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A Reusable Capacitive Immunosensor Based on a CuS Ultrathin Film Constructed by Using a Surface Sol-Gel Technique

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A capacitive sensing method based on a CuS ultrathin film modified electrode prepared by a surface sol-gel technique has been developed for the direct detection of human IgA. The resulting CuS film was investigated with cyclic voltammetry (CV), impedance spectroscopy, and quartz crystal microbalance (QCM). CV and impedance examinations showed that the CuS film formed on the gold electrode surface was insulated, and was applicable to form an insulating layer of a capacitive immunosensor. With QCM measurements, the thickness of the CuS film was evaluated to be 5.8 nm. The capacitance change was greatly increased by a CuS nanofilm-based immunosensor, which was initiated by the recognition of an immobilized antibody and the target antigen. The capacitance of the immunosensor corresponding to the concentration of human IgA was investigated by potentiostatic-step measurements. A linear calibration curve was obtained in the range of 1.81 – 90.5 ng ml^{-1} with a detection limit of 1.81 ng ml^{-1}. There were no obvious interferences from the nonspecific adsorption of other proteins. With nice reproducibility and regeneration capacity, the CuS ultrathin film modified immunosensor could be used for the detection of human IgA in serum samples with a recovery of 96.1 – 104.4%, showing its promising applicability and reliability.

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