

Report on the 2010 International Chemical Congress of Pacifichem Basin Societies (Pacifichem 2010), December 15-20, Honolulu, Hawaii: Symposium on Advances in Flow-based Analytical Techniques

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Pacifichem is held every five years, and is co-sponsored by the American Chemical Society, the Canadian Society for Chemistry, the Chemical Society of Japan, the Chinese Chemical Society, the Korean Chemical Society, the New Zealand Institute of Chemistry, and The Royal Australian Chemical Institute. Participating organizations include the Chemical Society of Thailand and the Japan Society for Analytical Chemistry. The Division of Analytical Chemistry of the American Chemical Society provided support for analytical symposia.

The Symposium on Advances in Flow-based Analytical Techniques was organized by Ian McKelvie (Monash University, Australia), Gary Christian (University of Washington, USA), and Toshihiko Imato (Kyushu University, Japan). Ian McKelvie arranged the program and other details. There were twenty-four oral presentations and 17 poster presentations.

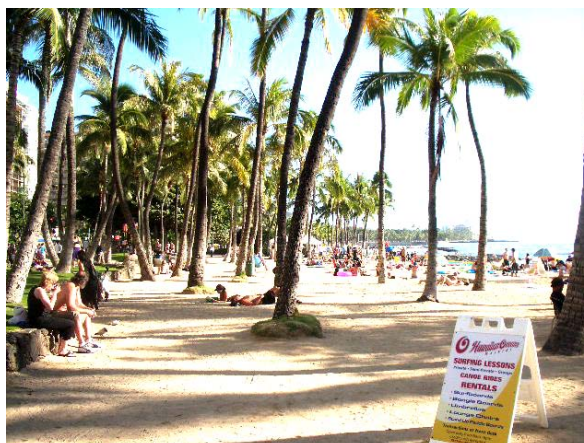
The Pacifichem opening ceremony and reception were held Wednesday evening, December 15th, with fine weather, which remained until Sunday when record rainfall came, just in time for the beginning of the symposium when we had to be inside anyway! On the Saturday evening before the symposium, Jarda Ruzicka invited a number of participants and friends to his home at Hawaii Kai for a relaxing party and viewing of the Christmas boats, which went by his house.

The symposium was held the last two days of the Congress, Sunday morning and afternoon, and Monday morning, with the poster session Sunday evening. Presiders were Ian McKelvie for the Sunday morning session, Toshihiko Imato and Gary Christian for the Sunday afternoon session, and Duangjai Nacapricha and Tadao Sakai for the Monday morning session.

Oral Presentations

The opening lecture was given by *Gary Christian*, who traced the early beginnings of flow injection analysis (FIA), and the history of the International Conference on Flow Analysis (FA) and the International Conference on Flow Injection Analysis (ICFIA). *Jarda Ruzicka* (now University of Hawaii) followed with the challenges of measuring ultratrace amounts of metals in sea water. He, and his student *Maxime Grand* with collaborator Professor Chris Measures in oceanography, described spectrophotometric and fluorometric measurement of iron and zinc in seawater, using sequential injection analysis (SIA). The major challenge is dealing with reagent blanks.

Toshihiko Imato described immunoassays using antibody or antigen-immobilized magnetic microbeads in an automated SIA system, to determine nonionic and ionic surfactants with chemiluminescence detection. *Paul Francis* (Deakin University, Australia) reported on advances in chemiluminescence detection





for flow analysis, emphasizing different types of flow cells for efficient collection of the generated light.

Sergey Krylov (York University, Canada) described a unique macroscopic approach to studying kinetics in the state of chemical equilibrium, using capillary flow. The method is based on two equilibrium reaction mixtures, one unlabeled and one labeled (for detection). *Conner Hogan* (La Trobe University, Australia) explored approaches for reagentless immobilization of electrochemiluminescent sensing molecules on electrode surfaces for use in flowing streams. *Samuel Mugo* (Grant MacEwan University, Canada) developed biocatalyst microreactors for rapid lipid transformations and blood profiling, by covalently immobilizing different types of lipases on different supports.

Hideji Tanaka (Tokushima University, Japan) described the principles and applications of amplitude modulated multiplexed flow analysis (AMMFA). Multiple analytes are determined from a single continuous analytical signal by frequency analysis. The flow rates of two sample solutions are independently varied in response to sinusoidal voltage signals, each at a different frequency.

Charles Lucy (University of Alberta, Canada) described how to control electro-osmotic flow using self-assembled surfactant bilayer coatings to provide pH independent control of the flow. *Kazuhiko Tsukagoshi* (Doshisha University, Japan) described analytical conditions and separation performance of capillary electrophoresis based on unique tube radial distribution of water-hydrophilic-hydrophobic organic carrier solvents under laminar flow conditions.

