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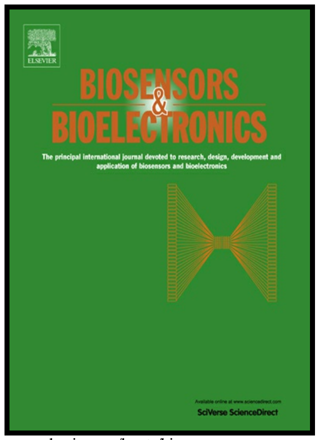

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Perovskite-type calcium titanate nanoparticles as novel matrix for designing sensitive electrochemical biosensing

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Abstract: In this work, novel perovskite-type calcium titanate nanoparticles ($CaTiO_3$NPs) were for the first time exploited for the immobilization of proteins and the development of electrochemical biosensor. The $CaTiO_3$NPs were synthesized with a simple and cost-effective route at low temperature, and characterized by scanning electron microscopy, X-ray photoelectron spectroscopic spectrum, electrochemical impedance spectrum, UV-visible spectroscopy, Fourier transform infrared spectrum, and cyclic voltammetry, respectively. The results indicated that $CaTiO_3$NPs exhibited large surface area, and greatly promoted the direct electron transfer between enzyme molecules and electrode surface. The immobilized enzymes on this matrix retained its native bioactivity and exhibited a surface controlled, quasi-reversible two-proton and two-electron transfer reaction with an electron transfer rate of 3.35 s^{-1}. Using glucose oxidase as model, the prepared glucose biosensor showed a high sensitivity of 14.10 ± 0.5 mA M^{-1} cm^{-2}, a wide linear range of 7.0×10^{-6} to 1.49×10^{-3} M, and a low detection limit of 2.3×10^{-6} M at signal-to-noise of 3. Moreover, the biosensor also possessed good reproducibility, excellent selectivity and acceptable storage life. This research provided a new-type and promising perovskite nanomaterials for the development of efficient biosensors.

Keywords: Perovskite nanomaterials, $CaTiO_3$ nanoparticles; Biosensor; Enzymes; Direct electrochemistry

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