

An electrochemical biosensor for the determination of *Ganoderma boninense* pathogen based on a novel modified gold nanocomposite film electrode

ABSTRACT

A sensitive approach for the determination of *Ganoderma boninense* DNA is reported based on an electrochemical affinity system using a modified gold sensor. Covalent attachment of probe DNA was achieved by attachment of the amine group to a carboxylic acid group of a 3,3'-dithiodipropionic acid monolayer on a nanocomposite film of gold nanoparticles bound to poly(3,4-ethylenedioxythiophen)-poly(styrenesulfonate) on a gold working electrode. The electrochemical detection of sequence-specific DNA of probe and target DNA hybridization was monitored using a new ruthenium complex $[\text{Ru}(\text{dppz})_2(\text{qtpy})\text{Cl}]_2$; dppz = dipyrrodo [3,2-a:2',3'-c] phenazine; qtpy = 2,2',-4,4''-4'4'''-quarterpyridyl redox marker. The potential was selected through the study of the electrochemical behavior of trisaminomethane-hydrochloride containing a ethylenediaminetetraacetic acid supporting electrolyte on the bare and modified gold electrode. The effect of the hybridization temperature and time were measured. The sensor demonstrated specific detection for the target over a concentration range of 1.0×10^{-15} M to 1.0×10^{-9} M with a detection limit of 1.59×10^{-17} M. Control experiments verified the specificity of the biosensor in the presence of a single mismatched DNA sequence. This detection technology was shown to be effective in terms of sensitivity and selectivity of hybridization events and is a promising device for early detection of *Ganoderma boninense* and other pathogenic threat agents.

Keyword: DNA biosensor; *Ganoderma boninense*; Nanoparticles; Poly(3,4-ethylenedioxythiophen)-poly(styrenesulfonate); Ruthenium complex