Abstract

Introduction: Accurate measurement of blood glucose is essential for assessing diabetes as well as adjusting the dose of insulin and hypoglycemic drugs. Therefore, the existence of simple, fast and inexpensive methods for measuring blood glucose is an essential human need. So far, various methods have introduced to measure human blood glucose, but most of these methods are expensive and require modification of the electrode surface with glucose oxidizing enzyme. Therefore, the development of a new method for direct measurement of glucose without the presence of enzymes can reduce the cost of the finished product. The aim of this project is to design an electrochemical sensor without the use of glucose oxidase enzyme to measure blood glucose concentration at biological pH 7.4.

Methods: For this purpose, first copper nanoparticles (Cu) precipitated electrochemically on a PtSPE electrode. Then, multi-walled carbon nanotubes (MW) used to modify the Cu-PtSPE surface. At the end of the work, the molecularly imprinted polymer (MIP) for glucose precipitated on Mw-Cu-PtSPE. MIP acts like a synthetic antibody, allowing only glucose to approach the electrode surface. As a result, the selectivity of the electrode increases.

Results: By precipitating Cu on PtSPE, the electrocatalytic properties of copper are combined with the unique properties of platinum for glucose oxidation and show an acceptable signal for glucose oxidation at pH = 7.4. MW also improves the signal and increases the conductivity of the electrode surface. In the end, MIP acts like a synthetic antibody, allowing only glucose to approach the electrode surface and of selectivity of MIP-Mw-Cu-PtSPE, increases.

Conclusion: Designed MIP-Mw-Cu-PtSPE sensor in a wide concentration range of 0.0001 M to 50 mM is proportional to glucose concentration and its detection limit was 0.05 µM.This biosensor provides a simple, reliable, high-sensitivity, selectivity option for quantifying glucose in a normal blood sample and could offer potential new applications in medicine and treatment.

Keywords: glucose, electrochemical sensor, enzyme free, copper nanoparticles, molecularly imprinted polymer, multi-walled carbon nanotubes