

Report on 17th International Conference on Flow Injection Analysis (ICFIA 2011) in Collaboration with the Japanese Association for Flow Injection Analysis (JAFIA), held in Krakow, Poland, July 3-8, 2011

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1. Introduction

The joint meeting of ICFIA and JAFIA was held at the Park Inn by Radisson Krakow Hotel. It was hosted by Pawel Kościelniak, with assistance from Joanna Kozak and colleagues from the local organizing committee from the Faculty of Chemistry, Jagiellonian University. There were over 140 participants, from 24 countries, including 13 participants from JAFIA.



2. Social Events

A welcome reception was held on Sunday evening, with fine Polish fare and cocktails where regular attendees and new ones met. On Tuesday evening, we enjoyed a guided tour of Krakow Old Town, including a walk along the Royal Route and visits of museums and churches along the route, and a visit to the old Jewish sector. Krakow is a beautiful city and all enjoyed the tour, in spite of unusual July rain. Wednesday was free for an excursion to Zakopane, situated at the foot of the Tatra mountains, famous for rich folklore and picturesque surroundings. We had a tour around downtown and a visit to the Tatra National Park, again in the rain. Then we were treated to a feast featuring regional cuisine, folk music, and dances.



The conference banquet was held Thursday evening at the Manggha Centre of Japanese Art and Technology, a beautiful setting overlooking the Visla river on a warm summer evening. We enjoyed fine dining, live music, and dancing.



Following the conference, optional tours on Friday included a trip to the Wieliczka salt mine or an excursion to the Memorial and Museum Auschwitz Birkenau.

3. Scientific Program

The program included 54 oral presentations and 74 poster presentations, held Monday, Tuesday, Thursday, and Friday. The oral presentations were chaired by Purnendu (Sandy) Dasgupta, Marek Trojanowicz, José Luis Burguera, Aristidis Antemidis, Miroslav Polášek, Koichi Oguma, Jaromir (Jarda) Ruzicka, Pawel Kościelniak, Tadao Sakai, Antonio Rangel, Manuel Miró, João Santos, Gary Christian, Victor Cerdà, José Luis Costa Lima, Shoji Motomizu, Elo Hansen, Toshihiko Imato, Spas Kolev, Petr Solich, Duangjai Nacapricha, and Stanislaw Walas.



4. Opening Lecture

The program began Monday morning with a lecture by Gary

Christian (University of Washington, USA) who traced the evolution and importance of analytical chemistry from biblical times to the modern era, and the early development of flow injection analysis.

5. Special Lectures

In this International Year of Chemistry commemorating the 100th anniversary of the Nobel Prize in Chemistry of the great Polish scientist, Maria Sklodowska-Curie (born in Warsaw, November 7, 1867), we were treated to a Special Lecture on her life and achievements, given by *Boguslaw Buszewski* (Nicolaus Copernicus University, Poland, President of the Polish Chemistry Society and of the European Society of Separation Science). Author's note: Maria stated "If Professor Napoleon Milicer and his assistant lecturer, Dr. Kossakowski hadn't given me a sound grasp of analysis in Warsaw, I would have never separated out radium" (Muzeum Marii Sklodowskiej-Curie, Warsaw).

The Polish session was organized by *Pawel Kościelniak* (Jagiellonian University, Poland) who gave a special lecture on flow injection analysis in Poland, discussing the contributions of Polish scientists to the development and popularization of FIA in the country. Contributions of Marek Trojanowicz, Robert Koncki, Stawomir Kalinowski, Anatol Kojlo, Pawel Kościelniak, and Joanna Kozak were highlighted. A Polish symposium on flow methods is held every two years.

