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

Ehab Abdulbur Alfakhoury

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

Development of the Diffusive Gradients in Thin Films Technique (DGT) for platinum (Pt), palladium (Pd), and rhodium (Rh) in Natural Waters

Supervisor:
Prof. dr. Martine Leermakers

The defense will take place on

Thursday, June 10, 2021 at 14h00

The defense can be followed through a live stream. Contact Ehab.Abdulbur.Alfakhory@vub.be for more information

Members of the jury

Prof. dr. Steven Goderis (VUB, chair)
Prof. dr. Yue Gao (VUB, secretary)
Prof. dr. Frederik Tielens (VUB)
Em. prof. dr. Willy Baeyens (VUB)
Prof. dr. Harry Olde Venterink (VUB)
Prof. dr. Ing. Pavel Divis (Brno University of Technology, Tsjechië)
Prof. dr. Gabriel Billon (Lille University, France)

Curriculum vitae

Ehab Abdulbur-Alfakhoury obtained a Bachelor Degree in Pure Chemistry at Al Baath University, Homs, Syria in 2007 and a Master Degree in Chemistry at Ghent University, Belgium in 2013 after working as a research assistant at the Atomic Energy Commission of Syria in Damascus from 2010-2011. In 2015 he started his PhD focussing on the development of the passive sampling technique of diffusive gradients in thin-films (DGT) for platinum group elements, and it's application in urban rivers. Ehab has presented the results from this work at several national and international scientific conferences. His work has led to the publication of four scientific articles in international peer-reviewed journals. He is currently working as a Technical Laboratory Specialist at the Department of Analytical, Environmental and Geochemistry of the VUB.

Abstract of the PhD research

The Platinum Group elements (PGEs) Pt, Pd and Rh are increasingly used in modern day society in industrial and medical applications, resulting in increases in their concentrations in the environment. However, their environmental behaviour, fate and impact are still widely unknown. The accurate determination of PGEs at environmentally relevant concentrations is still a challenge for analytical chemists. Sensitive and interference-free analytical methods are required for measuring the very low levels of Pt, Pd, and Rh in complex matrices. This involves preconcentration of the elements from the matrix and separation from the interfering elements. The aim of this PhD study was to thus to develop, validate, and apply the *in situ* preconcentration technique Diffusive Gradients in Thin Films (DGT) for Pt, Pd and Rh speciation in surface water.

In the first step, a comprehensive laboratory DGT investigation was performed to develop the method using various chelating resins: Purolite S914, Purolite S920, Purolite S985, MPX-317 and MP-102 resins. The influence of parameters such as pH, ionic strength, effective capacity and organic matter was explored. The precise quantitation of these elements by High Resolution Inductively Coupled Plasma Mass Spectrometry (HR-ICP-MS) was achieved. The method was further improved by developing selective leaching procedures to separate the PGEs from interfering elements accumulating on the resin gels. In addition, the influence of ageing of solutions containing PGEs on the DGT response was evaluated showing that inert species of Rh can be formed. Subsequently, the DGT technique was validated by several in situ DGT field trials which were carried out in both urban rivers and a hospital effluent. A first interlaboratory comparison was carried out between VUB_AMGC and LILLE_LASIRE showing a good agreement for Pt and demonstrating the need for evaluation of the DGT operational parameters in further studies.

The combination of the laboratory experiments and field studies allows obtaining a better understanding of the applicability of the DGT technique as an environmental monitoring tool for the new emerging pollutants of PGEs in environments heavily impacted by human activities, making it possible to trace their sources, monitor their evolution and evaluate their potential impact in the future.