8th Annual Congress on

Analytical and Bioanalytical Techniques

&

14th International Conference and Exhibition on

Pharmaceutical Formulations

August 28-30, 2017 Brussels, Belgium

Scientific Tracks & Abstracts

Day 1

Sessions

Analytical Techniques for Clinical Chemistry | Chemical Analysis

Session Chair
Rasha Hanafi
German University in Cairo, Egypt

Session Co-Chair
Graham Dawson
Xian Jiaotong Liverpool University, China

Session Introduction

Title: **Determination of capecitabine and its metabolites in plasma of Egyptian colorectal cancer patients**
Rasha Hanafi, German University in Cairo, Egypt

Title: **A potential universal cancer biomarker revealed by bioimaging of fluorescent probes for point-of-care screening of cancer**
Ta-Chau Chang, Academia Sinica, Taiwan

Title: **Surface functionalization and analysis of nanomaterials towards modification of their properties**
Graham Dawson, Xian Jiaotong Liverpool University, China

Title: **TiO_2 based nanoparticles as solid support for chemiluminescence detection: A range of analytical applications**
Entesar Al-Hetlani, Kuwait University, Kuwait

Rasha Hanafi et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Determination of capecitabine and its metabolites in plasma of Egyptian colorectal cancer patients

Rasha Hanafi[1] **S Shams**[1], **S Abdel-Maksoud**[1], **S Eid**[2] and **M Gad**[1]
[1]German University in Cairo, Egypt
[2]National Cancer Institute, Egypt

Colorectal Cancer (CRC) is constantly increasing in incidence both worldwide and at the national level. Chemotherapeutic agents often prescribed in CRC are Capecitabine (CCB) and 5-Fluorouracil (FU). CCB is activated to FU in a three steps reaction giving 5'-deoxy-5-fluorocytidine (DFCR), followed by 5'-deoxy-5-fluorouridine (DFUR) to yield finally FU, the active form, which is later deactivated to 5,6-dihydro-5-fluorouracil (DHFU). Patients exhibited variable responses and adverse events in response to CCB therapy, despite being treated with the same dose. This could be explained by the presence of different possible enzyme SNPs that can occur along the CCB activation and deactivation pathways. This study aims at developing a new method of analysis of CCB and its metabolites using HPLC-UV, to determine the plasma concentrations of CCB and its metabolites DFCR, DFUR, FU, DHFU and 5-Chlorouracil (CLU; the internal standard), followed by a correlation study with the toxicities occurring during therapy, to become a predictive method for toxicity, away from the exhausting genotyping process. A new superior analytical method is presented using computer-assisted method development, which achieved full separation of the six analytes during the least possible gradient time, eluting the compounds at 2.8, 3.2, 4.4, 5.2, 5.8 and 9.9 minutes for DHFU, FU, CLU, DFCR, DFUR and CCB, respectively. The method showed accuracy, precision and robustness upon validation. Clinical results showed a positive correlation between the DFCR concentration and mucositis, as well as, between the DFUR concentration and Hand-Foot Syndrome, confirming that this technique could be used for predicting such toxicities in CRC patients.

Biography

Rasha Hanafi joined the faculty of Pharmacy, Department of Pharmaceutical Chemistry in 2004, where she is currently Associate Professor of Instrumental Analysis and Analytical Chemistry. Dr. Hanafi received her pharmacy bachelor and her master's degree in pharmaceutical analysis from the faculty of Pharmacy, Cairo University in 1996 and 2005, respectively, and her PhD. degree from the faculty of Pharmacy, German University in Cairo in 2009 in biomedical analysis. She was promoted to associate professor in the Supreme Council of Universities in 2016. She is reviewer of international journals, has large number publications in peer reviewed journals and has presented in many conferences around the world. She supervised a large number of PhD and master students in the field of pharmaceutical and biomedical analysis. Dr. Hanafi's research involves analytical method development and validation within the Quality by Design framework, and is is a consultant and trainer for industry and academia.

rasha.hanafi@guc.edu.eg

Notes:

Ta-Chau Chang et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

A potential universal cancer biomarker revealed by bioimaging of fluorescent probes for point-of-care screening of cancer

Ta-Chau Chang[1,2], Ting-Yuan Tseng[1], Wei-Wen Chen[1]
[1]Academia Sinica, Taiwan
[2]National Taiwan University, Taiwan

Cancer remains as one of the leading causes of death in many countries. Cancer is not a single disease but a complex progression of cellular/tissue mutation. Currently, no "universal" cancer biomarker has been documented. It is a great challenge to find a universal cancer biomarker. Finding a common target of intracellular difference between cancer and normal cells is extremely important for cancer prevention, detection, and treatment. A single-stranded Guanine-rich (G-rich) sequence is capable of forming G-quadruplex (G4) via Hoogsteen hydrogen bonds under physiological condition. G4 oligonucleotides have recently gained much attention as a possible target for cancer research. Fluorescent probe together with optical imaging provides a means of visualizing the possible differences between cancer cells and normal cells. A fluorescent probe, 3,6-bis(1-methyl-2-vinylpyridinium) carbazole diiodide (o-BMVC), showed a large contrast in binding affinity to DNA of ~107 for G4s and ~105 for duplexes. Moreover, the fluorescent decay time of o-BMVC is longer (≥2.4 ns) upon binding to most G4s such as G-rich sequences in telomeres and some promoter oncogenes, while the decay time is shorter (~1.2 ns) upon interaction with duplex structures such as linear duplexes

Biography

Ta-Chau Chang was awarded his PhD degree from Iowa State University, USA 1985. He was a visiting fellow in CIRES at Boulder for one year and a postdoctoral fellow at University of Illinois at Urbana for two years. He went back to Taiwan and joined the Faculty of Institute of Atomic and Molecular Sciences, Academia Sinica 1988. His current research interests focus on the development and application of fluorescent theranostic agents in cancer research and advanced optical methods, and G-quadruplex in biomedical research.

tcchang@po.iams.sinica.edu.tw

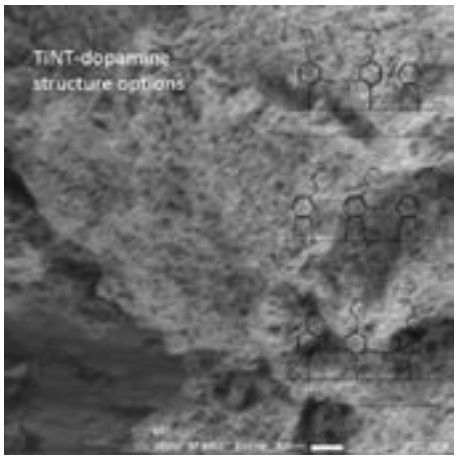
Notes:

Graham Dawson, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Surface functionalization and analysis of nanomaterials towards modification of their properties

Graham Dawson
Xian Jiaotong Liverpool University, China

Photo-catalyst materials which are suitably stable often have large band gaps, and can only be activated by UV light. Surface functionalization by organic molecules is a mild, efficient and green method to alter the photo-catalytic activity of semiconductors. Our recent research has involved the synthesis and modification of novel inorganic nanostructured materials in order to exploit their properties in visible light active photocatalytic systems. We have shown that self-assembled surface modification by organic molecules imparts trititanate nanotubes with stable, recyclable photocatalytic activity under visible light illumination. Using solid state NMR, XRD and Mass spectroscopy, we have recently been looking into the arrangement of the organic molecules on the nanotube surface. Surface Enhanced Raman Scattering (SERS) is a powerful analytical technique for chemical sensing of trace amounts of analyte, providing in-depth structural information. Once the molecule has been analyzed, in order to be reused, the surface molecule must be removed. Self-cleaning under UV or visible light is a promising method for this. We have incorporated photo-catalytically active titanate nanotubes with high surface area together with silver nanoparticles, rendering it SERS active, thus creating a self-regenerating SERS active nanocomposite material.



Biography

Graham Dawson is currently a Lecturer at Xi'an Jiaotong Liverpool University, Suzhou China, joining in March 2013. Before taking this position he worked at the Suzhou Institute of Nanotechnology and Nanobionics (SINANO) as a Post-doctoral Research Assistant then as an Associate Professor. During this time, he was Principal Investigator of several provincial and national level projects. He completed his PhD studies under Professor Wuzong Zhou at the University of St. Andrews, Scotland and has presented his research at several national and international conferences and published papers in peer reviewed international journals. His research interests are in the area of nanomaterial synthesis towards applications in photocatalytic degradation and water splitting.

graham.dawson@xjtlu.edu.cn

Notes:

Entesar Al-Hetlani et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

TiO_2 based nanoparticles as solid support for chemiluminescence detection: A range of analytical applications

Entesar Al-Hetlani, Mohmaed A and **Metwally M**
Kuwait University, Kuwait

This work describes a novel approach for analytes detection using $Ru(bpy)_3^{2+}$-Ce(IV) chemiluminescence (CL). Herein, we report the synthesis, characterization and application of a new type of hybrid nanoparticles (NPs). Mesoporous TiO_2-$Ru(bpy)_3^{2+}$ NPs were prepared using a modified sol-gel method by incorporating $Ru(bpy)_3^{2+}$ into the initial reaction mixture at various concentrations. The resultant bright orange precipitate was characterized via: TEM, N_2 sorptometry, ICP-OES, Raman and UV-Vis techniques. For comparison purposes, the concentration of $Ru(bpy)_3^{2+}$ incorporated in the NPs was quantified and compared to the same concentration of $Ru(bpy)_3^{2+}$ in solution in terms of the CL response. The results showed this type of hybrid material exhibited higher CL signal compared to the liquid phase due to the enlarged surface area of the TiO_2-$Ru(bpy)_3^{2+}$ NPs. The solid-state system was optimized using oxalate as a model compound. The amount of TiO_2-$Ru(bpy)_3^{2+}$ NPs and the effect of the oxidant flow rate were investigated. Subsequently, the optimized system was used to detect imipramine and bromazine. A linear range was obtained for both drugs at concentrations 1-100 pm. This approach is considered simple, low cost, facile and can be applied to a wide range of analytes.