6. Keynote Lectures

Keynote lectures were given by leaders in the areas of instrumentation, preconcentration/enhancement methods, interfaces between FIA and chromatography, and challenging analytical problems. *Jarda Ruzicka* (University of Hawaii, USA) gave a brief description of the evolution of FIA to still novel approaches, including microfluidics, integrated and hyphenated sequential injection systems, developed for the challenges of oceanographic and biochemical assays. *Tadao Sakai* (Aichi Institute of Technology, Japan) described a simultaneous injection effective mixing analysis system (SIEMA) as an alternative flow-based technique for measuring urinary constituents, including albumin/dreatinine ratio, protein, and trace bilirubin. *Victor Cerdà* (University of the Balearic Islands, Spain) applied multicommutated flow techniques for the automatic preconcentration and determination of radionuclides. *José Luis Burguera* (Los Andes University, Venezuela) gave a thorough description of different types of micro emulsions, their formation, and their utility in on-line analytical applications. *Marek Trojanowicz* (University of Warsaw, Poland) reported on the challenges of trace analysis of residue pharmaceuticals in the environment. Proper optimization of flow injection methods combined with crucial sampling processing procedures and sensitive detection methods allows determination of sub-parts per billion levels.

Manuel Miró (University of the Balearic Islands) described the utility of the Lab-on-Valve platform as a front-end to chromatographic separations. *Sandy Dasgupta* (The University of Texas at Arlington, USA) described the similarities and differences of open tubular liquid chromatography (OTLC) and



flow injection analysis, recent advances of OTLC, and the ability to work with pL to multi-nL volumes and 5 μm bore capillaries.

7. Invited Lectures

Elo Hansen (The Technical University of Denmark) gave a historical account of how FIA started and developed, beginning with the first experiments by him and Jarda Ruzicka at the

Technical University of Denmark in 1974. Eight other invited lectures covered advances in microfluidics and nanotechnology, on-line preconcentration, detection, and automation. *Jacobus (Koos) van Staden* (Process Analytical Technology Laboratory and the National Institute of Research for Electrochemistry and Condensed Matter, Romania) described nanotechnology and microfluidic flow systems being developed in response to European Commission solicitations. *João Santos* (Porto University, Portugal) described the prospects and applications of combined quantum dot nanotechnology and flow analysis. *Toshihiko Imato* (Kyushu University, Japan) used a microchip integrated with an organic thin-film photodiode for the fluorometric flow immunoassay of IgA.

Spas Kolev (The University of Melbourne, Australia) reported on paper-based microfluidic devices as promising platforms for miniaturization of flow analysis. *Aristidis Anthemidis* (Aristotle University of Thessalonki, Greece) reported on advances in liquid phase microextraction techniques for metal determination, while *Antonio Rangel* (Univerisdade Católica Portuguesa, Portugal) described solid-phase extraction flow systems based on NTA Superflow resin.

Robert Koncki (University of Warsaw) reported on the design and use of light emitting diodes in flow analysis. *Shoji Motomizu* (Okayama University, Japan) used computer-controlled flow chemical analysis (CC-FCA) systems in environmental analysis.

8. Commercial Technology

Marcin Moczulski (Comesa Polska Sp. z o.o., Poland) gave a presentation on the cIEF technology of Beckman Coulter, which provides high resolution separations throughout a pH gradient.

9. Oral Presentations

9.1. Fundamentals and Principles

Marcin Wiczorek (Jagiellonian University) discussed the similarities and differences of titration and indirect calibration in FIA. *Maciej Stafniński* (Jagiellonian University) evaluated recovery as a parameter for assessing accuracy of an analytical result, demonstrating that standard addition cannot detect additive effects. *Edgar Paski* (British Columbia Institute of Technology, Canada) described calibration requirements and techniques for ISO 17025 accredited laboratories using FIA and SIA based methods.

9.2. Instrumentation/detection

Vera L. R. G. Abreu (Porto University) reported on a multipumping system for the quantification of acetylcysteine in pharmaceutical preparations from its promoting effect on CdTe nanocrystal (quantum dot) luminescence. *Burkhard Horstkotte* (Spanish National Research Council, Spain) developed a multipumping ammonium analyzer based on fluorescence detection, for surface seawater ship-board monitoring. *Camelia Henriquez* (University of the Balearic Islands) determined cadmium in natural waters with an automatic multisyringe FI system coupled to a screen printed electrode. *Norio Teshima*



(Aichi Institute of Technology) described hybrid flow analysis systems and their application for determining urinary vanadium and creatinine, and hydroquinone and quinone.

