

The cover depicts DNA molecules being focused within a capillary, reported by Zheng and Yeung (p. 149).

AUSTRALIAN JOURNAL OF CHEMISTRY

AN INTERNATIONAL JOURNAL FOR CHEMICAL SCIENCE

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Guest Editorial

Interact 2002 Conference Special Issue

Simon Apte, Paul Haddad

Aust. J. Chem. **2003**, *56*, 67–69.



Analysis is perhaps the oldest discipline of the molecular sciences; ecotoxicology one of the youngest. These two disparate siblings were brought together during the Interact 2002 conference.

Essays

Measurement Challenges in Bioanalysis

Helen Parkes

Aust. J. Chem. **2003**, *56*, 71–72.



Life scientists generally regard poor measurement comparability as an inevitable consequence of the complexity and difficulty of their disciplines. Can the results of a DNA assessment be replicated between laboratories or the quantity of genetically modified material in a food crop be determined reliably enough? A debate on how to establish an international biomeasurement infrastructure has begun; its key step is to engage the bioscience community in how to best apply concepts as traceability and uncertainty, and to demonstrate clearly the benefits of better measurement comparability.

Chemistry, Biology and Politics—The Case for Excellence in Environmental Assessment of Mining

David Jones

Aust. J. Chem. **2003**, *56*, 73–75.



The often negative public perception of the chemical and mining industries is a result of historical legacy and arguably lower regulatory standards for environmental protection in the past. Future project approvals will demand much greater attention to the potential for impact. The author contends this will require the focussed effort of multidisciplinary teams, including chemistry professionals with strong backgrounds in the fundamentals of the chemical sciences.

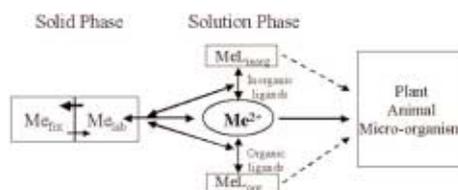
Reviews

Metal Bioaccumulation and Toxicity in Soils—Why Bother with Speciation?

Annette L. Nolan, Enzo Lombi,
Mike J. McLaughlin

Aust. J. Chem. **2003**, *56*, 77–91.

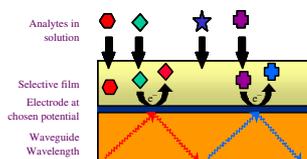
Unlike aquatic environments, guidelines for metals in terrestrial environments generally remain based on simple total concentration measurements. Such measurements cannot account for the different states (species) of the pollutant, their differing activities in a heterogeneous soil system, and their availabilities to organisms by means of many pathways. This review assesses the advantages and disadvantages of including chemical speciation information in soil protection policies.



Spectroelectrochemical Sensing Based on Multimode Selectivity Simultaneously Achievable in a Single Device: An Overview

William R. Heineman, Carl J. Seliskar,
John N. Richardson

Aust. J. Chem. **2003**, *56*, 93–102.



Recent advances in the development and application of spectroelectrochemical sensors possessing three modes of selectivity are reviewed here. The development and characterization of these novel sensors is described. An example of their application toward remediation of a nuclear waste site near Hanford, Washington (USA) is provided.

Measurement of Trace Elements in Marine Environmental Samples using Solution ICPMS. Current and Future Applications

William Maher, Frank Krikowa,
Jason Kirby, Ashley T. Townsend,
Peter Snitch

Aust. J. Chem. **2003**, *56*, 103–116.

Inductively coupled plasma–mass spectrometry offers excellent sensitivity but its susceptibility to interferences demands expert usage when applied to real-world samples. Coupling this detector to separation techniques, such as GC or HPLC, can circumvent these weaknesses but such a coupling remains a technical challenge.

Advances in the Application of Array Detectors for Improved Chemical Analysis, Part I. Comparison of Qualitative Analyses Using Large, Computer-Based Raman Spectral Libraries

M. Bonner Denton, Roger P. Sperline,
Jeffrey H. Giles, Daniel A. Gilmore,
Carolyn J. S. Pommier, Robert T. Downs

Aust. J. Chem. **2003**, *56*, 117–131.

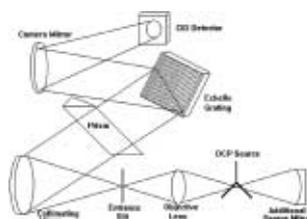


Successful analyses of five pure substances, six compound mixtures, and three minerals were achieved using Raman spectroscopy. Spectrum searches of the corresponding IR spectra were less successful. With qualitative identification by Raman often being accomplished in less than one minute, usually with no sample preparation, the authors predict that Raman spectroscopy will become a routine analytical technique in the near future.

Advances in the Application of Array Detectors for Improved Chemical Analysis, Part II. Rapid Trace Metal Analysis of High Solids Wastewater and Sludge Using a Direct Current Plasma Source Equipped with an Echelle Spectrometer and a Charge-Injection Device Detector

Jeff Prevatt, M. Bonner Denton

Aust. J. Chem. **2003**, *56*, 133–140.



Wastewater treatment works need a rapid trace metal analysis technique to screen incoming waste streams before discharging them into their treatment systems. The modified DCP-AES described here is shown to be one of the fastest screening techniques available for complex sample matrices. The instrument was typically able to produce a complete multi-element fingerprint from a high solids wastewater sample in less than one minute.

Regulation of Toxicants in the Australian Environment

Graham E. Batley

Aust. J. Chem. **2003**, *56*, 141–147.

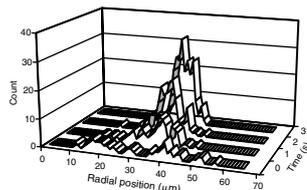
The chemical behaviour of toxicants in the environment will determine their impacts on human and ecological health. Speciation and bioavailability are recognized as important in assessing potential effects, yet only now are environmental guidelines addressing these. The way forward with respect to toxicant regulation is a departure from single-number guidelines, to site-specific risk-based assessments.

Current Chemistry

Counting Single DNA Molecules in a Capillary with Radial Focusing

Jinjian Zheng, Edward S. Yeung

Aust. J. Chem. **2003**, *56*, 149–153.

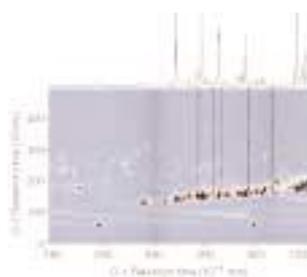


An improved method to count single molecules of DNA is reported. The method depends on radially focusing the molecules into the centre of a capillary using an electric field, and allows determination of attomolar concentrations. The technique can be applied to other molecules if they can be deformed or are non-spherical.

New Developments and Applications of Solvent-Free Sampling and Sample Preparation Technologies for the Investigation of Living Systems

Janusz Pawliszyn

Aust. J. Chem. **2003**, *56*, 155–158.

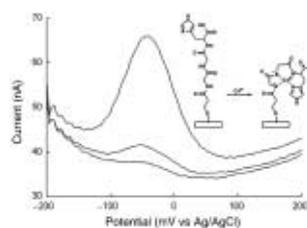


There is considerable interest in developing techniques to monitor levels of biologically active compounds in living systems in natural environments. The successful application of two in vivo solvent-free sampling techniques, based on coated fibre and membrane technologies coupled with GC, LC, or CE analysis instruments, are discussed here.

Biosensors for Detecting Metal Ions: New Trends

J. Justin Gooding, Edith Chow, Richard Finlayson

Aust. J. Chem. **2003**, *56*, 159–162.

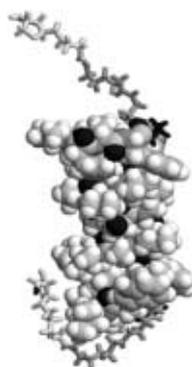


The presence of metals in the environment affects surrounding flora and fauna, so accurate monitoring is important. The detection of metal ions by the use of biological molecules has the advantage of selectivity, while electrochemical techniques are suitable for use in the field. Biosensors, which combine both of these advantages, can be based on peptides, DNA, or antibodies.

Solid-State NMR Structural Determination of Components in an Ion Channel Switch Biosensor

Aphrodite Anastasiadis, Frances Separovic

Aust. J. Chem. **2003**, *56*, 163–166.

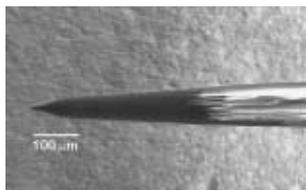


By combining solid-state NMR studies of powder and oriented samples with solution-state NMR studies of detergent micelles, three dimensional molecular structures of membrane proteins can be obtained. Here the authors describe how such techniques have enabled them to elucidate the structure of a number of biotinylated gramicidin A analogues with varying numbers of aminocaproyl linker groups.

Detection of NO at Small Carbon Electrodes as a Means to Assess the Inhibition Efficiency in its Release from Foetal Pig Islet-Like Cell Clusters

Jianwei Lin, Murray S. R. Smith,
Bernard E. Tuch, David A. Walsh,
Danny K. Y. Wong

Aust. J. Chem. **2003**, *56*, 167–174.

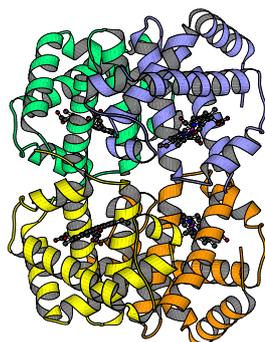


Nafion-coated carbon cylinder microelectrodes have been successfully used to determine the respective efficiency of *N*-monomethyl-L-arginine and heat shock treatment to inhibit the conversion of L-arginine to NO in cytokine-activated foetal pig islet-like cell clusters. These electrodes have the potential to be further developed as a probe for implantation into postgrafted islet clusters for the in vivo investigation of treatments to inhibit endogenous NO generation in β -cells (linked to hyperglycaemia in Type 1 diabetes patients).

Developments in Sports Drug Testing

Graham J. Trout, Jill H. Rogerson,
Adam T. Cawley, Christopher W. Alma

Aust. J. Chem. **2003**, *56*, 175–180.



