18th International Conference on
World Analytical Chemistry & Mass Spectrometry
&
World HPLC, Separation Techniques & Pharmacovigilance
August 29-30, 2018 | Toronto, Canada

A quantitative description of the kinetic and concentration regularities of bioanalytical techniques

Dmitriy V Sotnikov, Anatoly V Zherdev and **Boris B Dzantiev**
The Dmitry Mendeleev University Of Chemical Technology, Russia

Statement of the Problem: The high affinity and specificity of biological receptors create both the demand and the intensive development of analytical systems based on their use. Therefore, the development of theoretical concepts of such systems' functioning, studies of quantitative regularities for the reactions occurring within them and the interrelations between the parameters of bioreceptor reactions and analysis with their use, have become key fundamental tasks of bioanalytical chemistry. Although several proposed mathematical models have described various bioassays and biosensors, most of those models consider bioreceptor interactions in the approximation of equilibrium conditions. Due to this limitation, various effects that arise under nonequilibrium conditions remain outside existing studies.

Methodology & Theoretical Orientation: Any bioanalytical technique is based on the affine recognition reaction ($A+R \leftrightarrow AR$), which obeys the laws of the reversible kinetics of a bimolecular reaction. An analytical solution of the differential equation of the complexation rate gives the function, which is presented in Figure 1. In a multistage analysis, an analytical description of the processes requires more parameters and additional simplifications for efficient operation. We have shown that, within a high-affinity interaction ($kd<0.0001$), the approximation of an irreversible binding is adequate for describing the analytical system.

Conclusion & Significance: The presented equation is suitable for describing the elementary stages of bioanalytical techniques. This equation provides both the kinetic dependence (if the interaction time (t) is the variable parameter) and the calibration dependence (if the initial concentration of the analyte $[A]_0$ varies). The proposed approaches will be useful for developers of bioanalytical methods as instruments for assessing the influence of various factors on the parameters of analysis and their targeted optimization.

Biography

Dmitry V Sotnikov received his M.S. education in Chemistry in 2007 at the Dmitry Mendeleev University of Chemical Technology, Moscow, Russia. From 2008 to 2012, he was a Ph.D. student at the A.N. Bakh Institute of Biochemistry of the Russian Academy of Science. From 2015 to the present, Dmitry V. Sotnikov is a research associate of the Federal Research Center (Fundamentals of Biotechnology) of the Russian Academy of Sciences. After completing his dissertation "Detection of specific antibodies by immunochromatography: Principles and practical applications," Dmitry V. Sotnikov was awarded a Ph.D. in biochemistry in 2016. His current research is focused on the kinetics of antigen-antibody interaction, its influence on the sensitivity and specificity of immunoassays and the development of novel immunoanalytical techniques.

sotnikov-d-i@mail.com

Notes: