 to 3 mM to glucose concentration and has a sensitivity of 1017 μAmM^{-1} cm^{-2}.

Keywords Copper oxide · m-SILAR · Non-enzymatic glucose sensor · Cyclic voltammetry · Chronoamperometry

1 Introduction

Glucose detection is essential for the modern era as well as it is an important task in modern human life. It includes the food industry, pharmaceutical industry, environmental monitoring. According to the clinical field, the development of glucose sensors is paying great attention [1]. The usual range of glucose concentration in human blood is 4–8 mM. If it exceeds, the patient experiences diabetes mellitus. Also, they experience severe impediments like blindness, heart, and kidney failure [2, 3]. For the monitoring of glucose, many electrochemical methods are widely used in various research fields because they possess unique advantages like simplicity, sensitivity, and better cost, selectivity as well as detection [4]. All glucose sensors are grouped with enzyme and without enzyme. The enzymes show intrinsic behaviour hence enzymatic sensor having poor stability. Also, the pH of a solution, moisture, temperature, and hazardous chemicals rigorously affects the enzyme activity [5]. Usually, for enzymatic glucose sensors, glucose oxidase (GO) enzyme is used because it is more stable, but glucose sensors based on GO suffer instability, poor reproducibility, poor stability, and complicated immobilization procedure, thermal and chemical deformation [6]. Hence, it is important to develop and modify glucose sensors that are economical, highly selective, and trustworthy. The transition metal oxide like Co_3O_4 [7], CuO [8], NiO [9], Fe_2O_3 [10] shows high stability, low cost, improved oxidation of glucose. Amid, CuO is an emerging material to glucose sensors because it has high catalytic activity, excellent durability, environmentally friendliness, and the ability to promote electron transfer [11, 12]. The cupric oxide (CuO) is abundantly available in nature. Its synthesis is cost-effective [13]. It shows properties like nontoxicity, excellent chemical stability, good electrochemical activity, large surface area [14]. It shows stability in different solutions and air also [15].

For the deposition of CuO various physical or chemical methods have been used, like sol–gel [16], CVD [17], electrodeposition [18], thermal oxidation [19], sputtering [20], successive ionic layer adsorption and reaction (SILAR) [21], and spray pyrolysis [22]. Amid, the SILAR, is more effective because it is suitable at low temperatures, a cost-effective solution method. Also, it helps to mass production, to control thickness and phase purity over composition. Also,

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