Biography

Entesar Al-Hetlani completed her PhD in 2013 from Hull University, UK. She is an Assistant Professor at Kuwait University, Kuwait. Her research focuses on nanomaterials synthesis and applications for Forensic and Analytical Applications.

Entesar_saad@hotmail.com

Notes:

Sessions

Pharmaceutical Formulations | Liquid Dosage Forms | Pharmaceutical Analysis

Session Chair
Roger M Leblanc
University of Miami, USA

Session Introduction

Title: **Development and bioapplications of nontoxic carbon dots**
Roger M Leblanc, University of Miami, USA

Title: **Cyclodextrin-based formulations: The present and the future**
Tamas Sohajda, Cyclolab Ltd., Hungary

Title: **Optimizing early phase development of amorphous solid dispersion formulation thorough application of modeling tools**
Samuel Kyerematenng, AbbVie Deutschland GmbH & Co. KG, Germany

Title: **Properties of bacterial cellulose wound dressing containing sericin and polyhexamethylene biguanide**
Supamas Napavichayanun, Chulalongkorn University, Thailand

Roger M Leblanc, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Development and bioapplications of nontoxic carbon dots

Roger M Leblanc
University of Miami, USA

Carbon dots (C-Dots) with diameter smaller than 10 nm have recently attracted enormous attention in various fields due to their unique properties. In this talk, the synthesis, characterization and bioapplications of a new type of nontoxic, water-soluble C-Dots will be presented. A major medical challenge one faces to treat Central Nervous System (CNS) related diseases is to cross the tight junctions between endothelial cells, which are known as blood-brain barrier (BBB). Recently, our *in vivo* experimental observations suggested that the transferrin conjugated C-Dots could enter the CNS of Zebrafish while C-Dots alone could not. Thanks to the abundant presence of carboxylic acids on the surface, C Dots are easily conjugated with transferrin and anticancer drug doxorubicin. The system was then applied as a drug delivery system for the delivery of doxorubicin into cancerous cells. Our *in vitro* study showed greater uptake of the conjugates compared to free doxorubicin, the conjugates at 10 nM was significantly more cytotoxic than doxorubicin alone, reducing viability by 14-45 %, across multiple pediatric brain tumor cell lines. Accidents, disease and aging compromise the structural and physiological functions of bones, and *in vivo* bone imaging test is critical to identify, detect and diagnose bone related development and dysfunctions. Here we show that C-Dots with low quantum yield ("dark") bind to calcified bone structures of live Zebrafish larvae with high affinity and selectivity. Binding resulted in a strong enhancement of luminescence that was not observed in other tissues, including non-calcified endochondral elements. Retention of C dots by bones was very stable, long lasting, and with no detectable toxicity. These observations support a novel and revolutionary use of C-Dots as highly specific bioagents for bone imaging and diagnosis, and as a potential bone-specific drug delivery carrier.

Biography

Roger M Leblanc received his BS in Chemistry in 1964 from Universite Laval, Canada, and PhD in Physical Chemistry in l968 from the same university. From 1968 to 1970, he was a Postdoctoral Fellow in the Laboratory of Prof. George Porter, FRS, in Davy Faraday Research Lab, the Royal Institution of Great Britain. He was a Professor from 1970 to 1993 at Department of Chemistry and Biology in Universite du Quebec a Trois Rivieres, Canada. During this period, he was Chair from 1971 to 1975 at the same department, and Director from 1981 to 1991 at Photobiophysics Research Center. In 1994, he moved to University of Miami, where he has been a Professor at Department of Chemistry since then to present. At University of Miami, he was Chair of Department of Chemistry from 1994 to 2002, and he is appointed as Chair from 2013 to present. He was also one of the three editors of *Colloids and Surfaces B: Biointerfaces* from 1998 to 2017. During his early career as a Scientist, his research interest was on the photosynthesis and photoconductivity using surface chemistry and spectroscopy. His current research interest is to apply 2-dimensional (2-D) surface chemistry combined with spectroscopy and microscopy to investigate the properties of nanomaterials (carbon dots, graphene oxide and quantum dots) and the fibrillation process of amyloidogenic proteins (insulin, amyloid-beta peptide and islet amyloid polypeptide). He is also interested to design and develop biosensors with high sensitivity and selectivity for diseases diagnosis. He has published 512 scientific articles in peer-reviewed journals. As a Professor, he has supervised more than 100 Master's and PhD students.

rml@miami.edu

Notes:

Tamas Sohajda et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Cyclodextrin-based formulations: The present and the future

Tamas Sohajda and **Lajos Szente**
Cyclolab Ltd., Hungary

Cyclodextrins (CDs) are "cone-shaped" cyclic oligosaccharides, with a hydrophobic cavity and hydrophilic outer surface. These nanoscale substances have long been used as functional excipients in different pharmaceuticals due to their ability to encapsulate drugs and alter their disadvantageous features, e.g. increase the aqueous solubility, improve bioavailability, enhance chemical stability or simply to mask their taste. At present more than 40, CD-enabled human pharmaceutical products are on the market. The present of CDs is thus dominantly being used as excipients. The most favored are 2-hydroxypropyl-β-CD (HPBCD) and sulfobutylether-β-CD, applied in dozens of parenteral formulations, while other derivatives are used for oral, topical, nasal or ocular administration. The marvel of CDs lies in their flexibility: you can optimize the excipient for the active ingredient and for the purpose simultaneously. In the present lecture illustrative drug products will be highlighted demonstrating the applicability of derivatized oligosaccharides in the development of drug formulations. Outlook to the future potential related to drug delivery use of CDs will also be provided. CDs tagged with biological recognition-based labeling were prepared in order to deliver specific drugs to the site of action. Also, combinations with the application of colloidal structures (dispersions, liquid crystals and macromolecules) will be discussed. Yet the future of CDs is not limited to being used as excipients. We can harvest from their complex forming ability *in vivo* as well, in products, containing CDs as APIs. While the initial idea was to use CDs as detoxification agents or to selectively remove chemicals from the system (e.g. Sugammadex – Bridion), this concept has grown into clinical trials and studies using CDs as API alone (HPBCD as an orphan drug against Niemann-Pick C, Focal Segmental Glomerulosclerosis or Alport Syndrome). A number of further therapeutic applications of CDs themselves are expected to come, some potential areas will be reviewed.

Biography

Tamás Sohajda has been working at CycloLab Ltd., for six years. Currently he is the Director of Research and Development. After graduating as a Pharmacist, he obtained degrees in Pharmaceutical Economy and Quality Assurance. He wrote his PhD thesis on the investigation and understanding of cyclodextrin complexes on a molecular level studying a great number of biological activities and CD derivatives. At CycloLab Ltd. he has been coordinating all development and research works aimed at various and diverse fields such as developing new, cyclodextrin-aided formulations (solid and semi-solid dosage forms, parenterals, etc.), preparing generic formulations or improvements of current products by introducing CDs, designing new industrially important CD derivatives ideal as next generation excipients, drug delivery systems or as biologically active compounds.

sohajda@cyclolab.hu

Notes:

Samuel Kyerematen, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Optimizing early phase development of amorphous solid dispersion formulation thorough application of modeling tools

Samuel Kyerematen
AbbVie Deutschland GmbH & Co. KG, Germany

Statement of the Problem: Amorphous Solid Dispersion (ASD) is an established formulation technique for improving the bioavailability of poorly water-soluble Active Pharmaceutical Ingredients (APIs) by increasing solubility, wettability and dissolution rate. Successful manufacturing of ASD formulation by Hot Melt Extrusion (HME) requires selection of e.g. the right API load, excipients, and processing temperature. API load is also crucial in determining important quality attributes of the drug product such as long term physical stability to ensure consistent product performance during its self-life. Identifying the possible maximum drug load limit and excipients for HME feasibility and risk assessment, and long-term physical stability of the manufactured ASD can be quite challenging whereby several extrusion trials are required in addition to prolonged stability studies. Exploring the optimal design space during early phase of formulation development by this approach requires significant amount of resources including API which may be limitedly available during this phase.

Methodology & Theoretical Orientation: As an API-sparing approach, novel empirical model and the rigorous thermodynamic Perturbed Chain Statistically Associating Fluid Theory (PC-SAFT) were applied to model ASD phase diagram of several formulations to effectively and quickly explore the design space to optimize formulation development. These were followed up with HME manufacturing and long-term stability studies (up to 18 months) of the formulations under ICH conditions to verify the model-predicted results. Several APIs and polymeric excipients including Soluplus, Copovidone, PVP, and HPMCAS were used in the studies.