Steroids, stimulants, narcotics, diuretics, peptide hormones: The number of substances banned from high level sports is wide, and the techniques to detect them subtle. Advances in MS-based detection methods are described, which can detect compounds ranging from small endogenous steroids to large polymeric haemoglobins (as shown).

Frigidly Concentrated Seawater and the Evolution of Antarctic Saline Lakes

Scott C. Stark, Barry V. O'Grady,
Harry R. Burton, Peter D. Carpenter

Aust. J. Chem. **2003**, *56*, 181–186.



Most saline lakes are in temperate regions, but freezing seawater results in the precipitation of a different sequence of salts and so produces brines of different composition. Concentrations of ions have been accurately measured for some saline lakes in Antarctica and the results compared with two models for the evolution of polar saline lakes.

Ultra-High Resolution Capillary Gas Chromatography by Using Cryogenic Modulation

Philip Marriott, Ruby Ong,
Robert Shellie, Robert Western,
YaJing Shao, Ranjini Perera, LiLing Xie,
Ann Jang Kueh, Paul D. Morrison

Aust. J. Chem. **2003**, *56*, 187–191.



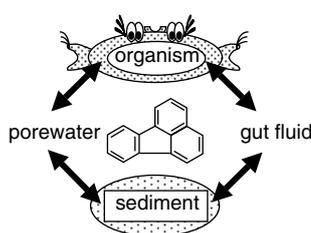
The science of chromatography has been practised for almost as long as chemistry itself—its importance reinforced through the award of a Nobel Prize. Here the development and use of ultra-high resolution capillary GC by using cryogenic modulation is discussed (shown). It allows the separation and identification of components of complex mixtures by modulating their movement between two GC columns (which comprise different stationary phase polarities) to increase the separation capacity and sensitivity of the system.

Full Papers

Extractability of Polycyclic Aromatic Hydrocarbons in Sediments: A Matter of Association?

Michael J. Ahrens,
Christopher W. Hickey

Aust. J. Chem. **2003**, *56*, 193–199.

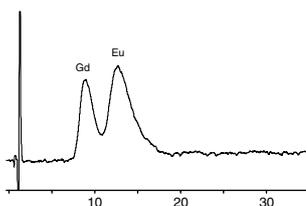


The bioavailability of polycyclic aromatic hydrocarbons (PAHs) to sediment-dwelling organisms greatly depends on the extent to which PAHs can desorb from sediment organic matter into aqueous medium. Results presented in this paper indicate that fluoranthene is bound by different types of organic carbon to different degrees, and question the utility of a universal equilibrium partition coefficient to predict this relationship.

Retention Characteristics of Lanthanide Ions on a Mixed Phosphonic Acid–Carboxylic Acid Cation Exchanger

Matthew J. Shaw, Pavel N. Nesterenko,
Greg W. Dicoski, Paul R. Haddad

Aust. J. Chem. **2003**, *56*, 201–206.



Ion-exchange resins functionalized with a mix of phosphonate and carboxylate groups have been used to separate lanthanide ions. The separation mechanism changes from ion-exchange to chelating with an increase in ionic strength of the eluent. Other factors influencing selectivity were investigated such as pH, presence of organics, and column temperature. Good separation of Gd and Eu (traditionally very difficult) was achieved (see Figure).

Active Barriers to Reduce Phosphorus Release from Sediments: Effectiveness of Three Forms of CaCO₃

Barry T. Hart, Simon Roberts,
Robert James, Mark O'Donohue,
Jeff Taylor, Dietfried Donnert,
Rüdiger Furrer

Aust. J. Chem. **2003**, *56*, 207–217.

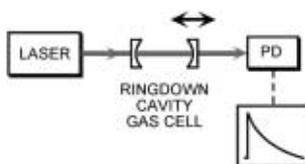


Core samples from Lake Carramar, Australia, were used in laboratory bioreactors (see Figure) to test three forms of calcite as active barriers to prevent phosphorus release from sediments (linked to algal blooms). The two precipitated calcite products (possessing the greatest surface area) proved most effective: a 2% layer of SoCal reduced phosphorous release by 100 times that of the control; ESCal, a cheaper Australian product, may go to further trials.

Swept-Cavity Ringdown Absorption Spectroscopy: Put Your Laser Light In and Shake It All About

Richard A. Shorten, Yabai He,
Brian J. Orr

Aust. J. Chem. **2003**, *56*, 219–231.



With effective optical path lengths in excess of 5 km, the cavity ringdown method represents an enhancement of traditional absorption spectroscopy. This paper covers some recent advances in the technique and surveys exciting advantages that sensors based on the ringdown principle offer in industry and medicine.

The Use of Lead Isotopes in Monitoring Environmental Impacts of Uranium and Lead Mining in Northern Australia

Niels C. Munksgaard,
Jennifer A. Brazier, Cristy M. Moir,
David L. Parry

Aust. J. Chem. **2003**, *56*, 233–238.

Lead isotope ratios have been used to assess environmental impacts associated with uranium and lead mining in northern Australia. The isotopic compositions allowed sources of lead in sediment, magpie geese liver, seagrass leaf and oyster soft tissue to be unambiguously identified.

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