

Screen-printed histamine biosensors fabricated from the entrapment of diamine oxidase in a photocured poly (HEMA) film

Abstract

A three-electrode system amperometric biosensor that consisted of screen-printed carbon paste working electrode (SPE), a commercial platinum rod counter electrode vs Ag/AgCl reference electrode was developed for rapid determination of histamine in prawns. The biosensor was designed from entrapping diamine oxidase (DAO) enzyme in a poly(2-hydroxyethyl methacrylate) (photoHEMA) film prepared via a simple and one-step direct photocuring process on a carbon paste screen-printed electrode (SPE). The photoHEMA film exhibited water absorption of 34.14% after four hours exposure to water and no leaching of DAO was observed from the hydrogel film. The histamine biosensor showed response time of < 50 s with a linear response range from 0 to 60 ppm histamine (R^2 of 0.9946). The sensitivity of the biosensor was of 5.56 nAppm^{-1} , with a limit detection of 0.65 ppm histamine. The performance of the fabricated biosensor in the analysis of histamine in tiger prawn (*Penaeus monodon*) samples was comparable to high performance liquid chromatography (HPLC). The three-electrode system was then converted to an all-screen-printed histamine biosensor by printing onto a polyester substrate with carbon paste to form the working and counter electrodes and Ag/AgCl paste as the reference electrode. The performance of all-screen-printed histamine biosensor was evaluated using potassium hexacyanoferrate (III) as a mediator deposited electrochemically on the carbon-paste SPE. The presence of this mediator demonstrated improvement to the response of the all-screen-printed histamine biosensor.