Findings: The modeling tools were found to be very suitable in estimating extrusion temperature required for generating crystal-free ASD formulations as well as predicting their physical stability under different storage conditions, i.e., temperature and relative humidity.

Conclusion & Significance: Recent advances in predictive ASD phase diagram modeling proved to be reliable tools for excipient selection, HME temperature prediction, and designing ASD formulations for maximum drug load and physical stability. Applying these tools enables successful ASD formulation optimization using less resources and materials.

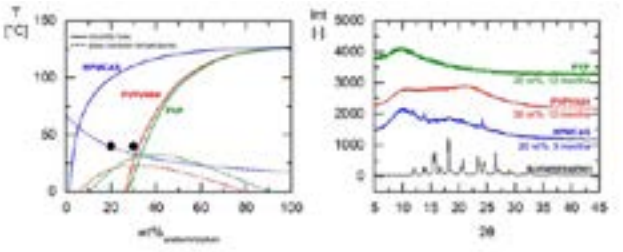


Fig 1. *Left:* Phase behavior of Acetaminophen/PVP, Acetaminophen/Copovidone, and Acetaminophen/HPMCAS at 40°C/75% RH. The solid and dashed lines show solubility prediction using PC-SAFT and glass transition temperature prediction by Gordon-Taylor equation, respectively. *Right:* XRPD diffractograms of crystalline Acetaminophen and its ASD formulations with the three polymers after storage at 40°C/75% RH.

Biography

Samuel Kyerematen is a Senior Scientist in the Global Pharmaceutical Sciences Division at AbbVie Deutschland in Ludwigshafen. His research activities focus on scientific advances in the understanding of amorphous molecular solids, and development and application of models in predicting with confidence the preferred composition, manufacturing process, and stability of amorphous solid dispersion formulations. His current responsibilities at AbbVie Deutschland include leading the Material Science Group that supports formulation development, and mentoring Doctorate research students and other scientists within the company. He received his Doctorate in Polymer Science from Martin-Luther-Universität in Germany.

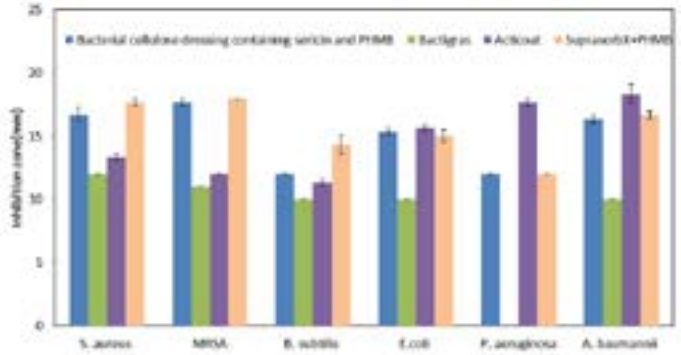
samuel.kyerematen@abbvie.com

Supamas Napavichayanun et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Properties of bacterial cellulose wound dressing containing sericin and polyhexamethylene biguanide

Supamas Napavichayanun and **Pornanong Aramwit**
Chulalongkorn University, Thailand

The ideal wound dressing should be a moist and oxygen-permeated environment, exudate adsorption, enhanced wound closure, and infection protection. The bacterial cellulose wound dressing containing sericin and polyhexamethylene biguanide (PHMB) is a natural wound dressing that is easily produced from bacterial cellulose (*A. xylinum* strain in coconut water medium), silk sericin (protein from silk cocoon), and antiseptic (PHMB). Components of this dressing contain many benefits closely to the ideal wound dressing properties. For the dressing production, the bacterial cellulose dressing was loaded with 1% w/v silk sericin followed by 0.3% w/v PHMB loading. All processes were carried out in sterile conditions. After preparation, the dressings were sterilized with gamma radiation at 25 kGy. The properties of the dressing were tested in term of sericin and antimicrobial releasing, antimicrobial property, and collagen type I production test comparing with commercial product. The results showed that the sufficient concentration for elimination of all bacteria (*S. aureus,* MRSA*, B. subtilis, E. coli, P.aeruginosa, A. baumannii*) of PHMB was released from the dressing within 30 minutes and optimal concentration for collagen type I production of sericin was released within 4 hours. The dressing was superior in terms of antimicrobial activity against all bacterial strains than Bactigras®. In comparison with silver-loaded Acticoat®, the antimicrobial activity of the dressing was better against Gram-positive bacteria often found in chronic wounds (*S. aureus* and MRSA). The antimicrobial difference between the dressing and Suprasorb®X + PHMB was only noticed for *B. subtilis*. Moreover, the cells cultured from the released solution of our novel dressing produced significantly higher amount of collagen type 1 than those cultured with the bacterial cellulose wound dressing without silk sericin. Therefore, the bacterial cellulose wound dressing containing sericin and PHMB contains many advantages to be the ideal wound dressing.



Biography

Supamas Napavichayanun is a PhD student at the Faculty of Pharmaceutical Sciences, Chulalongkorn University, Thailand. She earned a BSc from Faculty of Pharmaceutical Sciences, Chulalongkorn University in 2010. Her research experience has ranged from protein including silk proteins and biomaterials. She also did clinical researches in the area of dermatology especially materials for wound healing application.

snsupamas@gmail.com

Notes:

Sessions

Mass spectrometry | Electrochemical analysis | Spectroscopy

Session Chair
Yoshitaka Fujimoto
National university in Tokyo, Japan

Session Co-Chair
Daria V Navolotskaya
Saint-Petersburg State University, Russia

Session Introduction

Title: **Rapid determination of U-236 in the soil contaminated by the fukushima daiichi nuclear power plant accident using single extraction chromatography combined with triple-quadrupole inductively coupled plasma-mass spectrometry**
G S Yang, Hirosaki University, Japan

Title: **Resonant X-ray emission spectroscopy for analysis of platinum anti-cancer complexes and their interaction with biomolecules**
Joanna Czapla-Masztafiak, Institute of Nuclear Physics Polish Academy of Sciences, Poland

Title: **First-principles theoretical investigation of graphene for sensor applications**
Yoshitaka Fujimoto, National University in Tokyo, Japan

Title: **Applications of near infrared and raman spectroscopy for the analysis of counterfeit medicine**
K Dégardin, Roche, Switzerland

Title: **Interrupted amperometry: A new ultrasensitive electroanalytical method**
Daria V Navolotskaya, Saint-Petersburg State University, Russia

Title: **Electrochemical sensing of analytes using conducting polymers**
M V Sangaranarayanan, Indian Institute of Technology, India

Title: **Fluorescence quenching and diffusion within Li salt added ionic liquid media**
Anu Kadyan, Indian Institute of Technology Delhi, India

G S Yang et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Rapid determination of U-236 in the soil contaminated by the fukushima daiichi nuclear power plant accident using single extraction chromatography combined with triple-quadrupole inductively coupled plasma-mass spectrometry

G S Yang, H Tazoe and **M Yamada**
Hirosaki University, Japan
Institute of High Energy Physics, CAS, China

Method Development for 236U in Soil

Based on use of the new generation of triple-quadrupole ICP-MS (ICP-MS/MS), a novel technique for measuring ^{236U} activities and $^{236}U/^{238}U$ ratios in soil has been developed. This simple method incoporated two procedures: a total dissolution with HF + HNO_3 + HClO4 followed by single DGA chromatographic separation (Figure 1). The analytical accuracy and precision of $^{236}U/^{238U}$ ratios, measured as $^{236}U^{16}O+/^{238}U^{16}O+$, were validated by using the reference materials IAEA-135, IAEA-385, IAEA-447, and JSAC 0471[1].

U Isotope in the Soil Contaminated by the FDNPP Accident

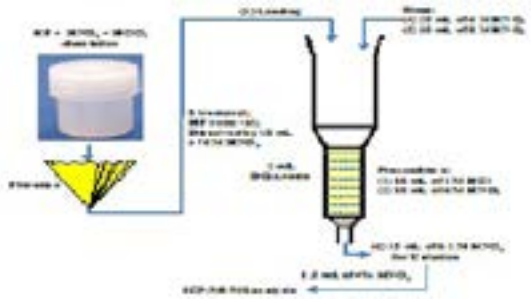
For 46 soil samples lightly and heavily contaminated as ^{134}Cs by the FDNPP accident, the $^{236}U/^{238}U$ isotopic ratio ((0.99–13.5)×10-8) was comparable with those of global fallout values found in surface soil in Japan [2, 3], indicating the release of radioactive U from the FDNPP accident was a trace amount.

References

[1]Yang *et al.* (2016) *Anal. Chim. Acta* 944, 44-50.

[2]Sakaguchi *et al. (2009) Sci. Total Environ.* 407, 4238–4242.

[3] Sakaguchi *et al. (2010) Sci. Total Environ.* 408, 5392–5398.



