DEVELOPMENT OF AMPEROMETRIC GLUCOSE BIOSensor BY SOL-GEL IMMOBILIZATION OF GLUCOSE OXIDASE

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Enzyme-based biosensors have attracted great attention in recent years. The most important factor in the development of an enzyme-based biosensor is the immobilization of enzymes on transducer surface. Among the various modification procedures used in the construction of the amperometric biosensors, sol-gel technology has attracted wide spread interest to immobilize the relevant enzyme owing to the distinct advantages of low temperature preparation, chemical inertness, negligible swelling, optical transparency, low-temperature encapsulation, tunable porosity and thermal stability. The routine analysis of glucose in variety of physiological fluids is one of the most frequent operations in a clinical chemical laboratory. The convenient, rapid, safe and precise determination of blood sugar in the diabetes patients is important for the treatment and control of diabetes [1-4]. Therefore, in this study, it is aimed developing a glucose biosensor prepared by immobilization of GOx in silica sol-gel film on the platinum electrode surface.

The sol-gel layer was prepared by mixing of GLYMO and MTEOS precursors. A volume of 2 μL of enzyme solution was dropped on the platinum electrode surface, and allowed to dry at room temperature for 30 min. After that, aliquots of 7 μL of the sol-gel solution diluted with alcohol to immobilize the enzyme was carefully dropped on the enzyme deposited onto the surface of platinum electrode, and allowed to dry at room temperature for 48 h. Electrochemical measurements were carried out amperometrically by determining hydrogen peroxide produced as the result of the enzymatic reaction between glucose and glucose oxidase. The optimum values of working potential and buffer solution pH were determined to be 700 mV and 7, respectively. It was determined that the glucose biosensor exhibited high sensitivity, selectivity, fast response time, good stability, and wide linear range.

The influences of some possible interfering species on the response of glucose were successfully prevented by sol-gel film. Figure 1 represents a plot of the typical amperometric responses of the silica/GOx electrode to glucose. The glucose concentration for each injection is 2 mM. The results obtained from the experiments demonstrated that the sol-gel organic-inorganic hybrid material due to their biocompatibility is an excellent matrix for the immobilization of glucose oxidase enzyme to develop biosensor.

Figure 1. The amperometric responses of the enzyme electrode to successive glucose injections.

References