What's New in Laboratory Technology

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ABSTRACTS

Sensory - Chemical analysis of VOCs for Environmental Assessment

Prof Richard Stuetz
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Abstract

Complaints due to annoyance have become a major issue for industrial processing as the repeated release of unpleasant emissions can constitute a nuisance to a local population. Traditionally, management has been achieved using buffer distances between industry and receptors or by the installation of abatement systems that both collect and dispersion the emission or treat the emission to acceptable level to limit receptor impact. Often these systems do not deliver the expected reduction in emissions and /or meet their original design specifications in terms of removal efficiency with the cause of process failures often been due to inadequate emissions characterisation. The integration of chemical and sensory techniques via the coupling of an olfactory port to a GC-MS (GC-MS/O), enables the differentiation and identification of key compounds in terms odorant annoyance (receptor impact) and chemical saturation (abatement loading).

Bio

Prof Stuetz is an environmental engineer and leads an interdisciplinary research group into understanding the fate of contaminants in atmospheric and aquatic systems in natural and engineering processes with specific research interests in the chemical and sensorial measurement of volatile organic compounds (VOCs) in water, wastewater and waste management processes.

Impurity testing Lithium Hydroxide Monohydrate using the NexION 5000 Multi-Quad ICPMS

Peter Dickenson
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Abstract

The capability to identify the presence of impurities in lithium battery materials is critical for manufacturers and suppliers to ensure that the final battery performance is not compromised. In this presentation, the analysis of trace elements in high purity Lithium Hydroxide Monohydrate (LHM) is presented using the NexION 5000 Multi-Quad ICPMS, with a focus on traditionally challenging elements by ICPMS, including Phosphorous, Sulphur and Silicon. Reaction mode using MS/MS and Mass-Shift will be explored using ammonia and oxygen as cell gases.

Bio

Peter started his career in 1992 as an Analytical Chemist at ALS, working in mining and environmental laboratories in Australia and New Zealand. He joined PerkinElmer as Inorganic Product Specialist in 2006 and supports customers across Oceania with elemental analysis by AAS, ICPOES and ICPMS, in applications including environmental, biological, food, agriculture, industrial and mining.

Selective Electrochemical Detection of Dopamine at a Physically Small, Antifouling Sensor

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Abstract

In this work, we will report on the development of physically small carbon electrodes with considerable antifouling properties against both biofouling and electrochemical fouling, making them a suitable sensor for *in vivo* dopamine detection in a complex biological matrix. A major challenge during dopamine detection *in vivo* is biofouling of electrodes caused by an impermeable layer formed by non-specifically adsorbed amphiphilic biomolecules present in extracellular fluid, leading to hindered electron transfer of dopamine at the electrode surface. Similarly, electrochemical fouling is encountered when an adsorbed dopamine-*o*-quinone layer was formed from dopamine oxidation on an electrode surface, yielding a reduced electron transfer rate of dopamine at an electrode. Consequently, diminished transient dopamine signals have produced compromising results in time-dependent *in vivo* dopamine detection experiments. In this work, we have systematically investigated a strategy involving reduction of a series of organic silanes on structurally small carbon electrodes (~2 μm tip diameters and ~9 μm axial length) to develop a hydrogenated carbon electrode with a hydrophobic surface that discourages adsorption of amphiphilic species and dopamine-*o*-quinone, while favouring the electron transfer reaction of dopamine. Results obtained using triethylsilane, *n*-butylsilane, phenylsilane, and diphenylsilane will be discussed. The antifouling properties of these carbon electrodes will be compared by evaluating the analytical detection of dopamine at electrodes that were deliberately treated in a laboratory synthetic fouling solution containing bovine serum albumin (a protein), cytochrome c (a protein), caproic acid (a lipid) and human fibrinopeptide (a peptide), before being applied to real-life biological samples.

Bio

Danny Wong completed his PhD at Monash University, followed by a postdoctoral position at Pennsylvania State University in USA. He was then recruited by Macquarie University to begin a formal teaching program in analytical chemistry. Danny's research areas cover electroanalytical chemistry and electrochemical sensors. Danny has been an RACI member for more than 25 years, serving in several roles including the President of the NSW Branch over the 2018-2021 period. Danny received a Citation Award from the Branch and the Division of Analytical and Environmental Chemistry, respectively.

Royal Australian Chemical Institute

Discover the possibilities: Introducing Agilent's New Single and Triple Quad GCMS and the new HydroInert Ion Source for Hydrogen Carrier Gas Specific Applications.

Dr Maria Findeisen
Sales Account Manager
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Abstract

Agilent has over 50 years of leadership in GC and GC/MS. We focus on your productivity in the lab and maximising your return on investment. Here we present our latest models and newest ion source designed to address the increasing expense of helium. The new HydroInert source is designed to overcome the inherent challenges of hydrogen as a carrier gas for electron ionisation mass spectrometry, while taking advantage of its improved chromatography and ready availability.

