A cascade amplifying microRNA detection based on graphene oxide-gold nanoparticles nanohybrid

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The graphene oxide-gold nanoparticles (GO-AuNPs) nanohybrid is a promising material in biosensors, due to its advantages in surface area, good biocompatibility and unique electrical and catalytic properties.\(^1,2\) Herein, an electrochemical microRNA biosensor is designed and demonstrated based on the GO-AuNPs hybrid material, which contains a duplex-specific nuclease (DSN)-assisted target recycling process\(^3\) and electrocatalytic measurement step (Fig. 1).

With addition of target microRNA, let-7b, the DNA probes on AuNPs surfaces were hydrolysed by DSN, leading to the exposure of the AuNPs surfaces. Then, these reacted AuNPs are built into a multi-layered GO-AuNPs hybrid structure which subsequently was deposited on electrode to catalyse the water splitting reaction. The value of catalytic current was determined by the exposed surface area of the AuNPs, which was proportional to the concentration of microRNA. By the proposed biosensor for let-7b detection, a linear detection range of 1 fM to 10 pM was obtained with a detection limit at 1.5 fM (Fig. 2). Moreover, despite the high sequence homology among the same microRNA family members, the detection still showed high specificity and could distinguish even one base mismatches.

References


Figures

Figure 1: Schematic illustration of (a) DSN-assisted target recycling and (b) three-electrode system for water splitting and the GO-AuNPs modified electrode is the working electrode.

Figure 2: The dose-response curve of microRNA let-7b detection. The solid and dashed curves correspond to the linear detection range and cut-off line, respectively.