

Facile Fabrication of an Ultrasensitive PEC Aptasensor for Diclofenac Based on Graphene-Doped CdS And Gold Nanoparticles

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ABSTRACT

Attributed to its unique physicochemical properties, graphene in its composites with semiconductors has been demonstrated to enhance visible light absorption efficiency, reduce the recombination of charge carriers and enhance electron transfer thus utilized in photocatalysis and Photoelectrochemical (PEC) sensing. Herein, graphene-doped CdS (GR-CdS) and gold nanoparticles (Au NPs) were employed to fabricate a PEC aptasensor for detection of diclofenac (DCF). It was observed that GR-CdS modified electrode exhibited a high and stable photocurrent response upon visible light illumination, due to the excellent electrical and optical property of GR as well as the high absorption efficiency of CdS in the visible region. While Au NPs were incorporated with GR-CdS, further increase in photocurrent response was observed owing to surface plasmon resonance. Moreover, the Au NPs were advantageous to immobilize the SH-terminated aptamer used as a biorecognition element. Upon interaction of DCF with the immobilized aptamer, the DCF molecules were captured by the aptasensor. When the sensor was illuminated with visible light, an enhanced PEC current response to DCF was realized due to the oxidation of the captured DCF by the photogenerated holes. Under the optimized conditions, the sensor showed a PEC response linear to DCF concentration in the range of 1 to 150 nM, with a detection limit (3S/N) of 0.78 nM. The proposed sensor gave satisfactory results when applied in the determination of DCF in pharmaceutical and environmental samples. Thus, a highly selective and sensitive PEC sensor for the determination of DCF was provided.

Keywords: Graphene; CdS; AuNPs; Photoelectrochemical Aptasensor; Diclofenac.

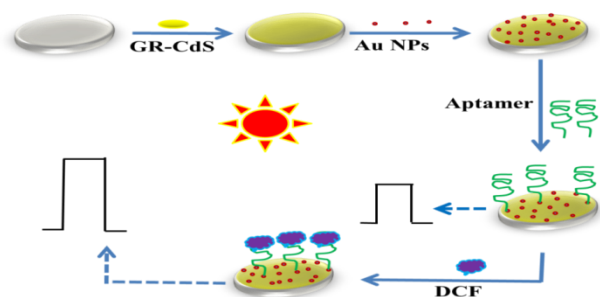


Fig. 1. Fabrication process and the working of diclofenac PEC aptasensor.

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