Biography

Guosheng Yang obtained his PhD from Institute of Chinese Academy of Sciences (CAS) in 2012. After working in the National Institutes for Quantum and Radiological Science and Technology, Japan (2012-2014) and CAS, China (2014-2015), he is working in the Institute of Radiation Emergency Medicine, Hirosaki University, Japan mainly to develop novel mass-spectrometric methods to measure trace radioisotopes (^{135}Cs, ^{236}U, ^{129}I, ^{90}Sr, Pu isotopes).

yanggs@hirosaki-u.ac.jp

Notes:

Joanna Czapla-Masztafiak et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

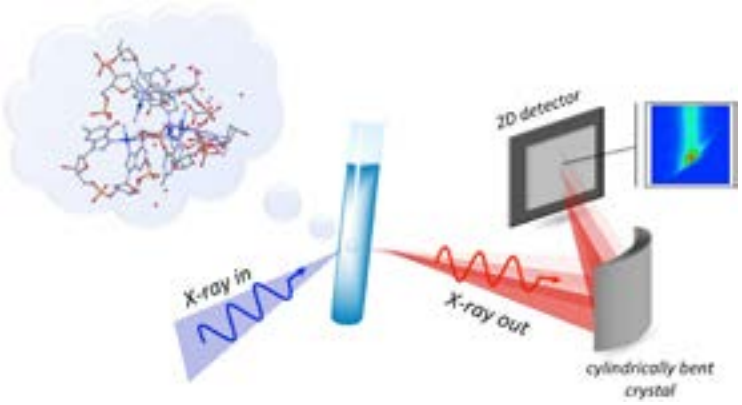
Resonant X-ray emission spectroscopy for analysis of platinum anti-cancer complexes and their interaction with biomolecules

Joanna Czapla-Masztafiak[1], Jacinto Sá[2], Jakub Szlachetko[3] and **Wojciech M Kwiatek[1]**
[1]Institute of Nuclear Physics Polish Academy of Sciences, Poland
[2]Uppsala University, Sweden
[3]Institute of Physics, Jan Kochanowski University Kielce, Poland

Statement of the Problem: The accidental discovery of the anticancer properties of cisplatin and its clinical introduction in the 1970s paved the way for the use of platinum based metallodrugs in chemotherapy. Second-generation analogues (e.g. carboplatin) were discovered shortly after. However, the clinical introduction of new anticancer metallodrugs has slowed down dramatically, especially considering the number of new drugs synthesized each year. Probably, the most critical factor for this slow progress is the inability to elucidate in a timely manner how metallodrugs induce tumor death, precluding the rational development of new derivatives with enhanced anticancer capabilities. Most chemotherapeutic agents exert their antitumor effect by damaging DNA and its replication machinery. Therefore, the correlation between the covalent bonding to DNA and the cytotoxicity of the metal complex remains a central step in the search for new anticancer drugs.

Methodology & Theoretical Orientation: Herein, we report a strategy to follow the chemical structure and coordination of platinum-based antitumor drugs by DNA under physiological conditions, namely by means of *in situ* resonant X-ray emission spectroscopy (RXES). RXES is an atom specific photon-in photon-out scattering technique which avoids the tedious steps of extraction and crystallization required by conventional X-ray techniques.

Conclusion & Significance: The spectroscopic method proposed by us was successfully used to validate the mechanism of action of cisplatin as well as elucidate the DNA binding of Pt103 compound that exhibits cytotoxic activity. Moreover, we showed that RXES can be used to unveil the electronic structure of metallodrugs with high resolution and sensitivity and to disentangle differences in the electronic structure of the metal canter induced by a secondary ligand stereochemistry.



Biography

Joanna Czapla-Masztafiak has her expertise in the use of X-ray spectroscopy to study biological systems. She obtained Master's Degree in Medical Physics from AGH University of Science and Technology in Krakow, Poland and PhD in Physical Sciences from Institute of Nuclear Physics Polish Academy of Sciences in Krakow, Poland. She also successfully completed Postdoc project in Paul Scherrer Institute in Villigen, Switzerland. Her research interests cover the application of X-ray spectroscopy to study DNA damage caused by radiation and chemical agents. Recently, she is developing laboratory instrument for X-ray absorption and X-ray emission studies of the interaction of metal compounds with biomolecules.

joanna.czapla@ifj.edu.pl

Yoshitaka Fujimoto, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

First-principles theoretical investigation of graphene for sensor applications

Yoshitaka Fujimoto
Tokyo Institute of Technology, Japan

Ever since the successful exfoliation of graphene from multilayer graphite, graphene has received much interest from the viewpoints of fundamental physics and relevant applications in nanoelectronics because it shows various unique properties. Specifically, due to its extremely high carrier mobility, graphene is a potential device material for next-generation nanoelectronics. One of the effective ways to control the electronic properties of graphene is to dope with heteroatoms. Furthermore, substitutionally doped graphene can often enhance its chemical reactivity. Thus, doped graphene is also a good candidate for promising sensor applications because of the high carrier mobility as well as the high sensitivity. I will talk about our theoretical works of chemical doping as well as gas adsorption including environmentally polluting gases effects on the stabilities and the electronic properties of graphene layers based on the first-principles electronic-structure study within the density-functional theory.

Biography

Fujimoto received his PhD degree in Engineering from Osaka University, Japan. After receiving his PhD he moved to the University of Tokyo. Then, he joined Department of Physics, Tokyo Institute of Technology as an Assistant Professor. His research interests include electronic properties of surfaces/interfaces of semiconductors and atomic-layered materials. He has published over 50 technical articles in peer-reviewed journals, reviews, book, book chapters, etc. and has served as referee of many international journals, organizer and committee in conferences.

fujimoto@stat.phys.titech.ac.jp

Notes:

K Dégardin et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Applications of near infrared and Raman spectroscopy for the analysis of counterfeit medicines

K Dégardin and **Y Roggo**
Roche, Switzerland

Counterfeiting is a crime with dreadful consequences, especially in the case of medicines. All type of counterfeits can be found, from the ones devoid of Active Pharmaceutical Ingredient (API) to under dosed medicines. Fast and reliable analyses are consequently necessary to confirm the cases and evaluate the risk encountered by the patients. Near Infrared Spectroscopy (NIRS) and Raman spectroscopy present many advantages for that purpose. There are indeed both fast, non-destructive methods, that provide chemical information about the analysed samples. The advances in technology enabled their miniaturisation and therefore their use on the field for even faster analyses. Thanks to chemo-metric tools, the chemical signature of a suspect sample can be rapidly compared to the genuine references, providing a fast yes/no answer. Three applications will be presented for the analysis of counterfeit medicines. The first methods that will be presented consist of the NIR identification with a lab instrument, using different chemo-metric models, of all the tablets produced by Roche, which represents 30 pharmaceutical products. The described method will also be applied to the detection of counterfeits of these products. The performance of two NIR handheld spectrometers will then be presented for the analysis of counterfeited tablets on the field. The complementarity of NIR with Raman spectroscopy will finally be illustrated through examples of spectral analysis of both solid and biological products.

Biography

Klara Dégardin is working at Roche Pharmaceuticals in Switzerland, and is responsible for the Anti-Counterfeiting lab. She is holder of a master's degree in Chemistry and of a PhD in forensic science. She has been working at Roche since 2007, and within the complaints and counterfeits group has specialized in various analytical methods like Raman and near infrared spectroscopy.

klara.degardin@roche.com

Notes:

Daria V Navolotskaya et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Interrupted amperometry: A new ultrasensitive electroanalytical method

Daria V Navolotskaya and **Sergey S Ermakov**
Saint-Petersburg State University, Russia

Interrupted amperometry is a new technique for diffusion current measuring. The extremely high sensitivity is achieved due to the special approach to the signal-to-noise ratio enhancement. Conventionally, the signal is associated with the diffusion controlled faradaic current. Capacitive current is usually referred to the noise. In interrupted amperometry, capacitive current is included in analytically useful part of the signal as well as faradaic current. Technically this is realized by adding a switcher to the conventional electrical circuit for amperometric measurements. The switcher locks the circuit for the period of time tl and then opens the circuit for the period of time to. Opening (or interrupting) and locking of the circuit are repeated periodically during the entire experiment. The average measured current is defined as: $I_m = T/t_l (I_d + \Sigma I_i)$ where, $T=t_l+to$ is the period of switching, I_d is the diffusion current and Ii are interfering currents. If the T/t_l ratio is of several orders, for example when tl=100 μs and T=100 ms, the measured current also exceeds the diffusion current for several orders. Analytical possibilities of the proposed technique were investigated via direct determination of iron (III), Cd (II), Pb (II) ions, phenol and hydroquinone in aqueous solutions; determination of dichromate ion in titration mode; and determination of oxygen using a Clark-type sensor.

Biography

Daria Navolotskaya completed PhD from Saint-Petersburg State University in 2013. She is currently working as a Senior Lecturer in the department of Analytical Chemistry at the same institution.Professor Sergey Ermakov is the head of the department of analytical chemistry at Saint-Petersburg State University. He has published more than 40 papers in reputed journals.

navolotskayadv@gmail.com

Notes:

M V Sangaranarayanan, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Electrochemical sensing of analytes using conducting polymers

M V Sangaranarayanan
Indian Institute of Technology, India

The electrochemical sensing of biologically important compounds is a frontier area of research in analytical, medicinal and environmental chemistry. The electrochemical sensing techniques using conducting polymers are robust and versatile.

Among various sensing applications of conducting polymers, enzymatic and non-enzymatic sensing of glucose, urea, dopamine etc deserve mention [1]. Conducting polymers extensively investigated in this context encompass polyaniline and polypyrrole. These can be prepared using various types of surfactants so as to yield impressive nanostructures, with improved sensitivity and selectivity. The sensing of glucose using polyaniline nanofibers has been demonstrated using cyclic voltammetric, amperometric and impedimetric analysis [2] with impressive detection limits and calibration range. The potentiodynamic polymerization of pyrrole on Pt is shown to yield non-enzymatic sensors of urea [3]. The sensing of other compounds such as Levo-thyroxine[4], dopamine etc will also be highlighted.

Biography

M V Sangaranarayanan obtained his PhD from the Indian Institute of Science Bangalore and was an Alexander von Humboldt Fellow with Prof. Dr. Wolfgang Schmickler subsequently. He is presently employed as a Professor at the Department of Chemistry, Indian Institute of Technology Madras, Chennai. He has published nearly 120 papers in refereed Journals and co-authored two textbooks. His research interests are in electron transfer theories, conducting polymers, electrochemical supercapacitors and biosensors.

sangara@iitm.ac.in

Notes:

Anu Kadyan et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-003

Fluorescence quenching and diffusion within Li salt added ionic liquid media

Anu Kadyan and **Siddharth Pandey**
Indian Institute of Technology Delhi, India

In the fast-growing world with the ever-increasing need for alternative solvents, ionic liquids are being explored widely in almost all areas of chemistry. Ionic liquids are room-temperature molten salts, composed of ions with notable physicochemical properties, such as, good thermal stability, high solubility, negligible vapor pressure, and non-flammability, among others. In the current energy scenario, lithium-ion batteries have proven to be a promising choice for mobile applications. But to expand its applications to large-scale, we have to cope-up with some of the limitations. Thermal stability is a major issue in the currently used electrolytes, in lithium ion batteries. While the organic solvents had their own limitations, ionic liquids, because of their desirable properties, have drawn much attention from researchers as alternative electrolytes for lithium-ion batteries. To further develop and improve this new alternative class of (ionic liquid + Li salt) electrolyte system for industrial and commercial purpose, knowledge of diffusion within such systems is of utmost importance. We present a detailed investigation of fluorescence quenching of a model solute pyrene by an electron/charge acceptor quenching agent nitromethane dissolved in [1-ethyl-3-methylimidazolium bis(trifluoromethyl sulfonyl)imide ([emim][Tf_2N]) + lithium bis(trifluoromethyl sulfonyl) imide ($LiTf_2N$)] mixtures in the temperature range (298.15 to 358.15)K. Various equilibrium quenching constants as well as bimolecular quenching rate constants are obtained and related to the diffusion behavior within ([emim][Tf_2N] + $LiTf_2N$) system. The result is correlated with the results from fluorescence correlation spectroscopy using a different probe. Details of diffusion behavior showing versatility of (ionic liquid + Li salt) systems are established.

anu.kadyan1@gmail.com

Notes:

8th Annual Congress on

Analytical and Bioanalytical Techniques

&

14th International Conference and Exhibition on

Pharmaceutical Formulations

August 28-30, 2017 Brussels, Belgium

Scientific Tracks & Abstracts

Day 2

Sessions

Spectroscopy | Separation Technique

Session Chair
Nobuyuki Ichinose
Kyoto Institute of Technology, Japan

Session Co-Chair
David G Churchill
Korea Advanced Institute of Science and Technology, South Korea

Session Introduction

Title: **Effect of laser-induced shockwave on molecules and particles in solution**
Nobuyuki Ichinose, Kyoto Institute of Technology, Japan

Title: **Synthetic steps towards reversible chalcogen-based sensing of essential neurodegenerative disease factors**
David G Churchill, Korea Advanced Institute of Science and Technology, South Korea

Title: **Forensic applications of chiral and stable isotope analysis**
Sherlock Tai, Unviversity of Glasgow, UK

Title: **Mass spectrometry: A complementary tool to ELISA for allergen detection**
M Planque, University of Namur, Belgium

Nobuyuki Ichinose, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Effect of laser-induced shockwave on molecules and particles in solution

Nobuyuki Ichinose
Kyoto Institute of Technology, Japan

Focusing of a nanosecond laser pulse (≈200 μJ) into aqueous solutions with an objective lens generates a high temperature plasma by dielectric breakdown, which induces generation of shockwave. Propagation of the shockwave with a high pressure causes linear and non-linear effects on the solute or dispersed particles. Time-resolved fluorescence spectroscopic observation under microscope has revealed that the shockwave affects local concentration of solutes due to a sub-mm movement of the molecules/particles with a near-sonic velocity in water. Combination of a ≈100μm capillary to confine the shockwave propagation into one-dimension and a collagen gel to control the holding and releasing of the loaded molecules/particles made their movement give a spot as if they were brought by a laminar flow. The distance travelled of a few tens to hundreds μm by the fluorescent-labeled proteins, DNAs, and polysaccharides or CdSe nanoparticles was found to be molecular type- and size-dependent. This technique (laser-induced shockwave chromatography) can avoid unwanted adhesion onto the solid stationary phase and will be applicable to prompt analysis to study aggregation/polymerization phenomena of biomolecules.

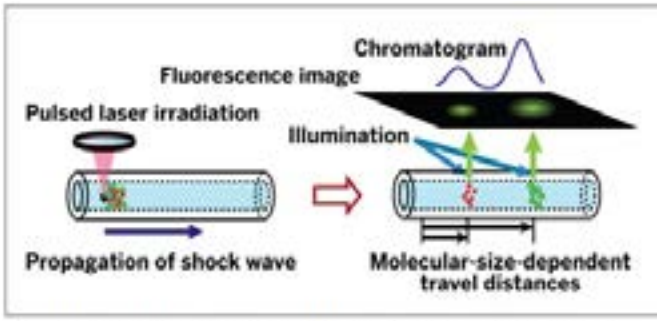


Figure 1: Schematic illustration of the laser-induced shockwave chromatography

Biography

Nobuyuki Ichinose received his PhD from Osaka Prefecture University, Japan. He is the professor of Kyoto Institute of Technology, Japan. He has over 60 publications in various fields in chemistry.

ichinose@kit.ac.jp

Notes:

David G Churchill et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Synthetic steps towards reversible chalcogen-based sensing of essential neurodegenerative disease factors

David G Churchill[1,2], **Sandip V Mulay**[1,2], **Youngsam Kim**[1,2] and **Tesla Yudhistira**[1,3]
[1]Korea Advanced Institute of Science and Technology, South Korea
[2]Institute for Basic Science, Republic of Korea
[3]Indonesia Endownment Fund for Education, Indonesia

The chemical etiology of neurodegenerative diseases, is multifactorial and relates to proteins, biomolecules, as well as small soluble analytes including metal ions and ROS. The over-abundance of ROS/RNS could be an indication of Alzheimer's and/or Parkinson's disease (PD). Recent articles by us and other researchers have begun connecting the dots of this small molecule chemistry. There is an incredible interest in preparing next-generation (e.g. ROS) probes that are reversible, sensitive, and also robust. Hypotheses involve also discrepancies in metal ion concentrations in various regions the brain; some metals are redox active. Concentrations and the innate chemistry of selenium for example may connect to proposed/tentative etiology of dementia. For all of these reasons and more, we feel that the pursuit of studying, e.g. organoselenium chemistry in this context will be fruitful for years to come. In this oral presentation and discussion, selenium, a key element in the redox chemistry of life and for its ability to engage in catalysis, is presented and debated in terms of diagnosis (probing), as well as potentially in therapy. To-date, the role of fluorescence and fluorescent molecules in diagnosis, treatment, as well as in biomedical research, has great current medicinal significance; this is the focus of concentrated effort across the scientific research spectrum. In particular, organoselenium and/or organosulfur molecules show great promise in the detection of reactive oxygen/nitrogen species (ROS/RNS) - key factors in ageing/neurodegenerative disease in living systems. The boron dipyrromethene (BODIPY) system is a versatile class of fluorescent dye; it is commonly used in labelling, chemosensing, light-harvesting, and solar cell applications due to the many compelling characteristics, including an intense absorption profile, a sharp fluorescence emission spectrum, and high fluorescence quantum yield. As part of our ongoing effort to study chalcogenide systems, dithiomaleimide- and phenylselenide probes (among many others) have been designed, synthesized and characterized. Commonly, fluorescence is quenched by photoinduced electron transfer (PeT) mechanism. These probes show a "turn-on" fluorescence response upon reaction with ONOO- (BDP-NGM) and HOCl (Mes-BOD-SePh) with significant increase in emission intensity with fast response to ROS/RNS. Related studies with superoxide have also been published. Live cell imaging showed that the current probes can be used for the selective detection of ROS and RNS in living systems.

