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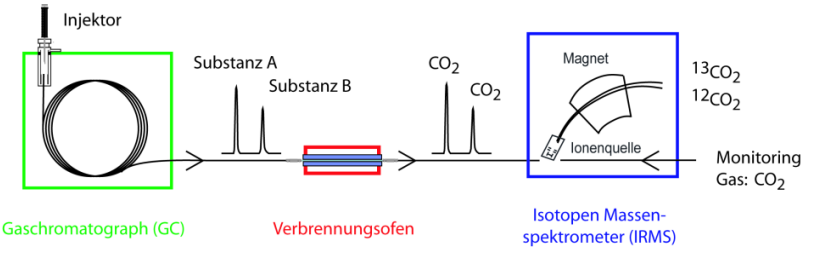

"Reactive Tracers in Chemical Substances: Analysis of Stable Isotopes to Elucidate Processes in Complex Systems"

Technical University of Munich, Institute of Hydrochemistry
Munich, Germany

Prof. Dr. Martin Elsner

Date: 7th May 2019 (Tuesday)
Time: 05:30 p.m.
Venue: Research Building Department „Life, Light & Matter"
of the Interdisciplinary Faculty of the University of Rostock,
seminar room 110, A.- Einstein-Str. 25, 18059 Rostock

Abstract

AInvestigating organic transformation mechanisms in complex environments (ground and surface water, living organisms, heterogeneous catalysis) is of fundamental importance in many sciences, yet challenged by the uncertainty whether lab-based studies adequately mirror real-world processes. To bridge this gap and to enable mechanistic reaction studies directly in complex systems, compound-specific stable isotope analysis (CSIA) of organic substances is conducted at their natural isotopic abundance. Through gas chromatography (GC) or liquid chromatography (LC) coupled to isotope ratio mass spectrometry (IRMS) we have accomplished the measurement of 13C-, 15N-, 2H- and 37Cl- isotope effects in pesticides, pharmaceuticals, chlorinated hydrocarbons and petroleum hydrocarbons at trace (microgram per liter) concentrations. This information does not only allow us to detect degradation of chemicals in the environment in complex situations and over time scales otherwise not accessible (months to years). Isotope effect analysis of multiple elements also enables us to elucidate transformation mechanisms (i.e. the manner and order of bond breaking) where conventional analysis provides complementary information about the identity of products (i.e. the net outcome of a reaction). My presentation summarizes our analytical developments, presents our latest results on the ability of CSIA to pinpoint micropollutant degradation in soil and groundwater and illustrates the capability of CSIA to elucidate underlying reaction mechanisms such as in Vitamin B12-catalyzed dehalogenation of chlorinated ethenes. This dual advantage of CSIA – the ability to tackle complex systems, yet to retrieve mechanistic information on the molecular level – offers the opportunity to trace degradation of chemical micropollutants in rivers, groundwater and engineered systems and to the study of reaction mechanisms in catalytic research.

Speaker's biography

Since 2017 Martin Elsner is Full Professor of Analytical Chemistry and Water Chemistry, and director of the Institute of Hydrochemistry at TUM. Martin Elsner studied chemistry at the University of Freiburg and ETH Zürich, and earned his doctorate in environmental sciences at ETH Zürich (2003). After postdoctoral stays at EAWAG and at the University of Toronto he moved to Helmholtz Zentrum München, Institute of Groundwater Ecology, where he headed a Helmholtz Young Investigator Group (2006-13) and, in the course of an ERC Consolidator Grant, his own research unit (2014-17). In 2011 he earned his venia legendi at the University of Tübingen in Analytical Chemistry und Environmental Chemistry.

*****All interested are welcome*****

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For further information please contact Prof. Dr. Ralf Zimmermann (E-Mail: ralf.zimmermann@uni-rostock.de) or his secretary Mrs. Christin Kühl (E-Mail: christin.kuehl@uni-rostock.de/ Tel. +49(0)381498 6527).