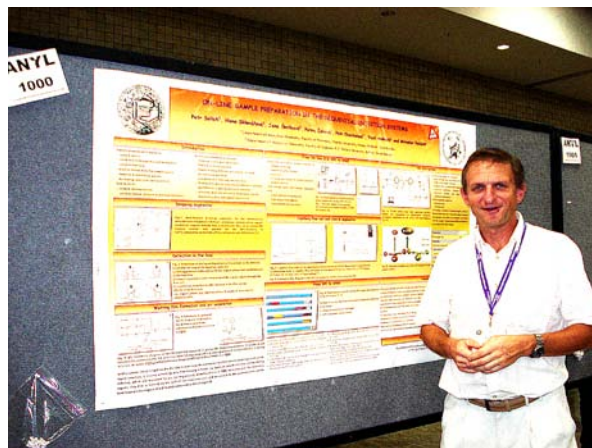
Tsutomu Nagaoka (Osaka Prefecture University, Japan) described the preparation of gold coated plastic microbeads for separation analysis. *Norio Teshima* (Aichi Institute of Technology, Japan) developed a hybrid analytical system composed of solid phase extraction and stopped-in-loop flow spectrophotometry for the determination of urinary vanadium/creatinine ratio. The simultaneous determination of creatinine corrects for urinary concentration variations in spot samples. Vanadium has attracted attention as a possible drug candidate for glucose control in diabetics. The vanadium was determined by a catalytic reaction and creatinine by the Jaffe reaction.

Spas Kolev (University of Melbourne, Australia) reported on the development and application of polymer exclusion membranes for the batch and on-line separation of Co(II) and Ni(II) and of Zn(II) from other base metals in a flow injection system. *Tadao Sakai* (Aichi Institute of Technology) described a simultaneous injection effective mixing analytical method (SIEMA) consisting of a syringe pump, 4 solenoid valves, a holding coil, a mixing coil, and a spectrophotometer, being a hyphenated SIA and FIA system. The system provides effective mixing and rapid detection with low reagent consumption.

Duangjai Nacapricha (Mahidol University, Thailand) reported on a potential quality control in-line system for the reagentless simultaneous determination of dissolved CO₂, sugar, and color for the carbonated drink industry. CO₂ is vaporized from the sample and dissolved in a water carrier and is detected by a capacitively coupled contactless conductivity detector, while sugar is monitored from its Schlieren effect using a near infrared LED detector, and the color is analyzed at a REB-LED detector. *Shin-Ichi Ohiro* (Kumamoto University, Japan) determined trace water in organic solvents by means of selective vaporization through a cellulose membrane and a highly sensitive humidity sensor. The moisture sensor was based on capacitance change of a water vapor sensitive layer, in which polyfluoropolymer and Nafion, with H₃PO₄ additive, were coated inside a capillary tube. Water was determined in ethanol as a demonstration for application to biofuels.

Kei Toda (Kumamoto University) performed trace analysis of dissolved species by vaporization-collection in a micro flow system, demonstrated by the determination of H₂S in water. Compounds with Henry's law constants less than one were suitable for determination by this method. The vaporized compound is collected in a microchannel scrubber, where it is reacted with a detection reagent. *Masaki Takeuchi* (The University of Tokushima, Japan) determined perchlorate in atmospheric aerosol using an automated analysis system for collection on a particle filter, and loading onto an anion exchange column, elution, and finally measurement by a conductivity detector. *Hideyuki Itabashi* (Gunma University, Japan) described his versatile all injection analysis (AIA) system, in which all reagent and sample solutions are injected into a reaction coil and are circulated for a definite time, followed by introduction into a detector.

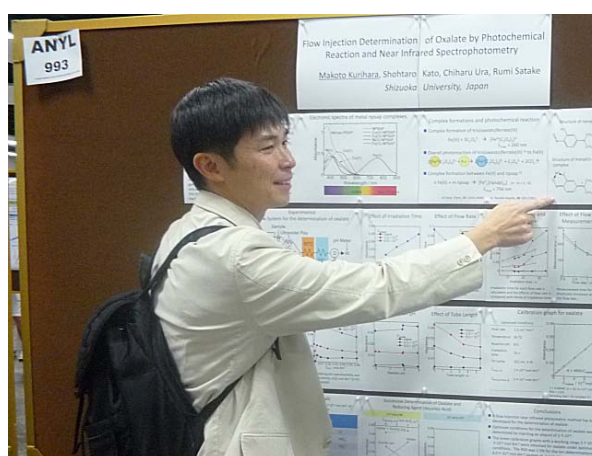
Shoji Motomizu (Okayama University, Japan) described several computer controlled flow systems using computer-controllable pumps and valves, and their application to trace analysis by coupling to different atomic spectroscopy detectors. A 12-port selection valve and a 12-port switching valve were assembled for a SIA/HPLC system for a multi-column/multi-sample handling system. *Koichi Oguma* (Chiba University, Japan) determined tramp elements in steel by FIA using on-line separation and atomic absorption spectrometric detection. A key to success was separation from the large iron base. This was accomplished by forming anionic complexes of the trace elements and separation on an anion exchange column. *Ikuo Satoh* (Kanagawa Institute of Technology, Japan) determined heavy metals in flow systems with use of immobilized apoenzymes which were activated by formation of the corresponding metalloenzymes on exposure to



the metals. The enzymes could be chemically or electrochemically regenerated.

