A novel molecularly imprinted chitosan-acrylamide, graphene, ferrocene composite cryogel biosensor used to detect microalbumin

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Abstract	A novel highly sensitive and selective molecularly imprinted polymer (MIP) cryogel biosensor for determination of microalbumin in urine samples was fabricated. The MIP gel was prepared based on the graft copolymerization of acrylamide with N,N'-methylenebisacrylamide on chitosan using human serum albumin (HSA) as the template. The sub-zero polymerization allowed the solvent to form ice crystals and left a macroporous cryogel structure when it was thawed. After removing the template, the specific imprinted surface on cryogel pore walls was used to detect HSA via a redox mediator (ferrocene), entrapped in the cryogel, using differential pulse voltammetry (DPV). The electrochemical detection was improved by the presence of graphene that has been composited within the polymer. For determination of albumin, the fabricated MIP cryogel biosensor showed a high sensitivity with a wide linear range of 1.0 x 10(-4) to 1.0 x 10(1) mg L-1 and a low limit of detection of 5.0 x 10(-5) mg L-1 (S/N = 3). The sensor also provided a very good reusability, i. e., the sensitivity remained >90% after 9 cycles of binding-rewashing (18 analyses per cycle), while the sensitivity only decreased to 90% after 6 weeks of storage at room temperature. The biosensor also showed a good selectivity, both against bovine serum albumin (BSA) and some common possible interfering compounds normally present in urine (ascorbic acid, uric acid, urea, sodium, chloride, potassium and creatinine). The excellent performance of the biosensor was confirmed by analyzing microalbumin in urine samples, and results were in good agreement with those obtained by the standard immunoturbidimetric method (P > 0.05).
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