SCIENCES & BIOENGINEERING SCIENCES

The Research Group

Analytical, Environmental and Geo- Chemistry

has the honor to invite you to the public defense of the PhD thesis of

Marek Reichstädter

to obtain the degree of Doctor of Sciences

Joint PhD with Brno University of Technology (BUT)

Title of the PhD thesis:

Application of diffusive gradients in thin films technique in food and environmental analysis

Promotors:
Associate prof. Ing. Pavel Diviš, PhD (BUT)
Prof. dr. Yue Gao (VUB)

The defense will take place on

Friday, October 23, 2020 at 16h00

The defense can be followed through a live stream. Contact marek.reichstadter@vub.be for more information

Members of the jury

Prof. RNDr. Ivana Márová, CSc. (BUT, chair)
Prof. dr. Frederik Tielens (VUB, secretary)
Prof. dr. Martine Leermakers (VUB)
Associate prof. Ing. Stanislav Obruča, PhD (BUT, CZ)
Prof. Ing. Josef Čáslavský, CSc. (Global Change Research Institute, CZ)
Associate prof. RNDr. Martin Urík, PhD (Institute of Laboratory Research on Geomaterials, SK)

Curriculum vitae

Marek Reichstädter obtained his Engineer degree in Food Science and Biotechnology in 2015 and started a PhD at BUT under the supervision of assoc. Prof. Pavel Diviš. After a traineeship at VUB in 2018-2019, he started a Joint PhD in 2019 under the supervision of assoc. Prof. Pavel Diviš (BUT) and Prof. Yue Gao (VUB). His PhD research focuses on the development of the diffusive gradients in thin-films technique, combining the assessment of mercury and other trace metals in the environment and foodstuffs. His work has led to the publication of two scientific articles in international peer-reviewed journals.

Abstract of the PhD research

The PhD study focuses on development of Diffusive Gradients in Thin films (DGT) technique for determination of mercury (Hg) and other trace metals and further application possibilities of this technique.

In this work, the DGT technique is developed for the determination of Hg and other trace metals in various liquid media. Two different Hg-specific ion-exchange resins were evaluated for application in the DGT technique – Purolite S924 and Cysteine-Modified Amino-Propyl silica (CAPS). The Purolite S924 is commercially available chelating resin, the CAPS resin was prepared under laboratory conditions by glutaraldehyde-mediated immobilisation of cysteine onto 3-aminopropyl functionalised silica. Both resins showed promising application potential in the DGT technique thanks to their reliable performance in solutions of a broad range of pH and ionic strength. The performance of the DGTs with the new resins was compared with the performance of the DGTs with the commonly used Chelex-100 and 3-mercaptopropyl silica resins. The major advantage of the S924 and CAPS resin is the ability of simultaneous assessment of Hg and other trace metals (Cu, Ni, Pb, Cd, Co). Due to different requirements on the resins used in the DGT technique for Hg and other trace metals, the DGT technique or simultaneous quantitative determination of Hg and other trace metals was not reported yet. Until now, the assessment of Hg and other trace metals have been performed by two separated types of the DGT samplers – one for Hg and one for other trace metals. That increased the number of samples produced and consumables used. The DGT technique with the CAPS resin was used for determination of metals in marine harbours in Oostende and Zeebrugge in the Belgian coastal zone. Although the DGT technique was originally introduced as an environmental analysis tool, the application of the DGT technique in food analysis was also studied in this work. The performance of the DGT technique was validated in fish sauces and the effective diffusion coefficients of Hg and trace metals in the fish sauce were determined. Subsequently, the DGT technique was successfully applied to determine the concentration of mercury and other trace metals in fish sauce samples. To compare the new analytical procedure using DGT technique, fish sauces were also analysed directly by thermal decomposition gold amalgamation atomic absorption spectrometry (TD-AAS) and also after microwave decomposition by sector field inductively coupled plasma mass spectrometry (SF-ICP-MS). Due to the preconcentration ability of the DGT technique, lower detection limits were achieved in comparison with the TD-AAS or the SF-ICP-MS. Moreover, the wear and corrosion of metal parts of the analytical instruments were eliminated by the ability of the DGT technique to separate the trace metals from the complex matrix of fish sauce.