National University of Singapore-Health Sciences Authority

WORKSHOP ON

"EXPLORING SYNERGIES & OPPORTUNITIES IN COLLABORATION"

Wednesday, May 10, 2006

Lecture Theatre 23
Faculty of Science
National University of Singapore

Programme & Abstracts

✷ PROGRAMME ✷

08:50 HRS	Guests and participants to be seated
09:00 HRS	Welcome address by Head, Department of Chemistry, National University of Singapore, Professor T.S. Andy Hor

SESSION I – Chairperson: Michael Ming Kiong Tay

09:10 HRS	Sam F.Y. Li *Analysis of Alkaloids in Herbal Medicine by Capillary Electrophoresis with On-Column Preconcentration*
09:30 HRS	Angela Li *Case Studies – Food Analysis*
09:50 HRS	Hwee Ling Koh *Chromatographic Fingerprinting and Screening for Adulterants in Botanical Medicine*
10:10 HRS	Chi Pang Lui *Synthesis and Characterisation of Drugs and Their Metabolites*
10:30 HRS	Refreshments

SESSION II – Chairperson: Sam F.Y. Li

11:00 HRS	Gaik Khuan Chuah *Analysis Using Powder X-Ray Diffractometry*
11:20 HRS	Michael Ming Keong Tay *Crime Scene Investigations*
11:40 HRS	Chee-Seng Toh *A Novel Immunosensor Using Immunoglobulin-Gated Nano-Channel Sensor*
12:00 HRS	Weibiao Zhou *Research Capabilities and Strengths in Food Science and Technology at the National University of Singapore*
12:20 HRS	Closing remarks by Director, Centre for Analytical Science, HSA, Dr Bosco Chen-Bloodworth, followed by lunch

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Analysis of Alkaloids in Herbal Medicine by Capillary Electrophoresis with On-Column Preconcentration

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Many naturally occurring pyrrolizidine alkaloids (PAs) are hepatotoxic, which may cause liver damage and in some cases liver cancer. Toxic PAs are often responsible for serious health problems through direct consumption of PA-containing herbal teas, herbal medicines, and herbal dietary supplements. In this study, methods for the extraction and analysis of toxic pyrrolizidine alkaloids were developed. In particular, the combination of solid phase extraction with a novel on-column electrokinetic focusing method based on hyphenation of dynamic junction and sweeping techniques for enhancement of sensitivity in the analysis of these alkaloids by capillary electrophoresis was investigated. Optimization of the conditions for solid phase extraction, as well as for on-column electrokinetic focusing was performed systematically. Subsequently, the optimized conditions were used for the extraction and analysis of toxic alkaloids in commercially available herbal products.

Case Studies – Food Analysis

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One of the main challenges in food analysis is the wide spectrum of food matrices, which can pose problems to the analysis conditions. Method development in the lab is usually carried out on a limited number of sample types but when the actual analysis is to be done on a sample from a similar class of food; poor recoveries may be experienced despite using the existing optimised conditions. Current food matrix related problems in the laboratory involve the analysis of contaminants such as benzene in soft drinks, monliformin in cereal products, polychlorinated biphenyls in oil, trace metals in food and patulin in juices. Apart from that, there is also the challenge of developing methods that are low in cost, time saving and yet high in quality, such as the analysis of potassium bromate in flour, detection of irradiation in food and other food analysis involving multiple reaction monitoring in liquid chromatography/tandem mass spectrometry.

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Chromatographic Fingerprinting and Screening for Adulterants in Botanical Medicine

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The World Health Organization estimates that 65 to 80 % of the world's population use traditional medicine as a form of primary healthcare. Botanical or herbal medicine has been used since time immemorial. It has been estimated that about 25% of prescription drugs have botanical origins, e.g. the anti-cancer drugs Taxol and Vincristine.

In this short presentation, an overview of various issues concerning the quality, safety and efficacy of botanical medicine will be presented. In particular, the work on quality control of botanical medicine and their products, namely, chromatographic fingerprinting and screening for adulterants will be discussed.