Bio

I did my PhD (Molecular characterization of RFamide peptide receptors: Structure-activity relationships and functional selectivity) back in Germany in 2012 and have been in Australia since then. I did my first PostDoc position (The role of C-reactive protein in localising inflammation to stressed cells and misfolded proteins) at the Baker Institute in Melbourne and the second PostDoc position (Investigation of the chimeric designer cytokine IC7 and its efficacy as a treatment strategy type 2 diabetes in pre-clinical experimental models) at the Garvan Institute in Sydney. I joined Agilent as Sales Account Manager in 2021. Customer satisfaction is one of my key drivers.

Royal Australian Chemical Institute

Multiplexed screening of thousands of natural products for protein-ligand binding in native mass spectrometry

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Abstract

The structural diversity of natural products offers unique opportunities for drug discovery, but challenges associated with their isolation and screening can hinder the identification of drug-like molecules from complex natural product extracts. In this talk, a multistage, high-resolution native mass spectrometry approach to rapidly identify natural products that bind to therapeutically relevant protein targets is reported. By directly screening crude natural product extracts containing thousands of drug-like small molecules using a single, rapid measurement, we could identify novel natural product ligands of human drug targets without fractionation. This method should significantly increase the efficiency of target-based natural product drug discovery workflows. This multiplexing strategy is being further developed to address more fundamental challenges, including mapping protein-metabolite interaction networks on an 'omics,' systems-level scale.

Bio

W. Alexander Donald is an Associate Professor, Australian Research Council Future Fellow, and UNSW Scientia Fellow in the School of Chemistry at UNSW Sydney. He completed his Ph.D. at the University of California Berkeley in 2010. After a research fellowship at the University of Melbourne in the Bio21 Institute, he joined the School of Chemistry at the University of New South Wales in 2013. He is currently an associate editor of the Journal of Enzyme Inhibition and Medicinal Chemistry. His research interests include developing mass spectrometry-based methods to investigate protein interactions and post-translational modifications, and diagnose diseases using non-invasive chemical sampling methods.

Importance of detection, quantification and identification of microplastics – does my instrumentation matter?

Åsa Jämting
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Abstract

Microplastics are now widely acknowledged as a significant environmental pollutant, and can be found in soils, natural waters, biota and animals. Microplastics are typically considered to have a size range spanning five orders of magnitude, from the sub-micron to millimetre range. In order to fully understand the source, distribution, transport, fate and impact of microplastics in the environment it is necessary to be able to accurately perform physico-chemical measurements. While the analysis of microplastics in the upper range of the size distribution is reasonably straight forward, as the size of the particles reduces, it becomes more challenging to characterise them appropriately. To do so accurately, it is essential to ensure that the testing instrumentation is fit-for-purpose for the sample under study and to understand the limitations of the technique being used for characterisation.

Here, we will discuss some international development opportunities in various forums (regulatory, metrology, standardization) and present some recent results from investigations into the presence or absence of microplastic particles in common personal care products to illustrate some of the issues in this emerging field.

Bio

Dr. Åsa Jämting is a senior scientist in the Nanometrology Section, National Measurement Institute, Lindfield, Sydney. She is the manager of the state-of-the-art nanoparticle characterisation facility, specialising in measurement and characterisation of a large number of different nanoparticle systems using a wide range of characterisation techniques. She is particularly interested in characterising nanoparticles in complex matrices, such as wastewater, food and sunscreen formulations. Her current research is focussed on various projects related to emerging measurement challenges for particulate materials, such as nanoparticles and microplastics in matrices of varying complexity.

Royal Australian Chemical Institute

Analysing Complex Volatile Compounds – The Need for Speed, the Map of Middle Earth and Which Pill to Choose, Red or Blue?

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Abstract

Today's laboratories are being asked for more every day; more samples run, more data acquired, more chemical information processed, and more results achieved… all in less time, for less money.
This presentation explores how higher throughput, better quality and more reliable analytical data acquisition and more thorough result interpretation may be achieved when analysing volatile and semivolatile compounds using a variety of Gas Chromatography (GC) and Mass Spectrometry (MS) techniques, hardware and software.
Firstly we'll look at the concept of Low Pressure Gas Chromatography (LPGC), the use of Hydrogen as a carrier gas and the Pegasus BT GC-Time-of Flight Mass Spectrometry (TOFMS) instrument for ways in which to speed up sample throughput. Then we'll explore the highly ordered way in which samples are resolved using comprehensive Gas Chromatography (GCxGC) and how we can take advantage of this when interpreting data. Finally we'll investigate how GCxGC coupled to High Resolution TOFMS can be used to resolve and identify unknown analytes in the most complex of samples.

Bio

I have been employed at LECO Australia for over 12 years as their Separation Science Sales expert responsible for the LECO range of low and high resolution GC and GCxGC Time-of-Flight instrumentation and Restek chromatography products. Prior to joining LECO Australia I worked for a number of pharmaceutical and specialty chemical companies including Pfizer, Astra Zeneca and Avecia in the UK as a research and development analytical chemist where he gained extensive hands-on chromatography experience before joining Thames Restek UK for a number of years as a Sales Representative. I am interested in the application of analytical chemistry, in particular chromatography, to solve real world challenges and in assisting analytical chemists in discovering solutions for these challenges. I live on the Central Coast, NSW with my wife and two lively sons and in my free time enjoy bushwalks, trips to the beach and running around on a soccer pitch with my local over 35s team!