Biography

David G. Churchill obtained a BS degree in Chemistry at the University at Buffalo(NY) while performing X-ray crystallographic studies. He then studied under professor Gerard (Ged) Parkin at Columbia University (NY). After his PhD, he served as a postdoctoral fellow for professor Kenneth N. Raymond in the Department of Chemistry at UC Berkeley (CA). He started his academic career in South Korea since 2004 and then became full professor at Korea Advanced Institute of Science and Technology (KAIST) in 2017.

dchurchill@kaist.ac.kr

Notes:

Sherlock Tai, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Forensic applications of chiral and stable isotope analysis

Sherlock Tai
University of Glasgow, UK

In a forensic investigation, identification of the source of physical evidence and the actual chemical composition are important. Two types of identification techniques which may be suitable for chemical source evaluation, namely chiral and stable isotope analysis, are introduced in this presentation. In many chemical or biochemical reactions, selectivity exists between a pair of enantiomeric reactants, the relative amount of an enantiomeric pair may therefore be different depending on the source. On the other hand, isotopic fractionation occurs during every physical, chemical and biological process, causing natural variation of stable isotopic abundances of chemicals in different sources to occur. Therefore, the stable isotopic ratio can also be a signature of chemical source. These two techniques are found to have potential on providing useful information in a wide range of forensic and environmental applications (crime investigation, drugs, contamination, etc.) with many examples found within the literature. In our current work, the techniques were applied to analyse synthetic cathinones, which are novel psychoactive substances synthesized by clandestine laboratories. These substances are thus concerned by law enforcement agencies worldwide and legislation has been set up in many countries, such as the Psychoactive Substance Act 2016 in UK.

Biography

Sherlock Tai is currently a PhD student in Forensic Medicine and Science, University of Glasgow, member of RSC, Chartered Society of Forensic Science and The Forensic Isotope Ratio Mass Spectrometry Network. His research is about Forensic Chemistry and Instrumental Analysis and he is interested in utilizing profiling techniques such as stable isotope and chiral analysis to identify possible sources of crime scene evidence.

sherlocksctai@gmail.com

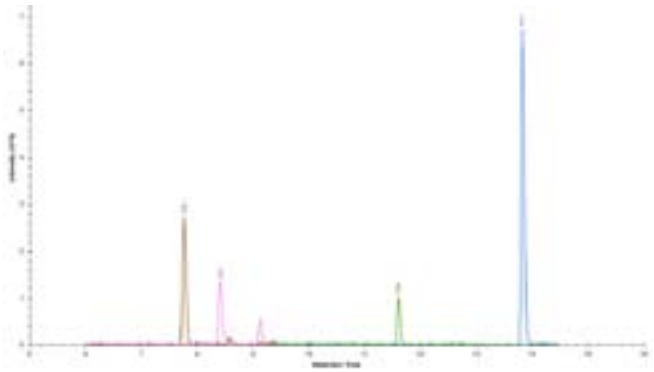
Notes:

M Planque et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Mass spectrometry: A complementary tool to ELISA for allergen detection

M Planque[1,2], A C Huet1, T Arnould[2], A Lamote[1], M Dieu[2], P Renard[2] and **N Gillard[1]**
[1]CER Groupe, Health Department, Belgium
[2]University of Namur, Belgium

Food allergies rise increasingly over the last decades. To protect themselves, food customers must exclude the allergenic food. Unfortunately, unintentional contaminations in finish products are still possible due to cross-contamination during food production, and food storage. To help producers, food laboratories developed methods for the protection of allergic customers. Most contaminations of food products by allergens are determined by enzyme-linked immunosorbent assay (ELISA). However, high-baked allergens in food products are sometimes hardly detected by ELISA. Ultra-high-performance liquid chromatography coupled to tandem mass spectrometry recently developed allows a highly specific and sensitive detection of processed allergens in food products. The establishment of a UHPLC-MS/MS method is expensive compared to ELISA method. Both methods present advantages and disadvantages, but, they are complementary. The guideline SMPR 2016.002, published in 2016, is dedicated for UHPLC-MS/MS methods. Food products selected in this guideline will be analyzed by ELISA and UHPLC-MS/MS and compared. This study will present the complementarity of UHPLC-MS/MS and ELISA method for a better use and comprehension of methods for the detection of allergens.



Biography

M Planque holds a Master's degree in Chemistry. She started her PhD in 2014 at CER Groupe (Health Department) and at the University of Namur in Belgium. She is currently working on the sensitive detection of allergens by ultra-high-performance liquid chromatography coupled to tandem mass spectrometry.

melanie.planque90@gmail.com

Notes:

Sessions

Pharmaceutical Formulations | Solid Dosage Forms | Novel Drug Delivery Systems | Drug Formulation Procedures | Pharmaceutical Excipients | Regulatory Affairs

Session Chair
Nagatoshi Nishiwaki
Osaka University, Japan

Session Introduction

Title: **Synthesis of versatile aza-heterocyclic compounds by three component ring transformation**
Nagatoshi Nishiwaki, Osaka Kyoiku University, Japan

Title: **Long-term stability of pharmaceutical formulations - prediction of recrystallization and amorphous-amorphous phase separation**
Christian Luebbert, TU Dortmund University, Germany

Title: **Investigating the dissolution performance of dipyridamole and cinnarizine spray dried amorphous solid dispersion using proton NMR**
Shrawan Baghel, Waterford Institute of Technology, Ireland

Title: **Formulation and *in-vitro* evaluation of montelukast oral disintegrating (5 mg) tablets: Effects of diluents**
Shahnaz Usman, College of Pharmaceutical Sciences Rakmhsu, UAE

Nagatoshi Nishiwaki, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Synthesis of versatile aza-heterocyclic compounds by three component ring transformation

Nagatoshi Nishiwaki
Osaka Kyoiku University, Japan

Dinitropyridone 1 is an excellent substrate for the nucleophilic type ring transformation to afford heterocyclic compounds and nitroanilines those are not easily available by alternative methods. When pyridone 1 was reacted with aromatic ketone in the presence of NH_4OAc, 6-arylated 3-nitropyriines 2 were formed besides bicyclic compounds 3. This method was also applicable to synthesis of cycloalka[b]pyridines 4 and 6-alkynylated/alkenylated pyridines 5, respectively. It was found to be possible to use aldehydes as the substrate, which leading to 3,5-disubstituted pyridines 6. On the other hand, when aliphatic ketones were employed as the substrate, two kinds of ring transformation proceeded. Namely, 2,6-disubstituted 4-nitroanilines 8 were formed in addition to nitropyridines 7. It was successful to apply this protocol to synthesis of N,N,2,6-tetrasubstituted nitroanilines 9 upon treatment of dinitropyridone 1 with ketone and amine in the presence of acetic acid.

Biography

Nagatoshi Nishiwaki received his PhD from Osaka University in 1991. He worked at Osaka Kyoiku University (1991–2008). From 2000 to 2001, he joined Karl Anker Jørgensen's group at Aarhus University, Denmark. Between 2008 and 2009, he worked at Anan National College of Technology. He then moved to the School of Environmental Science and Engineering, Kochi University of Technology, in 2009, and he became a Professor in 2011. His research interests comprise synthetic organic chemistry using nitro compounds, heterocycles (ring transformations, 1,3-dipolar cycloadditions etc.), and pseudo- intramolecular reactions. He has more than 120 papers and 20 review articles.

nishiwaki.nagatoshi@kochi-tach.ac.jp

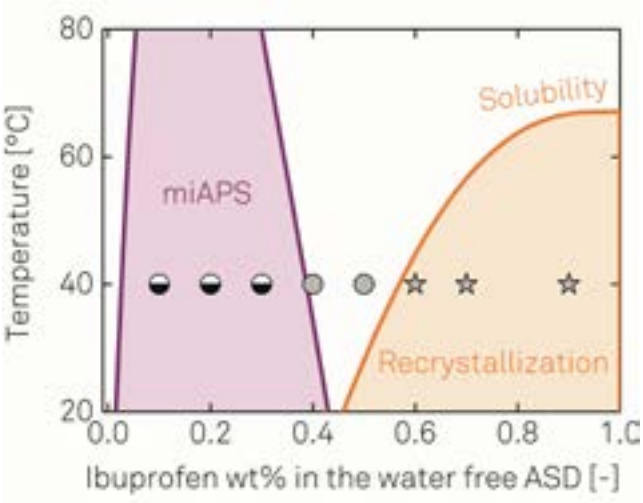
Notes:

Christian Luebbert et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Long-term stability of pharmaceutical formulations - prediction of recrystallization and amorphous-amorphous phase separation

Christian Luebbert and **Gabriele Sadowski**
TU Dortmund University, Germany

Numerous recently-developed Active Pharmaceutical Ingredients (APIs) have a low solubility in water leading to insufficient absorption and bioavailability. To overcome this solubility limitation, APIs are molecularly dispersed in hydrophilic polymers. The resulting formulations are denoted as Amorphous Solid Dispersion (ASDs). For the administration of new pharmaceutical formulations, long-term stability tests are imposed by regulatory authorities at defined conditions of temperature and humidity (25°C, 60% relative humidity (RH) for 12 months tests and 40°C, 75% RH for accelerated six-months tests). Recrystallization of the amorphous API and/or moisture-induced amorphous-amorphous phase separation (miAPS) might occur during storage indicating the thermodynamic instability of the ASDs. Long-term stable formulations are nowadays identified by trial-and-error principles. The aim of this work was to a-priory estimate the long-term stability of ASDs by applying advanced thermodynamic methods1 and thus to reduce the experimental effort for finding promising polymeric carriers suitable for formulation development. In order to validate the thermodynamic predictions, ASDs with different API/polymer compositions were prepared and subjected to two years enduring long-term stability tests at the aforementioned conditions. Recurring PXRD measurements were performed to detect recrystallization and Raman mapping was applied to quantify miAPS. Water sorption was observed as function of time using a magnetic suspension balance. Water sorption and thereby induced phase transitions (recrystallization/ miAPS) could be predicted in quantitative agreement with the experimental data. This study showed that results of long-term stability tests can be predicted correctly in early stages of drug development and that promising polymer candidates for long-term stable ASDs can be identified prior to long-term stability tests by thermodynamic modeling.