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Synthesis and Characterisation of Drugs and Their Metabolites

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One of the major functions of the laboratories under the Division of Drug and Toxicology at the Centre for Forensic Science is to provide analytical support to enforcement agencies in the analysis of drugs of abuse in seizures and in biological specimens. Toxicological service is also performed for clinical investigations, postmortem investigations and workplace drug testing. In the course of their work, the laboratories may come across new drugs, for example, the amphetamines and tryptamines, where no reference standards are presently available commercially. In biological specimens, only the metabolites of the drugs may be detected in some cases since the parent compounds are extensively metabolised. It would not be possible to confirm the consumption of the parent drugs without first identifying these metabolites. This cannot be done without the authentic reference standards. In order to provide a comprehensive analytical service to cover a full range of drugs of abuse, pharmaceuticals, and their metabolites, it is important for the Division to acquire the drugs and their metabolites that are not available commercially. One possibility is to achieve through organic synthesis and the subsequent characterisation of the drugs using elemental analysis, infra-red spectroscopy, high resolution gas chromatography/mass spectrometry and nuclear magnetic resonance spectroscopy.

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Analysis Using Powder X-Ray Diffractometry

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X-ray powder diffraction uses x-rays to probe solid samples. Being a non-destructive technique, it is widely applied for the characterization of crystalline materials and has been used for identification of solid samples and determination of their composition by analyzing the characteristic "fingerprint" diffractograms. Information about the type of phases present, quantitative information about the phases and structure imperfections can be obtained. It has applications in fields such as geological, materials, pharmaceuticals, and engineering sciences. Corrosion products, materials for fabrication, combustion products, mineral identification, drugs and chemicals can be rapidly determined using this technique. The Department of Chemistry has powder x-ray diffractometer systems which are equipped with high and low temperature accessories so that studies on variable temperature measurements can be performed. In addition, a system with pinhole collimators allows sampling from areas of spot sizes less than 50 μm diameter. A laser/video microscope allows for the probed area to be clearly defined so that microdiffraction investigation can be done.

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Crime Scene Investigations

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The Criminalistics Laboratory examines a wide variety of physical evidence collected from crime scenes for the purpose of establishing a link between a suspect and the crime or its victim, including: accelerants, volatile organic compounds, oil spill samples, explosives, propellants and incendiary materials, pyrotechnics, fire and explosion causes, electrical fires, fibres, textile materials, cordages and knots, packaging (paper and plastic bags, strapping, adhesives, newspapers, security seals), polymers, metals, gemstones, glass fragments and fractures, soils and building materials, paints, pigments and surface coatings, detergents, hairs, wood, paper products, corrosive and noxious substances, miscellaneous organic and inorganic analyses, gases and diving equipment, firearms, ammunition parts, gunshot residues, shoeprints, tyreprints and impressions, physical fits, physical examinations, obliterated stamped marks, toolmarks and manufacturing marks and causes of damages. The laboratory also carries out crime scene examinations, bloodstain pattern analyses and various reconstructions and simulations.

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A Novel Immunosensor Using Immunoglobulin-Gated Nano-Channel Sensor

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The current important issue in the area of immunosensors is the need for rapid and sensitive detection of infectious diseases including bird flu and dengue fever, here in the region. It is equally desirable to have fast response sensing capability towards other analytes, including proteins, DNAs and drugs, as long as their complementary binding immunoglobulins can be produced. Current approach used in immunoassay methods such as ELISA is the use of marker enzymes modified with antigens (or antibodies), which binds to the antibodies (or antigens) immobilised on a solid surface. The marker enzyme subsequently reacts with its substrate to give a coloured or electroactive compound which is readily detected by an optical or electrochemical sensor. This talk will focus on the present advanced immunoassay technology using label-free detection and quantification methods. A novel approach using immunoglobulin-gated nano-channel sensor developed in my group will be presented, as well as its potential applications in drug analysis.

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Research Capabilities and Strengths in Food Science and Technologyat the National University of Singapore

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The Food Science and Technology Programme at NUS was established in July 1999 in response to the need of the fast growing food industry in Singapore. Over the past seven years, the programme itself has been growing rapidly. Now with five academic staff members attached to the prorgamme, and some 20 postgraduate students, FST has a research programme covering the areas of functional foods/nutraceuticals, food processing, functionality of food components, food engineering and process control, natural flavour and aroma compounds, microbiology of Asian foods, and food waste utilization.

In this talk, the strengths of FST's staff members and their current research projects, as well as the major research facilities in the programme will be presented.