

## Particle-based Electrochemical Detection of DNA Hybridization

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New electrochemical genomagnetic hybridization biosensors have been developed to take advantage of a new and efficient magnetic separation/mixing process, the amplification feature of enzyme or metal - nanoparticle labels, and single-use thick-film carbon transducers operated in the pulse-voltammetric or potentiometric stripping mode. Such schemes represent the first examples of coupling a magnetic isolation with electrochemical detection of DNA hybridization. The new protocols employ a magnetic-particle labeled probe hybridizing to a biotinylated DNA target that captures a streptavidin-bound enzyme (alkaline phosphatase) or gold nanoparticle labels. The  $\alpha$ -naphthol product of the enzymatic reaction is quantitated through its well-defined, low-potential (+0.1V vs. Ag/AgCl) differential pulse voltammetric peak at the disposable screen-printed electrode. Highly sensitive stripping potentiometry is used for measuring the gold-nanoparticle label. The efficient magnetic isolation is particularly attractive for electrical detection of DNA hybridization which is commonly affected by the presence of nonhybridized nucleic acid adsorbates. The new biomagnetic processing combines such magnetic separation with a low-volume magnetic mixing, and allows simultaneous handling of 12 samples. The attractive bioanalytical behavior of the new enzyme- or gold-linked genomagnetic electrical assay is illustrated for the detection of DNA segments related to the breast-cancer BRCA1 gene.