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ABSTRACT BOOK

OP10-3-3 A modern curriculum for educating industry-oriented specialists in analytical and bioanalytical chemistry

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Swiss Universities of Applied Sciences offer industry-oriented bachelor curricula that are designed to allow students to perform successfully in industry right after their bachelor studies. A new and unique study program was introduced since Fall 2022 at the School of Engineering in Sion (Analytical Chemistry major of the Life Technologies degree program) for students interested in becoming specialists in industrial analytical and bioanalytical chemistry.

With 40 ECTS in analytical and bioanalytical chemistry (excluding the bachelor thesis), the curriculum addresses all current key instrumental analytical chemistry techniques in theory and practice for small and large molecules and biomolecules in simple and complex matrices. Furthermore, practical test method development and validation are integral parts of the curriculum. Acquisition of skills is ensured via industry-oriented practical work topics and projects using a variety of analytical instruments and sample preparation technologies. The curriculum provides a strong background education in basic chemical, engineering, and biochemical sciences, in particular the chemistry of biomolecules. The new curriculum also addresses current topics such as green analytical chemistry and digitalization. Teaching activities are connected to our Life Technologies Institute R&D activities and our ISO 17025-accredited analytical platform service activities, which supports the industry-oriented analytical education.

We believe that this 3y industry-oriented bachelor curriculum in analytical and bioanalytical chemistry is a timely, unique program at a University of Applied Sciences.

OP10-4-1 Addressing some challenges on metal ions determination in dynamic water systems using flow-based approaches

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As water bodies are dynamic systems, the presence of metal ions must be a target of spatial-temporal monitoring. The real-time monitoring is rather cumbersome as current methods rely on transport to off-site laboratories, causing the disruption of the sample characteristics, due to pH and redox potential change and exposure to oxygen, light or temperature shifts, leading to diverse chemical equilibria shifts. This could be potentially overcome by devising new smart sampling procedures and flow-based monitoring. Monitoring water bodies pose some important analytical challenges: coping with a wide range of analyte concentrations; the possible need for analyte enrichment; minimization of interferences; achieving speciation; search for more sustainable chemistries; reducing sample and reagents consumption. To tackle the above-mentioned challenges, the use of in-line separation processes like membrane separation processes and solid phase extraction, have emerged as powerful tools to increase the selectivity and sensitivity of the flow methods, and yet to maintain the major advantages of their use, namely the relative simplicity and good repeatability. In this scenario, some recent contributions of the group in this line of work will be presented.

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OP10-4-2 Monitoring dynamic water systems with microfluidic paper-based devices for in-situ analysis

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To attain an immediate, on-hand response, the use of self-readable, easy-to-use devices is a natural choice namely the concept of microfluidic paper-based analytical devices (µPADs). The portability and low consumption of both reagents and sample associated with this technique, make these devices ideally suited for unskilled operators and frequent analysis. The concept is based upon the microfluidics through the cellulose fibers and the setting of hydrophobic/hydrophilic interfaces for microflow manipulation. Using colorimetric reactions, the analyte concentration can be correlated to the colour intensity, which can be measured with a flatbed scanner and computer software. The use of digital scanning as detection process has enabled to maintain the accuracy and reliability of the analysis in opposition to other paper-based visual indication techniques, with a positive/negative or concentration range response.

The downscaling of the analytical procedures results in a size limitation for in-line pretreatments as well as speciation and interferences minimization processes. Targeting metal ions quantification in dynamic water systems emphasizes these challenges. The adverse effects of metal ions, namely zinc, iron, and copper, are well documented, for displaying toxic, carcinogenic, and mutagenic effects for living organisms if present in high concentrations. The presence of these ions must be a spatial-temporal monitoring and current methods rely on transport to off-site laboratories, causing the disruption of the sample characteristics, due to pH and redox potential change and exposure to oxygen, light or temperature shifts, leading to diverse chemical equilibria shifts.

In this context, we developed a series of µPADs for metal ions quantification for on-site, real-time monitoring of natural waters. To be an effective alternative, all the developed devices were validated by comparing the results obtained in analyzing different water samples with reference standard procedures. Several devices will be presented and the advantages and disadvantages discussed.

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OP10-4-3 Automated solid phase extraction and fluorimetric detection with a flow-based method for the determination of tetracyclines in wastewater

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