Hitoshi Mizuguchi (Yamagata University, Japan) described a dual-electrode flow system that was fabricated using track-etched porous membranes. *Slawomir Kalinowski* (University of Warmia and Mazury, Poland) described a new kind of electrochemical sensor for determination of electrochemically inactive molecules. The working principle of the detector is based on membrane electrorestriction. *Tsutomu Nagaoka* (Osaka Prefecture University, Japan) described over-oxidized polypyrrole molecularly-imprinted polymer detector/sensors for the recognition of analytes ranging from nano- to micro-size.

Stanislawa Koronkiewicz (University of Warmia and Mazury) described a new direct-injection paired emitter diode (pedd) detector integrated with a pulse multi-pumping flow system. *Jessica Avivar* (University of the Balearic Islands) reported on a fully automated LOV-MSFIA-ICP-MS system for thorium and uranium determination, exploiting reversible solid-phase extraction.

9.3. Separation, preconcentration, reactors, reagents

Petr Chocholouš (Charles University, Czech Republic) described the hyphenation of miniaturized solid-phase extraction (SPE) and sequential injection chromatography (SIC) to achieve automatic complete analysis. *Georgia Giakiskli* (Aristotle University of Thessalonki) used on-line FI-ICP-AES for trace element determination using a Hypersep-SCX microcartridge. *Stanislaw Walas* (Jagiellonian University) described new selective sorbents for FI on-line preconcentration of Cu(II) and Cd(II) for determination by FAAS. *Reena Saxena* (University of Delhi, India) performed FI on-line preconcentration of lead in water using Amerlite XAD-16 immobilized with xylenol orange for FAAS measurement.

9.4. Applications

Maxime Grand (University of Hawaii) described the use of micro-sequential injection lab-on-valve with fluorometric detection for the determination of trace zinc in seawater, reporting challenges of reaching sufficient sensitivity and fundamental studies needed to explain unusual peak shape recordings compared with water. *Piotr Halaburda* (University

of Bialystok, Poland) described a chemiluminescence multi-determination of five phenothiazine derivatives in pharmaceutical formulations by means of a combined multi-commutated/multi-pumped flow assembly. *Joanna Kozak* (Jagiellonian University) described a new approach to simultaneous determination of Fe(II) and Fe(III). It is based on measurement of the two at a single wavelength with the use of a two-stream reversed FI system, and chemical reactions to differentiate the two species.

Kanchana Uraisin (Mahidol University, Thailand) employed chemometrics to achieve simultaneous determination of phosphate and silicate using cross-injection analysis. *Anastasiia Petrova* (St. Petersburg State University, Russia) described stepwise injection photometric analysis of ascorbic acid, epinephrine, and norepinephrine by reaction to produce reduced forms of heteropolycids. *Orawan Chailapakul* (Chulalongkorn University, Thailand) described fast analysis for determination of ferulic acid and total antioxidant capacity by paper-based microfluidics. *Andrei Danet* (University of Bucharest, Romania) determined total antioxidant capacity of fruit extracts and juices by FIA via chemiluminescence inhibition.

Makoto Kurihara (Shizuoka University, Japan) determined hydrogen peroxide by use of its catalytic effect combined with cobalt(II) in a dye forming reaction. *Koichi Oguma* (Chiba University, Japan) described the kinetic simultaneous determination of vanadium(IV) and vanadium(V) using complex formations with xylenol orange.

Eulogio Llorent-Martínez (University of Jaén, Spain) gave a critical discussion of lanthanide-sensitized luminescence as a promising tool in clinical analysis. *Duangjai Nacapracha* (Mahidol University) described a reagent-free flow system for the simultaneous determination of dissolved carbon dioxide, sugar, and color in carbonated drinks.

Miroslav Polásek (Charles University) investigated the sensitizing effects of organic solvents on selected chemiluminescence reactions for determination of endralazine and verapamil pharmaceuticals. *Rasha El Nashar* (German University in Cairo, Egypt) described the FIA determination of hydrogen peroxide using a biosensor based on catalase immobilized on a glassy carbon electrode modified with an electrodeposited gold nanoparticle/multiwalled carbon nanotube/chitosan film.

