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Ján Labuda^{1,2}, Zuzana Zelinková^{1,3}, and Peter Mikuš¹

¹ Comenius University in Bratislava, Faculty of Pharmacy, Department of Pharmaceutical Analysis and Nuclear Pharmacy, Bratislava, Slovakia,

² Institute of Analytical Chemistry, Slovak University of Technology in Bratislava, Bratislava, Slovakia

³ Penta Hospital Bory Bratislava, Department of Gastroenterology, Bratislava, Slovakia

Research progress in analytical methods and devices for some groups of pharmaceutical, food and environmental analytes

The contribution presents novelty reflecting both sensitivity and selectivity as well as economic and environmental sustainability of the methods. For anti-inflammatory drugs from the group of Janus kinase inhibitors, in parallel to chromatographic and spectrometric methods, new cost-effective electrochemical sensors and procedures of their determination in pharmaceutical dosages and biological samples are developed reaching clinically relevant concentrations of ng/mL. Antioxidative effects of plant-derived extracts and products of pharmaceutical and medical interests are evaluated using tests with biomolecular interactions such as enzyme inhibition or nucleic acids and lipids competition at a pro-oxidant attack. Nanozymes attract interest for many advantages over natural enzymes, including extraordinary catalytic efficiency, tuneable activity, and excellent stability. are particularly treated being. For rapid assessment of food quality parameters such as nutritional components, additives, and contaminants, chemically modified electrodes become emerging as effective sensors. Trends in chemical modifiers (nano)materials and structure, sensors construction including 3D printing and flow analysis platforms are described and evaluated. Analysis automation is based on the implementation of liquid flow at injection analysis, devices with separation step, lab on chips, and paper-based analytical devices. Through miniaturization, platforms are designed with new recognition elements, coating chemistries, and signal amplification for multi-analyte sensing and portable equipments for on-site measurements. Analytical chemistry of engineered nanomaterials and their transformations in samples of complex composition is highlighted from the view of biological matrices, environmental systems, food, cosmetics and other consumer products. Future challenges cover methods validation and standardization. Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the project No. 09I03-03-V04-00157, the projects VEGA 1/0514/22, and IUPAC 2023-010-2-500.

Keywords

antioxidants, electrochemical sensors, flow-through systems, Janus kinase inhibitors, nanomaterials, portable assay

Biography

Jan Labuda occupied the Institute of Analytical Chemistry since 1978 being in 2009 to 2019 the director. His interests cover general analytical chemistry, electrochemical and bioanalytical methods of analysis, electrochemical sensors and biosensors, and analytical use of nanomaterials. He published 170 original and review journal papers with Science Citation Index >3500 and Hirsch index 33. Head is author of two editions of the textbook Analytical Chemistry. He was member and President of the Analytical Chemistry Division of International Union of Pure and Applied Chemistry (IUPAC), currently he is the Emeritus Fellow to the Division.