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A glucose biosensor based on novel Lutetium bis-phthalocyanine incorporated silica-polyaniline conducting nanobeads

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Abstract

The facile preparation of highly sensitive electrochemical bioprobe based on lutetium phthalocyanine incorporated silica nanoparticles ($\text{SiO}_2(\text{LuPc}_2)$) grafted with Poly(vinyl alcohol-vinyl acetate) itaconic acid (PANI(PVIA)) doped polyaniline conducting nanobeads ($\text{SiO}_2(\text{LuPc}_2)\text{PANI(PVIA)-CNB}$) is reported. The preparation of CNB involves two stages (i) pristine synthesis of LuPc_2 incorporated SiO_2 and PANI(PVIA); (ii) covalent grafting of PANI(PVIA) onto the surface of $\text{SiO}_2(\text{LuPc}_2)$. The morphology and other physico-chemical characteristics of CNB were investigated. The scanning electron microscopy images show that the average particle size of $\text{SiO}_2(\text{LuPc}_2)\text{PANI(PVIA)-CNB}$ was between 180-220 nm. The amperometric measurements showed that the fabricated $\text{SiO}_2(\text{LuPc}_2)\text{PANI(PVIA)-CNB/GOx}$ biosensor exhibited wide linear range (1-16 mM) detection of glucose with a low detection limit of 0.1 mM. $\text{SiO}_2(\text{LuPc}_2)\text{PANI(PVIA)-CNB/GOx}$ biosensor exhibited high sensitivity ($38.53 \mu\text{A mM}^{-1} \text{cm}^{-2}$) towards the detection of glucose under optimized conditions. Besides, the real (juice and serum) sample analysis based on a standard addition method and direct detection method showed high precision for measuring glucose at $\text{SiO}_2(\text{LuPc}_2)\text{PANI(PVIA)-CNB/GOx}$ biosensor. The $\text{SiO}_2(\text{LuPc}_2)\text{PANI(PVIA)-CNB/GOx}$ biosensor stored under refrigerated condition over a period of 45 days retains ~ 96.4 % glucose response current.

Key words: Silica nanoparticles, conducting nanobeads, lutetium phthalocyanine, glucose biosensor, PANI(PVIA)

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