Enhanced photoelectrochemical behavior of CdS/WS₂ heterojunction for sensitive glutathione biosensing in human serum

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This work develops an enhanced photoelectrochemical biosensor for sensitive determination of glutathione (GSH) by means of the heterojunction effect of CdS/WS₂. The CdS/WS₂ photoanode was successfully constructed through the method of stepwise assembly, and achieved around 310% increase of photocurrent response in respect to CdS quantum dots (QDs) modified electrode due to the formation of heterostructure, which was identified by the elevation of incident-photon-to-current conversion efficiency and electron lifetime. Under illumination, with the photogenerated electrons of CdS QDs tended to WS₂ nanosheets and sequentially driven to ITO electrode, the corresponding photogenerated holes could continuously oxidize GSH into glutathione disulfide, leading to a remarkable photocurrent change because of the efficient charge carrier separation. Under the optimized conditions, the biosensor demonstrated excellent sensing performances with the low applied bias potential of 0 V (versus Ag/AgCl), wide linear range from 20 μM to 2.5 mM, desirable detection limit of 5.82 μM, as well as high selectivity, good stability and acceptable stability. Moreover, this biosensor was also utilized to the monitoring of GSH in human serum. These results suggested this sensing strategy has a guiding significance for the development of photoelectrochemical devices, showing great prospect in molecular diagnostics and bioanalysis.

Keywords: Photoelectrochemistry; Biosensor; Heterojunction; WS₂; Glutathione

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