Anal. Chem. 2001, *73,* 5576−5581

Metal Nanoparticle-Based Electrochemical Stripping Potentiometric Detection of DNA Hybridization

Joseph Wang,* Danke Xu, Abdel-Nasser Kawde, and Ronen Polsky

Department of Chemistry and Biochemistry, New Mexico State University, Las Cruces, New Mexico 88003

A new nanoparticle-based electrical detection of DNA hybridization, based on electrochemical stripping detection of the colloidal gold tag, is described. In this protocol, the hybridization of a target oligonucleotide to magnetic bead-linked oligonucleotide probes is followed by binding of the streptavidin-coated metal nanoparticles to the captured DNA, dissolution of the nanometer-sized gold tag, and potentiometric stripping measurements of the dissolved metal tag at single-use thick-film carbon electrodes. An advanced magnetic processing technique is used to isolate the DNA duplex and to provide low-volume mixing. The influence of relevant experimental variables, including the amounts of the gold nanoparticles and the magnetic beads, the duration of the hybridization and gold dissolution steps, and the parameters of the potentiometric stripping operation upon the hybridization signal, is examined and optimized. Transmission electron microscopy micrographs indicate that the hybridization event leads to the bridging of the gold nanoparticles to the magnetic beads. Further signal amplification, and lowering of the detection limits to the nanomolar and picomolar domains, are achieved by precipitating gold or silver, respectively, onto the colloidal gold label. The new electrochemical stripping metallogenomagnetic protocol couples the inherent signal amplification of stripping metal analysis with discrimination against nonhybridized DNA, the use of microliter sample volumes, and disposable transducers and, hence, offers great promise for decentralized genetic testing.