

Application of electroanalytical techniques for assessment of human cells

Saifullina D., Shakhmaeva I., Abdullin T.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Rapid development of cell technologies stipulates the need for informative and express methods for the analysis of viability and physiological activity of human cells. We studied analytical possibilities of novel tools for comprehensive characterization of bioelectrochemical properties of living cells, e.g. surface charge of cellular membrane and redox activity of metabolites. Using Malvern Zetasizer dynamic light scattering analyzer we proposed an approach to assessment of zeta potential of human cells and detection of phosphatidylserine on their surface as an early apoptotic marker. On the basis of modified electrodes we designed sensors exhibiting high sensitivity towards electroactive cellular metabolites including antioxidants and macroergic molecules. The sensors were applied for assessment of metabolic activity/energetic status of human cells (blood cells and cell cultures). Electrochemical signal of adenine nucleotides of cells on sensor surface correlated with intracellular level of ATP according to luciferase assay and was found to be more sensitive to alteration in cell viability than conventional MTS test. On the basis of disposable screenprinted electrodes we fabricated a prototype of portable analyzer for rapid analysis of cell health (e.g. for donor cells) in less than 5 μ l volume of cell sample. Proposed tools and methods are of interest in cell transplantology, basic research and cell-based medical diagnostics.

Keywords

Apoptosis, ATP, Electrochemical properties, Human cells, medical diagnostics, Metabolic activity, Transplantology