Gold Nanoparticle-Decorated Single-Walled Carbon Nanotubes as a Catalytic Amplification Platform for the Electrochemical Detection of Alkaline Phosphatase Activity

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The detection of alkaline phosphatase (ALP) activity is of great significance in many biomedical applications and for understanding the functional mechanism of ALP-related biological events. A sensitive electrochemical ALP biosensor using ascorbic acid 2-phosphate (AA-P) as the substrate was developed based on a gold nanoparticle-decorated single-walled carbon nanotube (GNP/SWNT)-modified glassy carbon electrode (GCE). The activity of ALP was determined indirectly according to the concentration of ascorbate (AA), which was generated during the hydrolysis reaction of AA-P in the presence of ALP as a catalyst. The biosensor exhibited a low applied potential, high sensitivity and selectivity, and the current response increased with ALP concentration from 3 to 50 U L⁻¹ with a detection limit of 0.2 U L⁻¹. The applicability of the developed method was demonstrated for successfully detecting ALP in whole HeLa cell lysate, thus providing a promising tool for other sensing systems that involve ALP.

Keywords: Alkaline phosphatase activity, Gold particles, Single-walled carbon nanotubes (SWNTs), whole cell lysate.

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