Electrochemical sensing of glucose – a biosensor based on cuprous sulfide nanoflowers

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Electrochemical methods are the most commonly used for glucose detection in case of diabetes because of their high accuracy, good sensitivity, quick response, and easy maintenance, which made them suitable and practical for self-testing of patients. The functional principle in commercially available appliances is based on the electrooxidation of glucose present in blood by enzymes (glucose oxidase or dehydrogenase). Generated current is proportional to the amount of this monosaccharide in the sample. However, such systems suffer from stability issues (influence of temperature, pH, and presence of other electroactive species). Likewise, the mass production of them is hindered by low reproducible and high costs. In the majority of cases, test strips are only disposable. As diabetes is on the most widespread diseases in developing countries above disadvantages need to be overcome. An emerging new generation of nonenzymatic electrodes based on the direct transfer of electrons is believed to solve major concerns and contribute to the development of continuous glucose monitoring systems. Presented work aims to investigate the performance of modified glassy carbon electrode (GCE/CuS) in glucose detection. Copper sulfides in form of nanoflowers were synthesized and characterized (techniques: SEM, XRD, DLS). Electrochemical measurements, cyclic voltammetric and chronoamperometric, were carried out using the three-electrode system in which GCE/CuS electrode was the working one, silver chloride (Ag/AgCl) – reference and platinum wire (Pt) – auxiliary. The influence of polymer type, its concentration and the solvent kind involved in incorporation of copper sulfide nanoparticles on the surface of the electrode was examined. Limit of detection and quantification, as well as measuring range, were determined. This work has been supported by the European Union and Ministry of Science and Higher Education, project “Najlepsi z najlepszych! 3.0” POWER cofounded by European Social Fund titled "Transition metal compounds with a designed surface for non-enzymatic glucose sensors."

Biography

Julia Mazurkow has completed his B.Eng. at the age of 22 years from AGH Univeristy of Science and Technology. She is currently Master Student at the same univeristy and pursues her thesis with cooperation with Empa Swiss Federal Laboratories for Materials Science and Technology. Her research interest focuses on nanomaterials synthesis and characterization, as well as their application in the field of electrochemistry (biomolecules detection) and water purification.

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