Department of Analytical Chemistry

Bachelor thesis topics for 2024-2025

in the Biological Chemistry study program

Topic: Microchip electrophoresis for the analysis of body fluids

Supervisor: prof. RNDr. Marian Masár, PhD.

Annotation: Processing of the relevance literature sources on the analysis of body fluids by microchip electrophoresis and experimental work in the laboratory on the separation of selected analytes in body fluids.

Topic: Development of a database of chemical structures and corresponding electrophoretic mobilities with the aim of creating predictive models for calculating the separation characteristics of pharmaceutical active substances

Supervisor: Ing. Roman Szücs, PhD.

Topic: Although chromatography is the most frequently applied separation technique in many industrial applications, electrokinetic separation techniques offer significant alternative separation mechanism. As such, they are often considered complementary to chromatographic techniques. They are particularly suitable for the separation of polar, ionic compounds. These compounds are generally difficult to retain in RP-LC. Although many of recent developments in LC, such as HILIC or SFC are aimed at better retention of polar compounds, one distinct disadvantage of these techniques is their relatively high negative impact on environment. The pharmaceutical industry, as well as other industries, are committed to achieving the so-called "Net Zero initiative", where the amount of CO2 released into the atmosphere is balanced with the amount of CO2 collected from the atmosphere. This also includes indirect emissions e.g., emissions associated with the treatment of chemical waste. The "Net Zero" objectives can be achieved in several ways, including through chemical synthesis meeting the principles of green chemistry, reducing the environmental impact of pharmaceuticals and other bio-active substances and, finally, focusing on emission control. The last category includes activities aimed at reducing harmful waste, reducing water and energy consumption and focusing on renewable energy sources. These activities, which are in line with the "UN Race to Zero Campaign", create new challenges. Sample preparation and analysis itself currently rely on the use of organic solvents of approximately 2-3 litres/week per instrument in continuous operation. This adverse impact on the environment can be significantly reduced or eliminated, thereby contributing to the objectives of "Net Zero" by applying so-called miniaturized instrumental methods or methods where reliance on organic solvents is significantly reduced. Electrokinetic separation techniques meet both prerequisites.