Gamma irradiated Py/PVA for GOx immobilization on tapered optical fiber for glucose biosensing

ABSTRACT

Tapered optical fiber coated with pyrrole/poly(vinyl alcohol)-glucose oxidase (Py/PVA-GOx) for glucose biosensing was successfully fabricated by radiation immobilization of GOx onto polymeric surfaces. Polymerization of pyrrole and PVA crosslinking was carried out by means of gamma irradiation. The nature of enzyme immobilization was studied by Fourier transform infrared spectroscopy, X-ray photoelectron spectroscopy, scanning electron microscopy and atomic force microscopy. The observation of an absorption band at 1650 cm−1 and binding energy formed at 287.5 eV confirm the occurrence of GOx immobilization on the polymer matrix. An increase in film thickness is observed after irradiation, which confirms the entrapment of GOx into the Py/PVA polymer matrix. The peak to valley roughness for the irradiated Py/PVA-GOx reveals the intermolecular interaction between the polymers and enzyme. These characteristics are linked to the enzymatic reaction of the coated optical fiber towards the glucose concentration. The kinetic property of the GOx in the irradiated Py/PVA-GOx coated fiber was studied with a very low value obtained for the Michaelis-Menten constant, which contributes to improved adhesion and immobilization on the coated fiber. The response and sensitivity of the coated optical fiber were recorded as <0.31 μW and 8.7 × 10-3 μWmM-1, respectively. A selectivity study reveals that the irradiated fiber coated with Py/PVA-GOx is highly selective towards glucose.

Keyword: Optical fiber biosensor; Glucose sensing; Pyrrole; Poly(vinyl alcohol); Gamma irradiation