An electrochemical biosensor for the determination of Ganorderma 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 [Ru(dppz) 2 (qtpy)Cl 2 ; dppz = dipyrido [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