Synthesis of Iron(III) Tetracarboxyl–Phthalocyanine Sensitized Nano TiO₂ Composite as Photoelectrochemical Hydroquinone Sensor

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In this work, a simple photoelectrochemical (PEC) sensor was developed using anatase TiO₂ nanoparticles sensitized with iron(III) tetracarboxyl phthalocyanine (FeC₄Pc@TiO₂) for detection of hydroquinone (HQ). The FeC₄Pc@TiO₂ composite shows excellent photoelectrochemical activity under visible-light illumination compared with pure anatase TiO₂ nanoparticles and pure FeC₄Pc. After adding HQ, the photocurrent of the FeC₄Pc@TiO₂-modified indium tin oxide electrode (FeC₄Pc@TiO₂/ITO) was significantly enhanced, which was attributed to the life improvement of the electron–hole pairs. The sensor was developed based on the enhanced photocurrent response signal. The photocurrent response signal is linear with the concentration of HQ ranging from 0.2 μM to 78 μM, with a detection limit of 0.078 μM (S/N=3) under the optimal conditions. The PEC sensor showed high sensitivity, low cost, and wide linearity range and was successfully employed in the analysis of real water samples, with recoveries between 99.7%–101.7%.

Keywords: Photoelectrochemical sensor; TiO₂ nanoparticles; Iron(III) Tetracarboxyl Phthalocyanine; hydroquinone

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