In situ Growth of Gold Nanoparticles Based on Simultaneous Green Reduction by Methylene Blue for Non-Enzymatic Glucose Sensing

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We presents a novel approach for in situ growth of highly-dispersed gold nanoparticles (AuNPs) on the electopolymerized methylene blue (PMB)/ITO electrode (Au/PMB/ITO) without using additional binding molecules and toxic reductants. Methylene blue (MB) monomers remaining in the PMB films on ITO served as both the reductant to form AuNPs by reducing AuCl\(^{4-}\), and as anchoring sites for in situ growth of AuNPs via the electrostatic interaction between AuCl\(^{4-}\) and positively charged MB that avoids the aggregation of AuNPs, thereby improving their dispersity. Cyclic voltammetry (CV), differential pulse voltammetry (DPV), scanning electron microscope (SEM), UV–Vis spectroscopy (UV–Vis) and Fourier transformation infrared spectroscopy (FTIR) were used to characterize the resulting polymer and nanoparticles. The as-prepared Au/PMB/ITO exhibited an excellent electrocatalytic activity towards glucose oxidation with a high sensitivity of 312 μA mM\(^{-1}\) cm\(^{-2}\) at a low operating potential of 0.04 V.

Keywords: Gold Nanoparticles; In Situ Growth; Methylene blue; non-enzymatic glucose sensing

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