An Aptamer-based Magnetic Nanobead for the Ultrasensitive Detection of Tumor Biomarker

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Aptamers can specifically bind to proteins, small molecules and cell receptors, which are considered as chemical antibodies. In this study, we present an aptamer-based magnetic nanoparticle for the quantitative and qualitative detection of Mucin-1, which is one kind of tumor biomarkers and is overexpressed in breast cancer.

Compared with antibody, aptamers display an outstanding nature of high target specificity and affinity, biocompatibility and stability, as well as no immunogenicity and low production cost. The changes of sizes and zeta potentials are used to monitor the synthesis process during the fabrication of MBs and probes. The structure of the SERS nanoprobe is core-shell type. Raman reporter molecules are modified in the middle of the core-shell structure. This structure can prevent the aggregation of nanoparticles and maintain the stability of the nanoprobe, as well as significantly enhance SERS signals (see Figure 1). Compared with Au NPs, the color of Au@Ag probe is change from red to yellowish as determined from the inset in Figure 2. It is obvious that a blue-shift of the extinction peak was observed when introducing a silver shell onto the core nanoparticle (see Figure 2). The thickness of the silver shell of the nanoprobe is approximately 1nm-3nm as determined from the TEM images (see Figure 3).

In this strategy, core-shell nanoparticle is used as the reporting probe and MB is utilized as the capturing substrate. In the absence of Mucin-1, the SERS nanoprobes are assembled around the MB due to DNA hybridization. The SERS intensity is negatively correlated with the concentration of target Mucin 1. With high specificity and sensitivity, this method would have a promising application in early-stage cancer diagnosis.

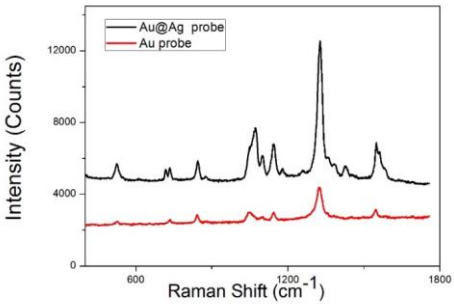

Fig. 1SERS spectra of the Au probe and Au@Ag probe

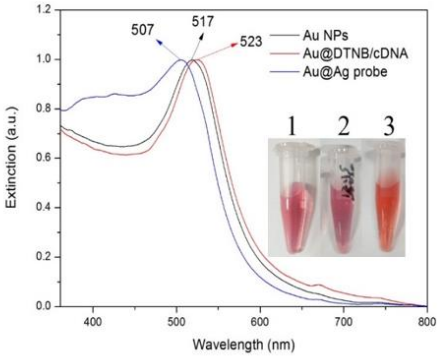

Fig. 2Extinction spectra of the AuNPs , Au@DTNB/cDNA and Au@Ag probe

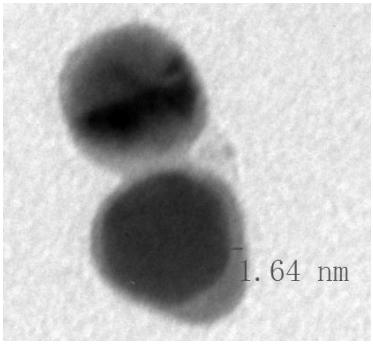

Fig. 3the TEM image of Characteristics of the Au@Ag probe

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