Abstract

The dissertation addresses several topics. The first part deals with nanotechnology and its applications for potential diagnostic purposes. First, we prepared nanomotors with a size above 3 µm and a diameter of 400 nm. The nanomotors were then covered with magnetic material and we evaluated the dependence of nanomotors velocity on the frequency of the applied magnetic field. The magnetic nanomotors were modified with a fluorescently labelled antibodies specific to the cancer cell line HeLa and then we observed their internalization into these cells. In further research we studied the interaction of dendrons with model lipid membranes - liposomes. We found that dendrons interacted with liposomes, increasing their hydrodynamic diameter and Zeta potential, depending on the applied concentration and generation of dendron. The hydrodynamic size increased from an initial value of 250 nm to above 1 µm, similarly the Zeta potential increased from an initial value of - 40 mV, to almost - 7 mV. We confirmed the electrostatic nature of the interaction of dendrons with liposomes composed of neutral 1,2-dimyristoyl-sn-glycero-3-phosphatidylcholine (DMPC).

In the next part of the work, we focused on the development of biosensors for detection of bacteria that may be present in food. The research has been focused on the development and testing of DNA aptamer-based biosensors for the detection of *Listeria monocytogenes*, *Listeria innocua* and *Lactobacillus acidophilus*. For specific detection, we chose an electrochemical approach and the quartz crystal microbalance (QCM) method. The QCM aptasensor demonstrated good sensitivity and specificity to detect *Listeria innocua* in real time, with a detection time of 30 min. The detection limit (LOD) was approximately 1.6 x 10^3 CFU/mL.

Electrochemical biosensors included detection by two methods - differential pulse voltammetry (DPV) and electrochemical impedance spectroscopy (EIS). Using the DPV method, we were able to develop an aptasensor sensitive for *L. monocytogenes* with a detection time of 20 min and an LOD of $10^{2.6}$ CFU/mL. We developed also an aptasensor for *L. acidophilus* using the EIS method with a detection time of 10 min and a LOD of $10^{1.9}$ CFU/mL. The Aptasensors were specific for the selected bacteria.

Keywords: DNA aptamer, biosensor, nanomotors, bacteria, cancer cells, antibodies