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Augmented sensitivity in electrolyte determination for sweat analysis: Rapid amperometric quantification by self-induced gold nanorods aggregation

Abstract

Background: In this research, different strategies for leveraging gold nanorods (GNRs) were proposed to augment the sensitivity of a fabricated aluminum interdigitated electrodes (IDE) biosensor for detecting sodium chloride (NaCl) at millimolar concentrations. Methods: The sensitivity of the electronic biosensor in detecting NaCl was evaluated by examining the linear relationships between current changes and salt concentrations established at specific voltages. Significant Findings: The results presented that current signals were enhanced when incorporating the catalysts into the detection. At 2.0 V, the biosensor whose surface was functionalized with immobilized GNRs generated prominent electrical responses, with a sensitivity value of 0.0596 mA mM^{-1} cm^{-2}. However, the performance of NaCl quantification recorded a further enhancement of 87.92 % when the mixture consisting of aggregated GNRs induced by the NaCl sample was pipetted onto the bare biosensor. The mechanisms for both application strategies of GNRs were introduced and discussed. This study provides insight into the detection of low concentrations of NaCl and potentially contributes to the 'sweat test' for screening health complications, such as cystic fibrosis (CF)

Keywords

Cystic fibrosis; Electrical transduction; Gold aggregation; Gold nanomaterial; Surface enhancement