Nanocomposites and nanomaterials

Usage of Gold Nanoparticles/Polymer/Enzymes Composite for Development of Adenosine Triphosphate Biosensor

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Development of enzyme-containing nanocomposites provides an excellent opportunity for development of sensitive and effective analytical devices – biosensors. In our work we used nanocomposites that contain two enzymes, polymers and gold nanoparticles (about 20 nm). Such nanostructure was expected to increase electron transfer in the bioselective element of biosensor and to improve enzyme stability during the immobilization process.

In the present work, an amperometric biosensor based on a bienzymatic system (glucose oxidase/hexokinase) was developed. The biosensor was sensitive to adenosine-5'-triphosphate (ATP). The enzymes were immobilized onto the surface of a platinum disc electrode which was used as amperometric transducer. Three different methods of immobilization were investigated: cross-linking of the enzymes with bovine serum albumin, entrapment in a photo-crosslinkable polyvinyl alcohol (PVA) matrix, and entrapment of the enzymes in a PVA / polyethylenimine matrix. All the methods were examined with and without addition of gold nanoparticles (GNPs) to the reacting mixture for enzymatic membrane creation. GNPs were added to decrease insulating properties of polymer/enzyme films and improve electron transfer between enzymes and electrode. ATP detection was achieved in all cases, with good reproducibility but variable time of response, the highest sensitivity being achieved by co-immobilizing glucose oxidase/hexokinase into the photo-crosslinked PVA/GNPs polymer matrix.

The authors gratefully acknowledge the financial support of this study by Project European IRSES-NANODEVICE and by NASU in the frame of Scientific and Technical Program “Sensor devices for medical-ecological and industrial purposes: metrology and trial performance”.