Enhanced electrochemical sensing of secondary metabolites in oil palms for early detection of *Ganoderma boninense* based on novel nanoparticle-chitosan functionalized multi-walled carbon nanotube platform

ABSTRACT

Ganoderma boninense, the causative fungal of basal stem rot disease in oil palms caused a major loss of revenue in leading palm oil producing countries in Southeast Asia. The late stage identification of the infected trees may not be able to respond to any treatment given. Therefore, the detection of secondary metabolites (SMs) which are synthesized de novo after Ganoderma boninense attack had the potential to be used as biomarker to identify the infected trees at the initial step of disease. The sensing of secondary metabolites could become a key factor in developing new strategy in early treatment of disease infection in oil palm plantation. In this regard, a new electrochemical sensor using functionalized multi-walled carbon nanotubes (MWCNTs) modified screen printed carbon electrode is developed for fast and sensitive detection of SMs in oil palms. Measurements were carried out in different root secondary metabolites sample solutions extracted from healthy and infected oil palms based on cyclic voltammetric observation with optimized conditions of 180 s accumulation time, −0.52 V accumulations potential and 0.60 V/s scan rate. The combination of MWCNTs and gold nanoparticles mixed with chitosan nanoparticles promotes the amplifying of the detection sensitivity. The newly developed electrode revealed satisfactory linear oxidative peak current response over the set concentration range of 0.1 to 0.5 ppm with coefficient of regression ranging from 0.9433 to 0.9996. The limit of detection is between 7.87 ppb and 18.54 ppb for all the SMs samples analyzed. The proposed sensor displayed good sensitivity, selectivity and reproducibility, making it as a potential method for early detection of oil palm disease through electrochemical detection.

Keyword: Secondary metabolites; Oil palms extracts; Voltammetry; Multi-walled carbon nanotubes; Screen printed carbon electrode