Biography

Christian Luebbert graduated in Chemical Engineering at TU Dortmund University, Germany in 2014. During his work as Research Assistant at the Laboratory of Thermodynamics, he focuses on the physical long-term stability of amorphous pharmaceutical formulations. With his expertise, he contributes from an engineering point of view to pharmaceutically highly relevant development of formulation strategies for poorly water-soluble drugs.

Christian.luebbert@bci.tu-dortmund.de

Shrawan Baghel et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Investigating the dissolution performance of dipyridamole and cinnarizine spray dried amorphous solid dispersion using proton NMR

Shrawan Baghel and **Niall O'Reilly**
Waterford Institute of Technology, Ireland

Amorphous Solid Dispersions (ASDs) are of great interest as enabling formulations because of their ability to increase the bioavailability of poorly soluble drugs. However, the dissolution of these ASD based formulations results in highly supersaturated drug solution that can undergo different types of phase transition. We have investigated the dissolution performance of amorphous solid dispersions of poorly water-soluble dipyridamole (DPM) and cinnarizine (CNZ) spray-dried amorphous solid dispersions (ASDs) using polyvinyl pyrrolidone (PVP) and polyacrylic acid (PAA) as a carrier matrix. Dissolution studies were carried out under non sink conditions and solution phase drug-polymer interactions was characterized using proton NMR. It was found that the dissolution of ASDs led to sustained supersaturation, the duration of which varied depending on the drug loading and type of polymer used in the formulation. The main mechanism for drug supersaturation generation and prolongation was found to be anti-plasticization effect of polymers on amorphous drugs within spray dried ASDs and the ability of polymers to reduce the crystal growth rates of DPM and CNZ. To further understand the molecular mechanism behind supersaturation stabilization in the presence of polymer, we employed, Solution 1H NMR. The change in electron densities of proton and the relative intensities of peak shifts indicated the nature of interaction between drug and polymer in different systems are different. These different effects suggest that DPM and CNZ interacts in a different way with PVP and PAA in solution which goes some way towards explaining the different polymeric effect, particularly in terms of inhibition of drug recrystallization and dissolution of DPM and CNZ ASDs. . The overall supersaturation profile observed thus depended on a complex interplay between dissolution rate, polymer type, drug loading, crystallization mechanism of drugs and drug-polymer interaction in the solution state.

Biography

Shrawan Baghel is currently doing PhD in "Novel technologies and optimized formulations for delivery of solid dispersion of BCS class II drugs" at Pharmaceutical and Molecular Biotechnology Research Center (PMBRC), Waterford Institute of Technology. He is the winner of Science Foundation Ireland scholarship for this project in collaboration with Synthesis and Solid State Pharmaceutical Centre. The main aim of this project is to gain an insight into the mechanistic and molecular aspects of solid dispersion prepared by spray drying, hot melt extrusion and supercritical fluid process using DSC, XRD and NMR. He had also planned, conducted, interpreted nanotechnology and lipid based formulation approaches to increase the solubility and dissolution of poorly soluble drugs.

baghel.shrawan@gmail.com

Notes:

Anu Kadyan et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Fluorescence quenching and diffusion within Li salt added ionic liquid media

Anu Kadyan and **Siddharth Pandey**
Indian Institute of Technology Delhi, India

In the fast-growing world with the ever-increasing need for alternative solvents, ionic liquids are being explored widely in almost all areas of chemistry. Ionic liquids are room-temperature molten salts, composed of ions with notable physicochemical properties, such as, good thermal stability, high solubility, negligible vapor pressure, and non-flammability, among others. In the current energy scenario, lithium-ion batteries have proven to be a promising choice for mobile applications. But to expand its applications to large-scale, we have to cope-up with some of the limitations. Thermal stability is a major issue in the currently used electrolytes, in lithium ion batteries. While the organic solvents had their own limitations, ionic liquids, because of their desirable properties, have drawn much attention from researchers as alternative electrolytes for lithium-ion batteries. To further develop and improve this new alternative class of (ionic liquid + Li salt) electrolyte system for industrial and commercial purpose, knowledge of diffusion within such systems is of utmost importance. We present a detailed investigation of fluorescence quenching of a model solute pyrene by an electron/charge acceptor quenching agent nitromethane dissolved in [1-ethyl-3-methylimidazolium bis(trifluoromethyl sulfonyl)imide ([emim][Tf_2N]) + lithium bis(trifluoromethyl sulfonyl) imide ($LiTf_2N$)] mixtures in the temperature range (298.15 to 358.15)K. Various equilibrium quenching constants as well as bimolecular quenching rate constants are obtained and related to the diffusion behavior within ([emim][Tf_2N] + $LiTf_2N$) system. The result is correlated with the results from fluorescence correlation spectroscopy using a different probe. Details of diffusion behavior showing versatility of (ionic liquid + Li salt) systems are established.

anu.kadyan1@gmail.com

Notes:

8th Annual Congress on

Analytical and Bioanalytical Techniques

&

14th International Conference and Exhibition on

Pharmaceutical Formulations

August 28-30, 2017 Brussels, Belgium

Scientific Tracks & Abstracts

Day 3

Sessions

Mass Spectrometry | Analytical Techniques for Clinical Chemistry | Separation Technique

Session Chair
Kazuaki Wagatsuma
Tohoku University, Japan

Session Co-Chair
MV Sangaranarayanan
Indian Institute of Technology, India

Session Introduction

Title: **Application of internal standard method for determination of 3D-transition metallic elements in flame atomic absorption spectrometry using a multi-wavelength high-resolution spectrometer**

Kazuaki Wagatsuma, Tohoku University, Japan

Title: **Simultaneous sensing of ascorbic acid, dopamine, uric acid and L-tryptophan using AgNPs, graphene oxide and poly(L-Arginine) composite**

Gozde Aydogdu Tig, Ankara University, Turkey

Kazuaki Wagatsuma et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Application of internal standard method for determination of 3D-transition metallic elements in flame atomic absorption spectrometry using a multi-wavelength high-resolution spectrometer

Kazuaki Wagatsuma, Yusuke Toya, and **Toshiko Itagaki**
Tohoku University, Japan

Flame Atomic Absorption Spectrometry (FAAS) is a technique, which has been extensively applied for the quantitative determination of different elements in inorganic materials. A particular element can be quantified only once for measurement with the help of a conventional atomic absorption spectrometer; whereas, by using a spectrometer system comprising of a xenon-lamp, continuum light source and an echelle-type spectrograph, it is possible to conduct sequential multi-element and multi-wavelength analysis, thus enabling the FAAS measurement over a certain wavelength range simultaneously. Due to this superior performance, an internal standard method, which can correct the physical interference in the solution sample as well as a long-time drift of the measurement system, can be properly employed, which leads to an improvement in the analytical precision of FAAS. In this study, selection criteria of an internal standard element which could be applicable for the measurement of 3D transition metals, such as Fe, Ni, Ti, were investigated in details, indicating that platinum-group elements could be suitably selected for the internal standard method. In Ti-Pd, Ni-Rh, and Fe-Ru systems, chosen as typical combinations, several variances of the analytical results; for instance, a variation in aspirated amounts of sample solution and a short-period drift of the primary light source, could be corrected and thus reduced, when the absorbance ratio of the analytical line to the internal standard line was measured.

Biography

Kazuaki Wagatsuma is a professor of Tohoku University, Japan, who manages Laboratory for Analytical Science in Institute of Materials Research. His major is material analysis and analytical spectroscopy. He has published more than 300 scientific papers and review articles in the field of atomic spectrometry, X-ray spectrometry, and chemical analysis.

wagatuma@imr.tohoku.ac.jp

Notes:

Gözde Aydogdu, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Simultaneous sensing of ascorbic acid, dopamine, uric acid and L-tryptophan using AgNPs, graphene oxide and poly (L-Arginine) composite

Gözde Aydogdu Tıg
Ankara University, Turkey

Electro-analytical methods are routinely used in analytical applications and clinical investigations to determine the concentration of biological compounds in human body fluids. Ascorbic acid (AA), dopamine (DA), uric acid (UA) and L-tryptophan (L-Trp) play critical roles in human metabolism, central nervous and renal systems. Abnormal concentration levels of these biomolecules can cause serious health problems such as mental illness, cancer, Parkinson's disease, hyperureaemia and gout. It is known that AA, DA, UA and Trp usually co-exist in biological samples such as serum and urine. Therefore, it is highly desirable to develop a sensitive method that can determine these biomolecules simultaneously in diagnostic research and analytical applications. However, the oxidation potentials of these compounds are too close to be separated at bare electrodes owing to their overlapping signals. Recently, metal/metal oxides nanoparticles have received great attention as a modifier material in developing electrochemical sensors due to their excellent properties such as high electron transfer ability, easy synthesis and small size. Graphene oxide (GO) which has a layered structure with a large specific area has been extensively used in the recent years for bio-sensing applications. Nowadays, graphene/conducting polymers composites have been considered as one of the most promising functional components due to their good electrical conductivity, chemical stability and high electrochemical capacity. Electropolymerization of amino acids have gained great attention in the field of sensors/biosensors. Among the poly (amino acids), poly (L–arginine) (P (Arg)) has attracted great attention in constructing biosensors owing to its functional $–NH_2$ and –COOH groups and it could electrostatically interact with negatively charged groups of GO. In this study, a composite glassy carbon electrode (GCE) based on AgNPs, GO and P (Arg) was prepared for the determination of AA, DA, UA and L-Trp. The composite was characterized by cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS) and scanning electron microscopy (SEM). All compounds can be well separated by their different peak potentials and they can be simultaneously detected in the quaternary mixture. Moreover, this proposed sensing strategy revealed excellent stability and reproducibility. The potential application of the modified electrode for sensing these compounds in human urine samples was also investigated.

