

Electrochemical determination of zearalenone using a label-free competitive aptasensor

ABSTRACT

An electrochemical aptasensor is described for determination of the phytohormone of zearalenone (ZEA). The gold electrode was modified with ZEA via covalent attachment using cysteamine-hydrochloride and 1,4-phenylene diisocyanate linker. A truncated ZEA aptamer with a dissociation constant of 13.4 ± 2.1 nM was used in an aptasensor. The electrochemical property was investigated using square wave voltammetry for monitoring the change in the electron transfer using the ferro/ferricyanide system as redox probe. Under optimal experimental conditions, the response was best measured at a potential of 0.20 V (vs. Ag/AgCl). The signals depended on the competitive mechanism between the immobilised ZEA and free ZEA for the aptamer binding site. The aptasensor works in the range 0.01 to 1000 ng·mL⁻¹ ZEA concentration, with a detection limit of 0.017 ng·mL⁻¹. High degree of cross-reactivity with the other analogues of ZEA was observed, whereas none towards other mycotoxins. The aptasensor was further applied for the determination of ZEA in the extract of maize grain and showed good recovery percentages between 87 and 110%.

Keyword: Biosensor; Zearalenone; Aptamer; Square wave voltammetry; Electrochemical impedance spectroscopy