Owen Osborne (Flinders University, Australia) developed an FIA method for determination of pyrite mineral activity, using 5-sulfosalicylic acid to measure total iron. This reagent was shown to be insensitive to common oxidizing agents, several other metals, and is relatively unaffected by moderate changes in pH. Acidic peroxide oxidation was used to create a kinetic plot to determine the reactivity of each sample.

Ian McKelvie concluded the oral sessions with a survey of on-line digestion in flow analysis, with emphasis on methods for total phosphorous and nitrogen for measurements in coastal and estuarine waters. Methods described included on-line thermal and microwave digestion, hydrolysis, and UV photo-oxidation.



Poster Presentations

The poster presentations included a range of fundamental, instrumentation, and application studies. The university affiliations given here are from Japan unless otherwise stated.

A. Hemmi (Kyushu University) illustrated a surface plasmon resonance detector on a compact disk-like microfluidic device. *M. Miyake* (Kyushu University) described an integrated fluorescence detection system using organic light emitting diodes as light source. *T. Tsunemine* (Hiroshima University) reported a chemiluminescence of cerium(IV)-rhodamine B system in a reversed micelle medium in 1-hexanol cyclohexane solvent.

N. Takemoto (Kitami Institute of Technology) described a flow injection-tandem spectrophotometric detection system for determining cadmium and lead using Soret band shift of a water-soluble porphyrin. *T. Sumida* (Kochi Prefectural Industrial Technology Center) synthesized cellulose functionalized with polyallylamine and applied it to on-line collection and determination of phosphate. *K. Kawamura* (Osaka Prefecture University) developed micro-flow analytical techniques for monitoring hydrothermal reactions in the millisecond time scale. *M. Ueda* (Aichi Institute of Technology) described an on-line gas diffusion/ion exchange preconcentration technique for the determination of trace ammonium ion in environmental water samples by FIA.

M. Kurihara (Shizuoka University) determined oxalate by photochemical reaction and near IR spectrophotometry using flow injection. *M. Hashimoto* (Doshisha University) performed rapid detection of DNA point mutations based on oligonucleotide ligation. *Y. Sumi* (Kyushu University) performed direct determination of non-labeled amino acids using micro hydrophilic interaction chromatography (HILIC)-HPLC with UV thermal lens spectroscopy. *T. Takayanagi* (Okayama University) described the fluorometric FIA analysis of fluoride ion with alkylsilylated fluoresceins. The alkylsilyl group is eliminated upon reaction with fluoride, resulting in fluorescence of the fluorescein.

M. Polasek (Charles University, Czech Republic) determined nefopam in pharmaceutical preparations by SIA with chemiluminescence detection. *M. S. Fuh* (Soochow University, Taiwan) described a microfluidic chip-based nanoliquid chromatography-tandem mass spectrometry system for bioanalysis. *J. Lin* (Tsinghua University, China) reported on the chemiluminescence from the decomposition of peroxydicarbonate and its application in FIA.

P. Solich (Charles University) described on-line sample preparation in sequential injection systems. A novel dual-valve SIA system was used for on-line incorporation of liquid-liquid extraction into an SIA manifold. *M. Murakami* (Nihon

University) prepared a chelating functional group modified polymer monolith as sorbent for preconcentration and matrix separation for ICP-AES and ICP-MS. L. Lim (Gifu University) reported on on-line selective determination of glucose via two-step immobilized enzymatic reactions.

JAFIA Party

All symposium participants, including those in the audience, were invited by the Japanese Association for Flow Injection Analysis to a dinner party following the Sunday afternoon oral session and before the evening poster session. We were treated to a fun-filled dinner and drinks at the Bubba Gump shrimp company, introduced in the movie Forrest Gump, in the Ala

Moana shopping center, near the Convention Center. Our thanks to Tadao Sakai, Norio Teshima, and Toshihiko Imato for arranging this special evening, and to JAFIA for their generosity.

Ian McKelvie Retires!

Professor McKelvie retired from Monash University as of the end of 2010, to take up an honorary position at the University of Melbourne, where he will collaborate with Spas Kolev, as well as continue his affiliation with the laboratory of Paul Worsfold in the UK. The group at the JAFIA party purchased a small gift to commemorate his retirement and recognize his years of scientific achievement. The Monday oral session was concluded with the presentation, along with a Hawaiian lei. Congratulations, Ian!