Raquel Mesquita (Univerisdade Católica Portuguesa) used 3-hydroxy-4-pyridinone derivatives as chelator colorimetric reagents for iron(III) determination in estuarine and marine waters. *Adam Wiryawan* (Brawijaya University, Indonesia) used FIA for spectrophotometric monitoring of metal contaminants in hot mud flow and in water.

Kanokwan Kewfo (Chiang Mai University, Thailand) described a strip test for iron using extract of guava leaf as a natural reagent immobilized onto paper. Modern IT devices such as a webcam camera, a digital camera, and a mobile phone were used for quantification. *Mohammed Al-Shwaiyat* (Zarka University, Jordan) performed simultaneous determination of two pharmaceutical compounds by kinetic differences in reaction with Wills-Dawson molydophosphate. *Wreen Siangproh* (Srinakharinwirot University, Thailand) described the sensitive determination of mercury by sequential injection-anodic

stripping voltammetry using simultaneous electroplating of copper on a glassy carbon electrode for enhancement.

10. Poster Sessions and Poster Session Awards

Posters were held in two sessions, Monday and Thursday afternoons from 15 countries, including in addition to the already 18 mentioned countries, Iraq, Croatia, and Slovak Republic. There were additional participants from Germany and Ukraine. Presentations covered a broad spectrum of flow analysis topics: instrumentation, microfluidics, detection, on-line processing, and applications.

The International Steering Committee (Gary Christian, Sue Christian, José Luis Burguera, Victor Cerdà, Toshihiko Imato, Pawel Kościelniak, Joanna Kozak, José Luis Costa Lima, Shoji Motomizu, Jarda Ruzicka, Tadao Sakai, Petr Solich, and Marek Trojanowicz) judged the posters to select the best poster presentation from each session. The award winners were Susanna S. M. P. Vidigal from Universidade Católica Portuguesa (Determination of Total Protein Content in White Wines by Solid Phase Spectrophotometry in a SI-LOV System), and Rasha M. El Nashar from the German University in Cairo (Potentiometric Determination of Tolterodine in Batch and Flow Injection Analysis).



11. JAFIA Awards

The Japanese Association for Flow Injection Analysis presented, at the banquet, their prestigious FIA Award for Science for 2010 to *Spas Kolev*, *Antonio Rangel*, and *Norio Teshima*. Congratulations to all.



12. Sponsors/Exhibition

Sponsors/ exhibitors included the Polish Academy of Science, Warszawa (www.pan.pl), Organization for the Prohibition of Chemical Weapons, Hague (www.opcw.org), Beckman Coulter (Comesa Polska Sp. z o.o, Warszawa (www.comesa.pl), Skalar Analytical BV, Breda (info@skalar.com), Sartorius Mechatronics Poland Sp. z o.o., Kostrzyn (www.sartorius.com, info.pl@sartorius.com), WICOM-ELSAB Sp. z o.o., świdnica (www.wicom-eslab.eu, biuro@wicom-eslab.eu), Analytyka (www.malamut.pl), Bruker Polska Sp. z o.o., Poznań (www.bruker.pl), and Perkin Elmer Polska Sp. z o.o., Warszawa (www.perkinelmer.com).



13. Publication of the Proceedings

Papers for the conference will be submitted for peer review for a Special Issue of *Talanta*, with Guest Editors *Pawel Kościelniak* and *Joanna Kozak*.

14. ICFIA 18

The International Steering Committee met Monday evening to consider potential venues for the next conference, and unanimously confirmed that ICFIA 18 will be held in Porto, Portugal, to be hosted by Antonio Rangel from Univerisdade Católica Portuguesa. The tentative time is September, 2013. For information, contact arangel@esb.ucp.pt.

In addition, ICFIA 19 is scheduled be hosted by Toshihiko Imato from Kyushu University in Fukuoka, Japan, the date to be determined.

