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Study of the Enzyme-Free Glucose Biosensor Based on Ni^{2+}@ Poly (Neutral Red) Hybrid Nanocomposites (Ni^{2+}@PNR HN)/MWCNTs/Nafion Modified Electrode

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In this paper, we concentrated on the simplest way to synthesize Nickel ion doped poly (neutral red) (Ni^{2+}@PNR) hybrid nanocomposites (abbreviated as Ni^{2+}@PNR HN) through a reverse microemulsion method. Because the MWCNTs/Nafion composite film was negatively charged, the positively charged Ni^{2+}@PNR HN can be adsorbed by electrostatic interactions onto the surface of MWCNTs/Nafion modified electrode. The hybrid nanocomposite exhibited excellent electrocatalytic activity for glucose oxidation due to three-in-one synergistic effects, namely, the special copolymerization structures of Ni^{2+}@PNR HN as an active catalytic center; the amount of doping of Ni^{2+} can be tuned by the attachment of NR with MWCNTs/Nafion, resulting in the hybrid nanocomposites containing much more Ni^{2+} and possessing a significant signal amplification effect toward the glucose oxidation reaction; the effective immobilization of Ni^{2+} at the modified electrode surface was achieved by the non-covalent interaction of hybrid nanocomposites and MWCNTs/Nafion support materials. Accordingly, the Ni^{2+}@PNR HN/MWCNTs/Nafion modified electrode displayed an enhanced electrocatalytic activity to glucose oxidation in 0.1 $mol \cdot L^{-1}$ NaOH solution, owning the advantages of higher sensitivity, lower detection limit, wide linear range, and good stability and selectivity for constructing a novel enzyme-free glucose electrochemical sensor.

Keywords: Ni^{2+}@poly (neutral red) hybrid nanocomposites (Ni^{2+}@PNR HN); MWCNTs/Nafion modified electrode; enzyme-free glucose biosensor

FULL TEXT