A biosensor with improved performance was developed through the immobilization of horseradish peroxidase (HRP) onto electropolymerized polyaniline (PANI) films doped with carbon nanotubes (CNTs). The effects of electropolymerization cycle and CNT concentration on the response of the biosensor toward H₂O₂ were investigated. It was found that the integration of CNTs into the biosensor system could increase the amount and stability of immobilized enzyme, and greatly enhance the biosensor response. Compared with the biosensor fabricated without CNTs, the proposed biosensor exhibited enhanced stability and approximately eight-fold higher sensitivity. A linear range from 0.2 to 19 μM for the detection of H₂O₂ was observed, with a detection limit of 68 nM at a signal-to-noise ratio of 3 and a response time of less than 5 s.

Conclusions

CNTs were successfully integrated into a PANI-HRP biosensor system, and were shown to greatly enhance the performance of the resulting biosensor. In the proposed biosensor system, CNTs play two important roles. On one hand, as a type of nanomaterial, CNTs can effectively adsorb enzyme and thus increase the amount of immobilized enzyme and enhance the stability of the biosensor. On the other hand, the doping of the PANI film with CNTs can greatly enhance the conductivity of the resulting film and increase the electron transfer efficiency. The PANI/CNT/HRP biosensor responded to H₂O₂ very rapidly with good sensitivity, and could be suitable for interference-free detection of H₂O₂. It is also hopeful that this protocol could be used to immobilize other enzymes to construct a range of biosensors.