gaydogdu@science.ankara.edu.tr

Notes:

Seungkyung Park et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Aptamer-based detection of arsenite for contaminated soil monitoring

Seungkyung Park, Seungmo Kim, and **Dongho Shin**
Korea University of Technology and Education, South Korea

Arsenic contamination poses a great threat to the living organisms even in small traces. Conventional methods for analysing heavy metal contamination in soil and water generally require laboratory equipped instruments and complex procedures, and thus have limited applicability for onsite sensing and monitoring of contaminated area. In the present work, we demonstrate the novel miniaturized setup for simple sample preparation and aptamer based optical sensing of arsenite in the contaminated soil. Colorimetric detection protocol utilizing aptamers, gold nanoparticles and NaCl has been optimized and tested on the PDMS chip in 50 ul volume to obtain the high sensitivity. Then the performance of the device is demonstrated through the comparative analysis of arsenic-spiked soil samples with standard laboratory method, and a good agreement is experimentally achieved. The presented method offers the simple, rapid, portable and cost-effective means for onsite sensing of arsenic in soil.

Biography

Seungkyung Park completed PhD in Mechanical Engineering from Texas A&M University, USA. He is the Assistant Professor of Korea University of Technology and Education and his research interests include microfluidics and micro-TAS, point of care testing.

spark@koreatech.ac.kr

Notes:

A I Archakov et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Molar concentration welcomes Avogadro in postgenomic analytics

A I Archakov, A V Lisitsa and **E A Ponomarenko**
Institute of Biomedical Chemistry, Russian Federation

The researchers working with high-throughput methods of genomics, transcriptomics, and proteomics reconsider the concept of concentration and evaluate the data obtained in the number of copies of biomacromolecules. Measurement of copy number reflects a steady trend in increasing the sensitivity of postgenomic analytical methods, up to the level of a single molecule. In this paper we review the physical meaning of the terms "molar concentration" and "Avogadro's number" to establish a relationship between them. The relationship between the molar concentration and the number of copies of that same macromolecule in a certain volume is set through the reverse Avogadro's number, the value of which (≈10-24 M) characterizes the molar concentration of a single molecule in 1 liter. Using the reverse Avogadro's number, we deal with situations in analyzing homogeneous biological solutions and heterogeneous cellular material.

inst@ibmc.msk.ru

Notes:

8th Annual Congress on

Analytical and Bioanalytical Techniques

&

14th International Conference and Exhibition on

Pharmaceutical Formulations

August 28-30, 2017 Brussels, Belgium

Video Presentations

Neha Bighane, Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Novel silica and silica-titania membranes for high temperature gas separations

Neha Bighane
Georgia Institute of Technology, USA

Concern over depleting supplies of fossil fuels (coal, oil and natural gas) and increasing global warming has driven tremendous interest worldwide in the development of alternate clean fuels. Hydrogen gas is a suitable candidate for a clean, abundant and efficient source of energy. Hydrogen is primarily produced from the steam reforming of natural gas coupled with the water gas shift reaction. Selective removal of H_2 from syngas mixture in the presence of steam at 200-350°C can increase the efficiency of the water gas shift reaction. It has been estimated that an overall energy saving of 43% in the water gas shift reaction can be achieved with the presence of a H_2/CO_2 membrane unit. A gas separation membrane is a robust material that enables selective permeation of one gas from a mixture based on partial pressure driving force. Novel silica and silica-titania membranes were developed from the controlled oxidative thermolysis of crosslinked polydimethylsiloxane precursors. The PDMS precursor film is prepared by humidity induced condensation cure reaction of PDMS resin with an alkoxy crosslinker. The rubbery PDMS films are heated to 377°C in an oxygen atmosphere in a tubular furnace and this results in the formation of silica membrane films. The developed silica membranes are microporous amorphous silica, have 1.4% water adsorption and can withstand up to 377°C in an oxidizing environment. They exhibit high hydrogen permeability and moderate H_+/CO_2 selectivity. Silica-titania membranes have been fabricated from controlled oxidative thermolysis of Ti-crosslinked PDMS by heating to 407°C. The developed silica-titania membranes are microporous amorphous silica-titania, have 0.85% water adsorption and can withstand up to 407°C in an oxidizing environment. At 80°C at 30 psia, silica membranes have selectivity of H_2/CO_2= 2 and H_2/N_2=20. At 35°C at 55 psia, silica-titania membranes have molecular sieving selectivity of H_2/CO_2=2.33, H_2/N_2=H_2/CH_4=64 and O_2/N_2=4.97. Material characterization studies on silica and silica-titania membranes include TGA, FTIR, XPS, SEM, EDS, TEM, BET and adsorption measurements.

Biography

Neha Bighane done Master of Science in Chemical Engineering, from Georgia Institute of Technology, Atlanta, USA, in Spring 2012. She was 8 years graduate research assistant, 2007-2015, ChBE, Georgia Tech, USA. She was junior research fellow, for PhD degree, in Indian Institute of Chemical Technology (Hyderabad, India) in collaboration with Royal Melbourne Institute of Technology (Melbourne, Australia). She published 2 Paper in Journal of Membrane Science, she attended 5 in national and international conferences She was Selected as a Global Scholar by PreScouters Inc., in February 2015 and awarded certificate of merit in social science by CBSE, India in 2001.

nbighane3@gmail.com

Notes:

Yasuhiko Fujii et al., Insights in Analytical Electrochemistry, 3:2
DOI: 10.21767/2470-9867-C1-002

Chromatographic separation of calcium isotopes by using crown ether resin and acidic solutions

Yasuhiko Fujii[1], Shin Okumura[1], Saori Umehara[2], Masao Nomura[1], Toshitaka Kaneshiki[1] and **Tadafumi Kishimoto[2]**
[1]National University in Tokyo, Japan
[2]Osaka University, Japan

Natural calcium consists of six isotopes. The heaviest isotope ^{48}Ca is a double-beta-decay nuclide and important for the study of neutrinoless double-beta decay. Since the natural abundance of ^{48}Ca is very low (0.187%), the enrichment of ^{48}Ca on a large scale is anticipated. However, the enrichment is very difficult, since calcium has no appropriate gaseous compounds which are usable as mediums for isotope separation processes such as gaseous diffusion, centrifugation, etc. Therefore, we have studied the chemical isotope separation based on the isotopic fractionation between chemical compounds in solution phase and in adsorption phase. The enrichment of calcium isotopes was observed at the adsorption band boundary of chromatography using benzo-18-crown-6 ether resin. For this purpose, the crown ether resin was synthesized by condensation polymerization of crown ether monomer and organic materials in porous silica beads. In our previous work calcium isotope separation by crown ether resin has been studied by using concentrated HCl solutions, mixed medium of alcohol and acid and organic solvents, etc. In the present work, attention was placed on the engineering aspects of the chromatographic separation system. Prior to the chromatographic isotope separation experiments, adsorption experiments were conducted in batch wise to obtain information on the adsorption of calcium in benzo-18-crown-6-ether resin (B18C6) at different conditions of HBr concentration. Then calcium isotope enrichment experiments were conducted by breakthrough-mode column chromatography using aqueous HBr feed solutions and B18C6 resin. Observed separation coefficients were 3.9x10-3 ~ 4.3x10-3. Determined engineering parameter HETP (Height Equivalent to a Theoretical Plate) were 2.6 ~ 6.7 mm; the HETP clearly showed the dependence on the concentration of calcium in feed solution. Discussion was extended to the analysis on the productivity of the separation system using the concept of separative power. Results indicate that the separative power is approximately proportional to the stage velocity. This fact suggests that the increase in the band speed is an effective measure to increase the capability of the separation system. A conceptual design of ^{48}Ca enrichment plant is presented as a summary of the basic research work on the chromatographic calcium isotope separation.

Biography

Academic Degrees received from Tokyo Institute of Technology; Master of Engineering in 1969 and Doctor of Engineering in 1973. Occupational Career: Chemical Engineer for Asahi Chem. Co. (1972 - 1974), Research Staff of Tokyo Institute of Technology (Research Associate, Associate Professor and Professor) (1974 - 2009), Professor Emeritus in2009. Published papers are 185. Award of Atomic Energy Society of Japan in 2003, Award of Japan Association of Ion Exchange in 2004 and Fellow of American Association for the Advancement of Science in 2006.

fujiiyaxyz@road.ocn.ne.jp

Notes: